# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

The present document is part 1 of a multi-part deliverable covering the 5G System (5GS) User Equipment (UE) protocol conformance specification, as identified below:

- **3GPP TS 38.523-1: "5GS; User Equipment (UE) conformance specification; Part 1: Protocol"** (the present document).

- 3GPP TS 38.523-2 [2]: "5GS; User Equipment (UE) conformance specification; Part 2: Applicability of protocol test cases".

- 3GPP TS 38.523-3 [3]: "5GS; User Equipment (UE) conformance specification; Part 3: Protocol Test Suites".

# 1 Scope

The present document specifies the protocol conformance testing for the 3GPP UE connecting to the 5G System (5GS) via its radio interface(s).

The following information can be found in the present document (first part of a multi-part test specification):

- the overall test structure;

- the test configurations;

- the conformance requirement and references to the core specifications;

- the test purposes; and

- a brief description of the test procedure, the specific test requirements and short message exchange table.

The applicability of the individual test cases is specified in the ICS proforma specification (3GPP TS 38.523‑2 [2]). The Test Suites are specified in part 3 (3GPP TS 38.523‑3 [3]).

The present document is valid for UE implemented according to 3GPP Releases starting from Release 15 up to the Release indicated on the cover page of the present document.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.523-2: "5GS; UE conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification".

[3] 3GPP TS 38.523-3: "5GS; User Equipment (UE) conformance specification; Part 3: Protocol Test Suites".

[4] 3GPP TS 38.508-1: "5GS; User Equipment (UE) conformance specification; Part 1: Common test environment".

[5] 3GPP TS 38.508-2: "5GS; User Equipment (UE) conformance specification; Part 2: Common Implementation Conformance Statement (ICS) proforma"

[6] 3GPP TS 38.509: "5GS; Special conformance testing functions for User Equipment (UE)".

[7] 3GPP TS 36.508: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRAN); Common Test Environments for User Equipment (UE) Conformance Testing".

[8] 3GPP TS 36.509: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Special conformance testing functions for User Equipment (UE)".

[9] 3GPP TS 38.113: "New Radio (NR); Requirements for support of radio resource management".

[10] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[11] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[13] 3GPP TS 36.523-1: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification".

[14] 3GPP TS 38.212: "NR; Multiplexing and channel coding".

[15] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[16] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[17] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[18] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[19] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[20] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System ".

[21] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[22] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3"

[23] 3GPP TS 38.306: "NR: User Equipment (UE) radio access capabilities"[24] 3GPP TS 38.211: "NR; Physical channels and modulation".

[25] 3GPP TS 36.523-3: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRAN); User Equipment (UE) conformance specification; Part 3: Abstract Test Suites (ATS)".

[26] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage 2".

[27] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".

[28] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".

[29] 3GPP TS 36.523-2: " Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification".

[30] 3GPP TS 38.133: " NR; Requirements for support of radio resource management".

[31] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[32] IETF RFC 7296: "Internet Key Exchange Protocol Version 2 (IKEv2)".

[33] 3GPP TS 24.502: "Access to the 3GPP 5G Core Network (5GCN) via Non-3GPP Access Networks (N3AN); Stage 3"

[34] 3GPP TS 23.003: "Numbering, addressing and identification"

[35] 3GPP TS 34.229-1: "Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification".

[36] 3GPP TS 31.102: "Characteristics of the Universal Subscriber Identity Module (USIM) application".

[37] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[38] 3GPP TS 23.122: "Non-Access-Stratum functions related to Mobile Station (MS) in idle mode".

[39] GSMA PRD IR.88: "LTE and EPC Roaming Guidelines".

[40] 3GPP TS 27.007: "AT command set for User Equipment (UE)".

[41] 3GPP TS 34.229-5: "Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); User Equipment (UE) conformance specification; Part 5: Protocol conformance specification using 5G System (5GS)".

[42] 3GPP TS 22.101: "Service aspects; Service principles".

[43] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[44] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], specifications referred to in the tests' Conformance requirements clauses and the following apply. A term defined in the present document takes precedence.

**Floor**: Floor(x) is the largest integer smaller than or equal to x.

**Ceil**: Ceil (x) is the smallest integer larger than or equal to x.

## 3.2 Symbols

For the purposes of the present document, symbols defined in specifications referred to in the tests' Conformance requirements clauses and the following apply. A symbol defined in the present document takes precedence.

None.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1]], specifications referred to in the tests' Conformance requirements clauses and the following apply. An abbreviation defined in the present document takes precedence.

ICS Implementation Conformance Statement

FFS For Further Study

# 4 Overview

## 4.1 Test methodology

### 4.1.1 Testing of optional functions and procedures

Any function or procedure which is optional, as indicated in the present document may be subject to a conformance test if it is implemented in the UE.

A declaration by the apparatus supplier (ICS) is used to determine whether an optional function/procedure has been implemented.

### 4.1.2 Test interfaces and facilities

Detailed descriptions of the UE test interfaces and special facilities for testing are provided in TS 38.509 [6].

## 4.2 Implicit testing

For some 3GPP signalling and protocol features conformance is not verified explicitly in the present document. This does not imply that correct functioning of these features is not essential, but that these are implicitly tested to a sufficient degree in other tests.

Implicit testing of 5GS requirements may be done also in tests specified in other 3GPP conformance test specifications. For clarity these are listed below:

- Indication for support of EN-DC: if the UE supports E-UTRA-NR dual connectivity, then the UE shall set the DCNR bit to "dual connectivity with NR supported" in the UE network capability IE of the ATTACH REQUEST/TRACKING AREA UPDATE REQUEST message; verified implicitly (the setting of the DCNR bit to 1) by tests specified in TS 36.523-1 [13].

NOTE 1: It is assumed that an UE supporting EN-DC will support EPS (legacy LTE) and therefore it will be tested against all relevant legacy LTE tests.

## 4.3 Repetition of tests

As a general rule, the test cases specified in the present document are highly reproducible and don't need to be repeated unless otherwise stated. However, the rate of correct UE behaviour such as cell re-selection, measurement and handover is specified statistically, e.g. "at least 90%" [8], [9]. Additionally, in some of the test cases, presented in TS 38.523-3 [3], HARQ retransmissions are not tolerated, because of characteristics of the test case. In such cases a repetition of test may be required. Details are FFS.

## 4.4 Handling of differences between conformance requirements in different releases of core specifications

The conformance requirements which determine the scope of each test case are explicitly copy-pasted from relevant core specifications in the especially dedicated for this clause of each test with the title 'Conformance requirements'.

NOTE: When in the copy/pasted text there are references to other specifications the reference numbers will not match the reference numbers used in the present document. This approach has been taken in order to allow easy copy and then search for conformance requirements in those specifications.

When differences between conformance requirements in different releases of the cores specifications have impact on the Pre-test conditions, Test procedure sequence or/and the Specific message contents, the Conformance requirements related to different releases are specified separately with clear indication of the Release of the spec from which they were copied.

When there is no Release indicated for a conformance requirement text, this should be understood either as the Conformance requirements in the latest version of the spec with release = the TC Applicability release (which can be found in the column 'Release' for the relevant for the test case entry in the tables in TS 38.523-2 [2], subclause 4.1, or, as the Conformance requirements in the latest version of the spec of the release when the feature was introduced to the core specs.

# 5 Reference conditions, generic and test procedures, test parameters

## 5.1 Reference conditions

The reference environments used by all signalling tests in the present document are specified in TS 38.508-1 [4]. If a test requires an environment that is different to those specified in TS 38.508-1 [4] then, this shall be specified in the test itself.

## 5.2 Generic and test procedures

A set of basic generic procedures for bringing the UE into a specific signalling state, as well as, test procedures comprising well defined actions after the UE enters a specific state are specified in TS 38.508-1 [4]. These procedures are used (referred to) in numerous test cases throughout the present document.

## 5.3 Test parameters

### 5.3.1 PLMNs

PLMN identifiers such as PLMN1, PLMN2, etc. are used in test cases to associate a cell with an MCC and MNC for that cell.

Whenever a PLMN identifier is provided explicitly in a test description without explicit MCC and MNC values, the MCC and MNC values corresponding to the PLMN identifier shall be understood as those specified in TS 36.523-1 [42], Table 6.0.1-1.

If no PLMN is explicitly specified in the test then the PLMN(s) specified for the relevant cell(s) in TS 38.508-1 [4] (NR cells) or 36.508 [2] (E-UTRA cells) apply. If no PLMN is explicitly specified in the test nor in the TS 38.508-1 [4] (NR cells) or 36.508 [2] (E-UTRA cells) for the used in the test cell(s) then the PLMN used in the test is the one defined as PLMN1 in TS 36.523-1 [42], Table 6.0.1-1.

### 5.3.2 Cells

Cell identifiers such as NR Cell 1 and NGC Cell A (for NR cells), or, Cell 1 and Cell A (for E-UTRA cells). are used in test cases to associate a cell with various parameters.

Cells used in the tests throughout the present document are defined in TS 38.508-1 [4], subclauses 4.4.2 and 6.3.2.2 for NR cells, and, TS 36.508 [2], subclauses 4.4.2 and 6.3.2 for E-UTRA cells respectively. Signal levels for signalling tests are defined in TS 38.508-1 [4], subclause 6.2.2 and TS 36.508 [2], subclause 6.2.2.

Associated with the Cells used in the test cases are a number of parameters e.g. Tracing Area Identifiers (TAIs) such as TAI-1, TAI-2, etc., specific MCC and MNC values for the simulated PLMN, etc. For Default NAS parameters for simulated NR cells and Simulated network scenarios for NAS test cases for 5GS these are defined in TS 38.508-1 [4], subclauses 4.4.2 and 6.3.2.1 respectfully. Similarly such parameters are defined in TS 36.508 [2] for E-UTRA cells.

Whenever a Cell identifier is provided explicitly in a test description without explicit definition of parameters, the parameters values corresponding to the Cell identifier shall be understood as those specified in TS 38.508-1 [4] or TS 36.523-1 [42] respectively for the cell with that identifier.

Whenever a test in the present document requires cells characteristics, e.g. power level settings, TAIs, MCC/MNC which differ to those specified in TS 38.508-1 [4] for NR cells or in TS 36.508 [2] for E-UTRA cells then, these shall be specified explicitly in the test itself.

### 5.3.3 USIM

Default USIM fields and signalling test case specific USIM Configurations are specified in TS 38.508-1 [4], subclause 6.4.

Whenever a test in the present document does not provide an explicit reference to a specific USIM Configurations specified in TS 38.508-1 [4], subclause 6.4 then, the default parameters specified in TS 38.508-1 [4], subclause 4.8.3 shall be assumed.

Whenever a test in the present document requires specific USIM settings which do not exist in any of the defined USIM Configurations in TS 38.508-1 [4], it is recommended that a new USIM Configuration is defined and then the configuration is referred from the test. Defining specific USIM setting within a test definition should be avoided.

### 5.3.4 Messages and Information Elements (IEs)

Default Messages and IE contents, and where applicable IE fields values, used by the tests defined in the present document are specified in TS 38.508-1 [4], subclauses 4.6, 4.7 and 4.7A. For messages exchanged on other RAT e.g. E-UTRAN/EPC these can be found in TS 36.508 [2].

If a test requires a message and/or IE contents and/or IE field value which is different to those specified in TS 38.508-1 [4] then, specific message content shall be specified in the test itself with a derivation path referring to the relevant default message in TS 38.508-1 [4]. Whenever a specific message content is not explicitly provided in a test then this shall be understood as the message having exactly the same content as the default message specified in TS 38.508-1 [4].

NOTE: Similar rules apply to messages exchanged on other RATs and defined elsewhere e.g. in TS 36.508 [2].

# 6 Idle mode and RRC Inactive state operations

## 6.1 NR idle mode operations

### 6.1.1 NG-RAN Only PLMN Selection

#### 6.1.1.1 PLMN selection of RPLMN, HPLMN/EHPLMN, UPLMN and OPLMN / Automatic mode

6.1.1.1.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode **and** RPLMN, HPLMN, UPLMN and OPLMN NR cells available **and** UE is fitted with a USIM indicating RPLMN should be selected }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE selects a cell of the RPLMN and UE attempts Registration on the selected cell }

}

(2)

**with** { UE camped on an NG-RAN VPLMN cell and cells of a higher priority NG-RAN PLMN available }

**ensure that** {

**when** { higher priority PLMN search timer T expires }

**then** { UE selects and camps on a cell of the highest priority PLMN and UE attempts Registration with mobility on the selected cell }

}

(3)

**with** { UE in Automatic network selection mode **and** HPLMN, UPLMN and OPLMN NG-RAN cells available **and** UE is fitted with a USIM with Access Technology data files for each PLMN **and** there are no equivalent HPLMNs defined}

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE selects a cell of the highest priority PLMN and UE attempts Registration with mobility on the selected cell }

}

(4)

**with** { UE camped on an NR VPLMN cell **and** cells of a NG-RAN HPLMN available }

**ensure that** {

**when** { higher priority PLMN search timer T expires }

**then** { UE selects and camps on a cell of HPLMN and UE attempts Registration on the selected cell }

}

6.1.1.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clauses 4.4.3.1, 4.4.3.1.1 and 4.4.3.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.1]

At switch on, or following recovery from lack of coverage, the MS selects the registered PLMN or equivalent PLMN (if it is available) using all access technologies that the MS is capable of and if necessary (in the case of recovery from lack of coverage, see subclause 4.5.2) attempts to perform a Location Registration.

NOTE 1: The MS in automatic network selection mode can end the PLMN search procedure once the registered PLMN or equivalent PLMN is found on an access technology.

NOTE 2: An MS in automatic network selection mode can use location information to determine which PLMNs can be available in its present location.

EXCEPTION: As an alternative option to this, if the MS is in automatic network selection mode and it finds coverage of an EHPLMN, the MS may register to that EHPLMN and not return to the registered PLMN or equivalent PLMN. If the EHPLMN list is not present or is empty, and the HPLMN is available, the MS may register on the HPLMN and not return to the registered PLMN or equivalent PLMN. The operator shall be able to control by SIM configuration whether an MS that supports this option is permitted to perform this alternative behaviour.

EXCEPTION: In A/Gb mode an MS with voice capability, shall not search for CPBCCH carriers. In A/Gb mode an MS not supporting packet services shall not search for CPBCCH carriers.

If successful registration is achieved, the MS indicates the selected PLMN.

If there is no registered PLMN, or if registration is not possible due to the PLMN being unavailable or registration failure, the MS follows one of the following two procedures depending on its PLMN selection operating mode. At switch on, if the MS provides the optional feature of user preferred PLMN selection operating mode at switch on then this operating mode shall be used. Otherwise, the MS shall use the PLMN selection mode that was used before switching off.

EXCEPTION: At switch on, if the MS is in manual mode and neither registered PLMN nor PLMN that is equivalent to it is available but EHPLMN is available, then instead of performing the manual network selection mode procedure of subclause 4.4.3.1.2 the MS may select and attempt registration on the highest priority EHPLMN. If the EHPLMN list is not available or is empty and the HPLMN is available, then the MS may select and attempt registration on the HPLMN. The MS shall remain in manual mode.

NOTE 3: If successful registration is achieved, then the current serving PLMN becomes the registered PLMN and the MS does not store the previous registered PLMN for later use.

EXCEPTION: If registration is not possible on recovery from lack of coverage due to the registered PLMN being unavailable, an MS attached to GPRS services, attached via E-UTRAN or registered via the NG-RAN may, optionally, continue looking for the registered PLMN for an implementation dependent time.

NOTE 4: An MS attached to GPRS services, attached via E-UTRAN or registered via the NG-RAN should use the above exception only if one or more PDP contexts, PDN connections or PDU sessions are currently active.

[TS 23.122, clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

When following the above procedure the following requirements apply:

a) An MS with voice capability shall ignore PLMNs for which the MS has identified at least one GSM COMPACT.

b) In A/Gb mode or GSM COMPACT, an MS with voice capability, or an MS not supporting packet services shall not search for CPBCCH carriers.

c) In ii and iii, the MS should limit its search for the PLMN to the access technology or access technologies associated with the PLMN in the appropriate PLMN Selector with Access Technology list (User Controlled or Operator Controlled selector list).

An MS using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, the MS shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent.

d) In iv and v, the MS shall search for all access technologies it is capable of, before deciding which PLMN to select.

e) In ii, and iii, a packet only MS which supports GSM COMPACT, but using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, the MS shall search for all access technologies it is capable of and shall assume GSM COMPACT access technology as the lowest priority radio access technology.

f) In i, the MS shall search for all access technologies it is capable of. No priority is defined for the preferred access technology and the priority is an implementation issue, but "HPLMN Selector with Access Technology" data file on the SIM may be used to optimise the procedure.

g) In i, an MS using a SIM without access technology information storage (i.e. the "HPLMN Selector with Access Technology" data file is not present) shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent. A packet only MS which supports GSM COMPACT using a SIM without access technology information storage shall also assume GSM COMPACT access technology as the lowest priority radio access technology.

NOTE 1: For f) and g), the MS in automatic network selection mode can end the PLMN search procedure once the HPLMN or the highest priority EHPLMN is found on an access technology.

NOTE 2: For i, ii and iii, the MS can use location information to determine which PLMNs can be available in its present location.

h) In v, the MS shall order the PLMN/access technology combinations in order of decreasing signal quality within each access technology. The order between PLMN/access technology combinations with different access technologies is an MS implementation issue.

NOTE 3: Requirements a) and b) apply also to requirement d), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if capable of GSM COMPACT.

NOTE 4: Requirements a) and b) apply also to requirement f), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if this is the only access technology on the "HPLMN Selector with Access Technology" data file on the SIM.

NOTE 5: High quality signal is defined in the appropriate AS specification.

i) In i to v, the MS shall not consider PLMNs where voice service was not possible as PLMN selection candidate, unless such PLMN is available in GERAN or UTRAN or no other allowed PLMN is available.

j) In i to v, if the MS only supports EMM-REGISTERED without PDN connection (see TS 24.301 [23A]), the MS shall not consider PLMNs which do not advertise support of EMM-REGISTERED without PDN connection.

k) In i to v, if the MS only supports control plane CIoT EPS optimization (see TS 24.301 [23A]) and the UE camps on a E-UTRA cell which is not NB-IoT cell (see TS 36.304 [43], TS 36.331 [22]), the MS shall not consider PLMNs which do not advertise support of EPS services with control plane CIoT EPS optimization.

l) In i to v, if the MS is in eCall only mode, the MS shall not consider PLMNs which do not advertise support for eCall over IMS, unless such PLMNs are available in GERAN or UTRAN.

NOTE 6: As an implementation option, an MS in eCall only mode that was not able to select any PLMN according to l) can perform a second iteration of i to v with no restriction.

If successful registration is achieved, the MS indicates the selected PLMN.

If registration cannot be achieved because no PLMNs are available and allowable, the MS indicates "no service" to the user, waits until a new PLMN is available and allowable and then repeats the procedure.

If there were one or more PLMNs which were available and allowable, but an LR failure made registration on those PLMNs unsuccessful or an entry in any of the lists "forbidden location areas for roaming", "forbidden tracking areas for roaming", "5GS forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service" or "5GS forbidden tracking areas for regional provision of service" prevented a registration attempt, the MS selects the first such PLMN again and enters a limited service state.

[TS 23.122, clause 4.4.3.3.1]

If the MS is in a VPLMN, the MS shall periodically attempt to obtain service on its HPLMN (if the EHPLMN list is not present or is empty) or one of its EHPLMNs (if the EHPLMN list is present) or a higher priority PLMN/access technology combinations listed in "user controlled PLMN selector" or "operator controlled PLMN selector" by scanning in accordance with the requirements that are applicable to i), ii) and iii) as defined in the Automatic Network Selection Mode in subclause 4.4.3.1.1. In the case that the mobile has a stored "Equivalent PLMNs" list the mobile shall only select a PLMN if it is of a higher priority than those of the same country as the current serving PLMN which are stored in the "Equivalent PLMNs" list. For this purpose, a value of timer T may be stored in the SIM. The interpretation of the stored value depends on the radio capabilities supported by the MS:

- For an MS that does not support any of the following: EC-GSM-IoT, Category M1 or Category NB1 (as defined in TS 36.306 [54]), T is either in the range 6 minutes to 8 hours in 6 minute steps or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 60 minutes is used for T.

- For an MS that only supports any of the following or a combination of: EC-GSM-IoT, Category M1 or Category NB1 (as defined in TS 36.306 [54]), T is either in the range 2 hours to 240 hours, using 2 hour steps from 2 hours to 80 hours and 4 hour steps from 84 hours to 240 hours, or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 72 hours is used.

- For an MS that supports both:

a) any of the following or a combination of: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]); and

b) any access technology other than the following: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]),

then T is interpreted depending on the access technology in use as specified below:

1) if the MS is using any of the following at the time of starting timer T: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 2 hours to 240 hours, using 2 hour steps from 2 hours to 80 hours and 4 hour steps from 84 hours to 240 hours, or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 72 hours is used; and

2) if the MS is not using any of the following at the time of starting timer T: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 6 minutes to 8 hours in 6 minute steps or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 60 minutes is used for T.

If the MS is configured with the MinimumPeriodicSearchTimer as specified in 3GPP TS 24.368 [50] or 3GPP TS 31.102 [40], the MS shall not use a value for T that is less than the MinimumPeriodicSearchTimer. If the value stored in the SIM, or the default value for T (when no value is stored in the SIM), is less than the MinimumPeriodicSearchTimer, then T shall be set to the MinimumPeriodicSearchTimer.

The MS does not stop timer T, as described in 3GPP TS 24.008 [23] and 3GPP TS 24.301 [23A], when it activates power saving mode (PSM) (see 3GPP TS 23.682 [27A]).

The MS can be configured for Fast First Higher Priority PLMN search as specified in 3GPP TS 31.102 [40] or 3GPP TS 24.368 [50]. Fast First Higher Priority PLMN search is enabled if the corresponding configuration parameter is present and set to enabled. Otherwise, Fast First Higher Priority PLMN search is disabled.

The attempts to access the HPLMN or an EHPLMN or higher priority PLMN shall be as specified below:

a) The periodic attempts shall only be performed in automatic mode when the MS is roaming, and not while the MS is attached for emergency bearer services, is registered for emergency services, has a PDU session for emergency services or has a PDN connection for emergency bearer services;

b) The MS shall make the first attempt after a period of at least 2 minutes and at most T minutes:

- only after switch on if Fast First Higher Priority PLMN search is disabled; or

- after switch on or upon selecting a VPLMN if Fast First Higher Priority PLMN search is enabled.

c) The MS shall make the following attempts if the MS is on the VPLMN at time T after the last attempt;

d) Periodic attempts shall only be performed by the MS while in idle mode;

d1) Periodic attempts may be postponed while the MS is in power saving mode (PSM) (see 3GPP TS 23.682 [27A]).

d2) Periodic attempts may be postponed while the MS is receiving eMBMS transport service in idle mode (see 3GPP TS 23.246 [68]).

e) If the HPLMN (if the EHPLMN list is not present or is empty) or a EHPLMN (if the list is present) or a higher priority PLMN is not found, the MS shall remain on the VPLMN.

f) In steps i), ii) and iii) of subclause 4.4.3.1.1 the MS shall limit its attempts to access higher priority PLMN/access technology combinations to PLMN/access technology combinations of the same country as the current serving VPLMN, as defined in Annex B.

g) Only the priority levels of Equivalent PLMNs of the same country as the current serving VPLMN, as defined in Annex B, shall be taken into account to compare with the priority level of a selected PLMN.

h) If the PLMN of the highest priority PLMN/access technology combination available is the current VPLMN, or one of the PLMNs in the "Equivalent PLMNs" list, the MS shall remain on the current PLMN/access technology combination.

6.1.1.1.3 Test description

6.1.1.1.3.1 Pre-test conditions

System Simulator:

- Four multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2.1 are configured broadcasting PLMNs as indicated in Table 6.1.1.1.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.1.1.1.3.1-1 and the PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.1.1.1.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN name |
| 1 | PLMN1 |
| 12 | PLMN15 |
| 13 | PLMN16 |
| 2 | PLMN17 |

All NR cells are high quality

All NR cells are suitable cells;

System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells

UE:

The UE is in Automatic PLMN selection mode.

USIM configuration as defined in TS 38.508-1 [4] Table 6.4.1-1 will be loaded except for PLMN identifiers in Table 6.1.1.1.3.1-1.

Preamble:

- The UE is registered to NR Cell 12 and then Switched OFF (State 0N-B) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.1.1.1.3.2 Test procedure sequence

Table 6.1.1.1.3.2-1 for FR1 and Table 6.1.1.1.3.2-2 for FR2 illustrates the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1", "T2" and "T3" are to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.1.1.1.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 13 | NR Cell 2 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | "Off" | "Off" | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | -88 | "Off" | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | -88 | "Off" | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | -88 | -88 | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |

Table 6.1.1.1.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 13 | NR Cell 2 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -82 | “Off” | “Off” | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | -82 | ”Off” | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -82 | -82 | “Off” | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -82 | -82 | -82 | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |

Table 6.1.1.1.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS adjusts cell levels according to row T1 of table 6.1.1.1.3.2-1 for FR1 and table 6.1.1.1.3.2-2 for FR2 | - | - | - | - |
| 2 | Power on the UE. | - | - | - | - |
| 3 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 12? | --> | *RRCSetupRequest* | 1 | P |
| 4-21 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 subclause 4.5.2.2-2 are performed on NR Cell 12.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |
| 22 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 1 after 120 seconds, but before 660seconds (Note 1 and 2) from power on? | --> | *RRCSetupRequest* | 4 | P |
| 22A-22B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed.  (Note 3) | - | *-* | - | - |
| - | EXCEPTION: Steps 23a1 to 23b5a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | *-* | - | - |
| 23a1-23a16a1 | IF 5GS registration type is set as Initial Registration in step 22B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 1. | - | *-* | - | - |
| 23b1-23b2 | Void | - | *-* | - | - |
| 23b3-23b5a1 | IF 5GS registration type is set as Mobility Registration in step 22B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 1. | - | *-* | - | - |
| 24-27 | Void | - | - | - | - |
| 28 | SS adjusts cell levels according to row T2 of table 6.1.1.1.3.2-1 for FR1 and table 6.1.1.1.3.2-2 for FR2 | - | - | - | - |
| 29 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 13? | --> | *RRCSetupRequest* | 3 | P |
| 29A-29B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed.  (Note 3) | - | - | - | - |
| - | EXCEPTION: Steps 29a1 to 29b5a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | - | - | - |
| 29a1-29a16a1 | IF 5GS registration type is set as Initial Registration in step 29B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 13. | - | - | - | - |
| 29b1-29b2 | Void. | - | *-* | - | - |
| 29b3-29b5a1 | IF 5GS registration type is set as Mobility Registration in step 29B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 13. | - | - | - | - |
| 30 | SS adjusts cell levels according to row T3 of table 6.1.1.1.3.2-1 for FR1 and table 6.1.1.1.3.2-2 for FR2 | - | - | - | - |
| 31 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 2 after 120 seconds, but before 660 seconds after step 30? (Note 1 and 2) | --> | *RRCSetupRequest* | 2 | P |
| 31A-31B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 3) | - | - | - | - |
| - | EXCEPTION: Steps 32a1 to 32b5a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | *-* | - | - |
| 32a1-32a16a1 | IF 5GS registration type is set as Initial Registration in step 31B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 2. | - | *-* | - | - |
| 32b1-32b2 | Void | - | *-* | - | - |
| 32b3-32b5a1 | IF 5GS registration type is set as Mobility Registration in step 31B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 2. | - | *-* | - | - |
| 33-36 | Void | - | *-* | - | - |
| Note 1: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-15).Hence, window between 120s to T+Tolerance is being used, where the high priority PLMN search timer T defined by EFHPPLMN.  Note 2: Tolerance of 5min is added to allow time for the UE to find the proper PLMN.  Note 3: The 5GS registration type shall be only set as Mobility Registration for R16 UEs according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to R15 UEs. | | | | | |

6.1.1.1.3.3 Specific message contents

None

#### 6.1.1.2 PLMN selection of "Other PLMN/access technology combinations" / Automatic mode

6.1.1.2.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode and EHPLMN, UPLMN and OPLMN/access technology combinations cells available and UE is fitted with a USIM with Access Technology data files for each PLMN }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE selects a cell of the EHPLMN and UE attempts a Registration on the selected cell }

}

(2)

**with** { UE in Automatic network selection mode and UPLMN, OPLMN and other PLMN/access technology combinations cells available and UE is fitted with a USIM with Access Technology data files for each PLMN }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE selects a cell of the UPLMN and UE attempts a Registration on the selected cell }

}

(3)

**with** { UE in Automatic network selection mode and OPLMN and other PLMN/access technology combinations cells available and UE is fitted with a USIM with Access Technology data files for each PLMN }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE selects a cell of the OPLMN and UE attempts a Registration on the selected cell }

}

(4)

**with** { UE in Automatic network selection mode and other PLMN/access technology combinations cells not belonging to any of EHPLMN, UPLMN or OPLMN available }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE selects a cell of other PLMN/access technology combinations and UE attempts a Registration on the selected cell }

}

6.1.1.2.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122 clauses 4.4.3.1.1. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

When following the above procedure the following requirements apply:

a) An MS with voice capability shall ignore PLMNs for which the MS has identified at least one GSM COMPACT.

b) In A/Gb mode or GSM COMPACT, an MS with voice capability, or an MS not supporting packet services shall not search for CPBCCH carriers.

c) In ii and iii, the MS should limit its search for the PLMN to the access technology or access technologies associated with the PLMN in the appropriate PLMN Selector with Access Technology list (User Controlled or Operator Controlled selector list).

An MS using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, the MS shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent.

d) In iv and v, the MS shall search for all access technologies it is capable of, before deciding which PLMN to select.

e) In ii, and iii, a packet only MS which supports GSM COMPACT, but using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, the MS shall search for all access technologies it is capable of and shall assume GSM COMPACT access technology as the lowest priority radio access technology.

f) In i, the MS shall search for all access technologies it is capable of. No priority is defined for the preferred access technology and the priority is an implementation issue, but "HPLMN Selector with Access Technology" data file on the SIM may be used to optimise the procedure.

g) In i, an MS using a SIM without access technology information storage (i.e. the "HPLMN Selector with Access Technology" data file is not present) shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent. A packet only MS which supports GSM COMPACT using a SIM without access technology information storage shall also assume GSM COMPACT access technology as the lowest priority radio access technology.

NOTE 1: For f) and g), the MS in automatic network selection mode can end the PLMN search procedure once the HPLMN or the highest priority EHPLMN is found on an access technology.

NOTE 2: For i, ii and iii, the MS can use location information to determine which PLMNs can be available in its present location.

h) In v, the MS shall order the PLMN/access technology combinations in order of decreasing signal quality within each access technology. The order between PLMN/access technology combinations with different access technologies is an MS implementation issue.

NOTE 3: Requirements a) and b) apply also to requirement d), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if capable of GSM COMPACT.

NOTE 4: Requirements a) and b) apply also to requirement f), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if this is the only access technology on the "HPLMN Selector with Access Technology" data file on the SIM.

NOTE 5: High quality signal is defined in the appropriate AS specification.

i) In i to v, the MS shall not consider PLMNs where voice service was not possible as PLMN selection candidate, unless such PLMN is available in GERAN or UTRAN or no other allowed PLMN is available.

j) In i to v, if the MS only supports EMM-REGISTERED without PDN connection (see 3GPP TS 24.301 [23A]), the MS shall not consider PLMNs which do not advertise support of EMM-REGISTERED without PDN connection.

k) In i to v, if the MS only supports control plane CIoT EPS optimization (see 3GPP TS 24.301 [23A]) and the UE camps on a E-UTRA cell which is not NB-IoT cell (see 3GPP TS 36.304 [43], 3GPP TS 36.331 [22]), the MS shall not consider PLMNs which do not advertise support of EPS services with control plane CIoT EPS optimization.

l) In i to v, if the MS is in eCall only mode, the MS shall not consider PLMNs which do not advertise support for eCall over IMS, unless such PLMNs are available in GERAN or UTRAN.

NOTE 6: As an implementation option, an MS in eCall only mode that was not able to select any PLMN according to l) can perform a second iteration of i to v with no restriction.

If successful registration is achieved, the MS indicates the selected PLMN.

If registration cannot be achieved because no PLMNs are available and allowable, the MS indicates "no service" to the user, waits until a new PLMN is available and allowable and then repeats the procedure.

If there were one or more PLMNs which were available and allowable, but an LR failure made registration on those PLMNs unsuccessful or an entry in any of the lists "forbidden location areas for roaming", "forbidden tracking areas for roaming", "5GS forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service" or "5GS forbidden tracking areas for regional provision of service" prevented a registration attempt, the MS selects the first such PLMN again and enters a limited service state.

6.1.1.2.3 Test description

6.1.1.2.3.1 Pre-test conditions

System Simulator:

- Four inter-frequency multi-PLMN cells as specified in TS 38.508-1 [4] clause 4.4.1.1.3 are configured broadcasting default PLMNs as indicated in TS 38.508-1 [4] Table 4.4.2-3.

- The PLMNs are identified in the test by the identifiers in Table 6.1.1.2.3.1-1.

Table 6.1.1.2.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN name** |
| 1 | PLMN1 |
| 12 | PLMN2 |
| 13 | PLMN3 |
| 11 | PLMN4 |

UE:

- The UE is in Automatic PLMN selection mode.

- The UE is equipped with a USIM configuration as defined in TS 38.508-1 [4] Table 6.4.1-4.

Preamble:

- The UE is in state Switched OFF (state 0-A).

6.1.1.2.3.2 Test procedure sequence

Table 6.1.1.2.3.2-1/2 shows the cell configurations used during the test. Subsequent configurations marked “T1”, “T2” “T3” “T4”etc are applied at the points indicated in the Main behaviour description in Table 6.1.1.2.3.2-3. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.1.1.2.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 12** | **NR Cell 13** | **NR Cell 11** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | -88 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -88 | -88 | -88 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | -88 | -88 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | “Off” | -88 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |

Table 6.1.1.2.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 12** | **NR Cell 13** | **NR Cell 11** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | -82 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -82 | -82 | -82 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | -82 | -82 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | “Off” | -82 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. |

Table 6.1.1.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts cell levels according to row T1 of table 6.1.1.2.3.2-1/2. | - | - | - | - |
| 2 | Power on the UE. | - | - | - | - |
| 3 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 4-21 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 1.  NOTE: The UE performs registration and the RRC connection is not released. | - | - | - | - |
| 21A | The UE is switched off by executing generic procedure in Table 4.9.6.3-1 in TS 38.508-1 [4] | - | - | - | - |
| 22 | SS adjusts cell levels according to row T2 of table 6.1.1.2.3.2-1/2. | - | - | - | - |
| 22A | Void | - | - | - | - |
| 22B | The UE is Switched ON. | - | - | - | - |
| 23 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.5.2.2-2 indicate that the UE is camped on NR Cell 12?  NOTE: The UE performs registration and the RRC connection is not released. | --> | - | 2 | P |
| 24-27b1 | Void | - | - | - | - |
| 28 | The UE is switched off by executing generic procedure in Table 4.9.6.3-1 in TS 38.508-1 [4]. | - | - | - | - |
| 29 | SS adjusts cell levels according to row T3 of table 6.1.1.2.3.2-1/2. | - | - | - | - |
| 29A | Void. | - | - | - | - |
| 29B | The UE is Switched ON. | - | - | - | - |
| 30 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.5.2.2-2 indicate that the UE is camped on NR Cell 13?  NOTE: The UE performs registration and the RRC connection is not released. | --> | - | 3 | P |
| 31-34b1 | Void. | - | - | - | - |
| 35 | The UE is switched off by executing generic procedure in Table 4.9.6.3-1 in TS 38.508-1 [4] |  |  |  |  |
| 36 | SS adjusts cell levels according to row T4 of table 6.1.1.2.3.2-1/2. | - | - | - | - |
| 36A | Void. | - | - | - | - |
| 36B | The UE is Switched ON. | - | - | - | - |
| 37 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.5.2.2-2 indicate that the UE is camped on NR Cell 11? | --> | - | 4 | P |
| 38-42b1 | Void. | - | - | - | - |

6.1.1.2.3.3 Specific message contents

None

#### 6.1.1.3 Cell reselection of ePLMN in manual mode

6.1.1.3.1 Test Purpose (TP)

(1)

**with** { UE camped normally on a cell and network has downloaded a list of equivalent PLMNs during the Registration procedure }

**ensure that** {

**when** { Higher ranked cell is a cell of a PLMN in the downloaded equivalent PLMN list }

**then** { UE reselects to the equivalent PLMN cell }

}

(2)

**with** { UE camped normally on a cell and network has downloaded a list of equivalent PLMNs during Registration procedure for mobility }

**ensure that** {

**when** { Highest ranked cell is a cell of a PLMN not in the downloaded equivalent PLMN list }

**then** { UE does not reselect to the cell }

}

6.1.1.3.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122, clauses 4.4.3.1.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.1.2]

The MS indicates whether there are any PLMNs, which are available using all supported access technologies. This includes PLMNs in the "forbidden PLMNs" list, "forbidden PLMNs for GPRS service" list, PLMNs which only offer services not supported by the MS, and the list of "PLMNs not allowed to operate at the present UE location". An MS which supports GSM COMPACT shall also indicate GSM COMPACT PLMNs (which use PBCCH).

If displayed, PLMNs meeting the criteria above are presented in the following order:

i)- either the HPLMN (if the EHPLMN list is not present or is empty) or, if one or more of the EHPLMNs are available then based on an optional data field on the SIM either only the highest priority available EHPLMN is to be presented to the user or all available EHPLMNs are presented to the user in priority order. If the data field is not present on the SIM, then only the highest priority available EHPLMN is presented;

ii)- PLMN/access technology combinations contained in the " User Controlled PLMN Selector with Access Technology " data file in the SIM (in priority order);

iii)- PLMN/access technology combinations contained in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order) or stored in the ME (in priority order);

iv)- other PLMN/access technology combinations with received high quality signal in random order;

NOTE 1: High quality signal is defined in the appropriate AS specification.

v)- other PLMN/access technology combinations in order of decreasing signal quality.

In ii and iii, an MS using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead present the PLMNs contained in the "PLMN Selector" data file in the SIM (in priority order).

In v, requirement h) in clause 4.4.3.1.1 applies.

In i to v, requirements j), k) and l) in clause 4.4.3.1.1 apply.

In iii, requirement p) in clause 4.4.3.1.1 applies.

6.1.1.3.3 Test description

6.1.1.3.3.1 Pre-test conditions

System Simulator

- Three inter-frequency multi-PLMN NR cells.

- Each NR cell has only a single PLMN identity. The PLMNs are identified in the test by the identifiers in Table 6.1.1.3.3.1-1.

Table 6.1.1.3.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN name** |
| 1 | PLMN1 |
| 12 | PLMN2 |
| 13 | PLMN3 |

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2-1 is used in NR cell 1 and NR cell 12.

- System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.2-1 is used in NR cell 13.

UE

- The UE is in Manual PLMN selection mode.

Preamble

- The UE is registered on PLMN1 (NR Cell 1) using the procedure described in TS 38.508-1 [4] clause 4.5.2.2-2 except that the REGISTRATION ACCEPT message indicates PLMN2 in the Equivalent PLMN list as described in Table 6.1.1.3.3.3-3.

- The UE is in state Registered, Idle Mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4];

6.1.1.3.3.2 Test procedure sequence

Table 6.1.1.3.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 12** | **NR Cell 13** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -99 | -88 | -78 |  |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | "Off" | Power level "Off" is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |

Table 6.1.1.3.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 12** | **NR Cell 13** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -100 | -91 | -82 |  |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | "Off" | Power level "Off" is defined in TS 38.508-1 [4] Table 6.2.2.2-2 |

Table 6.1.1.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts cell levels according to row T1 of table 6.1.1.3.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] subclause 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 12?  NOTE: The REGISTRATION REQUEST is accepted with PLMN1 listed as an Equivalent PLMN. | - | - | 1 | - |
| 3 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 13 within 60s? | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| 4 | SS adjusts cell levels according to row T2 of table 6.1.1.3.3.2-1/2. | - | - | - | - |
| 5 | Set UE to Automatic PLMN selection mode. (Note 1) | - | - | - | - |
| Note 1: Step 5 is to ensure UE is set back to automatic PLMN selection mode for the next test case. | | | | | |

6.1.1.3.3.3 Specific message contents

Table 6.1.1.3.3.3-1: *SIB4* for NR Cell 1 (preamble and all steps, Table 6.1.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 12 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 13 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.1.3.3.3-2: *SIB4* for NR Cell 12 (preamble and all steps, Table 6.1.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF nterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 13 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.1.3.3.3-3: REGISTRATION ACCEPT for NR Cell 1 (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| Equivalent PLMNs | PLMN2 |  | NR Cell 1 |

Table 6.1.1.3.3.3-4: REGISTRATION ACCEPT for NR Cell 12 (step 2, Table 6.1.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| Equivalent PLMNs | PLMN1 |  | NR Cell 12 |
| Allowed NSSAI |  |  |  |
| S-NSSAI |  |  |  |
| Length of S-NSSAI contents | ‘0000 0010’B |  |  |
| Mapped HPLMN SST | Same as SST |  |  |

#### 6.1.1.4 PLMN selection in shared network environment / Automatic mode

6.1.1.4.1 Test Purpose (TP)

(1)

**with** { The UE is in automatic network selection mode and there is a suitable cell with multiple PLMN identities among which the HPLMN but not the registered PLMN }

**ensure that** {

**when** { the UE is switched on }

**then** { the UE attaches to the HPLMN on the shared cell }

}

(2)

**with** { the UE in automatic network selection mode and there is a suitable cell with multiple PLMN identities among which the registered PLMN }

**ensure that** {

**when** { the UE returns to coverage }

**then** { the UE performs a registration procedure due to mobility to the registered PLMN on the shared cell }

}

6.1.1.4.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304 clause 5.1.1.2, TS 23.122 clauses 4.4.3 and 4.4.3.1.1, TS 38.331 clauses 5.3.3.4, and TS 24.501 clause 5.3.1.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304 clause 5.1.1.2]

The UE shall scan all RF channels in the NR bands according to its capabilities to find available PLMNs. On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which PLMN(s) the cell belongs to. If the UE can read one or several PLMN identities in the strongest cell, each found PLMN (see the PLMN reading in TS 38.331 [3]) shall be reported to the NAS as a high quality PLMN,

…

Once the UE has selected a PLMN, the cell selection procedure shall be performed in order to select a suitable cell of that PLMN to camp on.

[TS 23.122 clauses 4.4.3]

When the MS reselects to a cell in a shared network, and the cell is a suitable cell for multiple PLMN identities received on the BCCH or on the EC-BCCH the AS indicates these multiple PLMN identities to the NAS according to 3GPP TS 44.018 [34], 3GPP TS 44.060 [39], 3GPP TS 25.304 [32] and 3GPP TS 36.304 [43]. The MS shall choose one of these PLMNs. If the registered PLMN is available among these PLMNs, the MS shall not choose a different PLMN.

The MS shall not use the PLMN codes contained in the "HPLMN Selector with Access Technology" data file.

It is possible for the home network operator to identify alternative Network IDs as the HPLMN. If the EHPLMN list is present, and not empty, the entries in the EHPLMN list are used in the network selection procedures. When attempting to select a network the highest priority EHPLMN that is available shall be selected. If the EHPLMN list is present and is empty or if the EHPLMN list is not present, the HPLMN derived from the IMSI is used for network selection procedures.

NOTE 1: The "HPLMN Selector with Access Technology" data file is only used by the MS to get the HPLMN access technologies related to the HPLMN code which corresponds to the PLMN code included in the IMSI if the EHPLMN list is not present or is empty. If the EHPLMN list is present then this data field is applicable to all the entries within the EHPLMN list.

NOTE 2: Different GSM frequency bands (e.g. 900, 1800, 1900, 400) are all considered GSM access technology. An MS supporting more than one band should scan all the bands it’s supports when scanning for GSM frequencies. However GSM COMPACT systems which use GSM frequency bands but with the CBPCCH broadcast channel are considered as a separate access technology from GSM.

NOTE 3: The inclusion of the HPLMN derived from the IMSI in the EHPLMN list is allowed. The priority of the HPLMN derived from the IMSI is given by its position in the EHPLMN list, see 3GPP TS 31.102 [40]

[TS 23.122 clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

When following the above procedure the following requirements apply:

a) An MS with voice capability shall ignore PLMNs for which the MS has identified at least one GSM COMPACT.

b) In A/Gb mode or GSM COMPACT, an MS with voice capability, or an MS not supporting packet services shall not search for CPBCCH carriers.

c) In ii and iii, the MS should limit its search for the PLMN to the access technology or access technologies associated with the PLMN in the appropriate PLMN Selector with Access Technology list (User Controlled or Operator Controlled selector list).

An MS using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, the MS shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent.

d) In iv and v, the MS shall search for all access technologies it is capable of, before deciding which PLMN to select.

e) In ii, and iii, a packet only MS which supports GSM COMPACT, but using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead use the "PLMN Selector" data file, for each PLMN in the "PLMN Selector" data file, the MS shall search for all access technologies it is capable of and shall assume GSM COMPACT access technology as the lowest priority radio access technology.

f) In i, the MS shall search for all access technologies it is capable of. No priority is defined for the preferred access technology and the priority is an implementation issue, but "HPLMN Selector with Access Technology" data file on the SIM may be used to optimise the procedure.

g) In i, an MS using a SIM without access technology information storage (i.e. the "HPLMN Selector with Access Technology" data file is not present) shall search for all access technologies it is capable of. The priority ordering amongst the access technologies is implementation dependent. A packet only MS which supports GSM COMPACT using a SIM without access technology information storage shall also assume GSM COMPACT access technology as the lowest priority radio access technology.

NOTE 1: For f) and g), the MS in automatic network selection mode can end the PLMN search procedure once the HPLMN or the highest priority EHPLMN is found on an access technology.

NOTE 2: For i, ii and iii, the MS can use location information to determine which PLMNs can be available in its present location.

h) In v, the MS shall order the PLMN/access technology combinations in order of decreasing signal quality within each access technology. The order between PLMN/access technology combinations with different access technologies is an MS implementation issue.

NOTE 3: Requirements a) and b) apply also to requirement d), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if capable of GSM COMPACT.

NOTE 4: Requirements a) and b) apply also to requirement f), so a GSM voice capable MS should not search for GSM COMPACT PLMNs, even if this is the only access technology on the "HPLMN Selector with Access Technology" data file on the SIM.

NOTE 5: High quality signal is defined in the appropriate AS specification.

i) In i to v, the MS shall not consider PLMNs where voice service was not possible as PLMN selection candidate, unless such PLMN is available in GERAN or UTRAN or no other allowed PLMN is available.

j) In i to v, if the MS only supports EMM-REGISTERED without PDN connection (see 3GPP TS 24.301 [23A]), the MS shall not consider PLMNs which do not advertise support of EMM-REGISTERED without PDN connection.

k) In i to v, if the MS only supports control plane CIoT EPS optimization (see 3GPP TS 24.301 [23A]) and the UE camps on a E-UTRA cell which is not NB-IoT cell (see 3GPP TS 36.304 [43], 3GPP TS 36.331 [22]), the MS shall not consider PLMNs which do not advertise support of EPS services with control plane CIoT EPS optimization.

l) In i to v, if the MS is in eCall only mode, the MS shall not consider PLMNs which do not advertise support for eCall over IMS, unless such PLMNs are available in GERAN or UTRAN.

NOTE 6: As an implementation option, an MS in eCall only mode that was not able to select any PLMN according to l) can perform a second iteration of i to v with no restriction.

If successful registration is achieved, the MS indicates the selected PLMN.

If registration cannot be achieved because no PLMNs are available and allowable, the MS indicates "no service" to the user, waits until a new PLMN is available and allowable and then repeats the procedure.

If there were one or more PLMNs which were available and allowable, but an LR failure made registration on those PLMNs unsuccessful or an entry in any of the lists "forbidden location areas for roaming", "forbidden tracking areas for roaming", "5GS forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service" or "5GS forbidden tracking areas for regional provision of service" prevented a registration attempt, the MS selects the first such PLMN again and enters a limited service state.

[TS 38.331 clause 5.3.3.4]

The UE shall perform the following actions upon reception of the *RRCSetup*:

...

1> set the content of *RRCSetupComplete* message as follows:

2> if upper layers provide an *5G-S-TMSI*:

3> if the *RRCSetup* is received in response to an *RRCSetupRequest*:

4> set the *ng-5G-S-TMSI-Value* to *ng-5G-S-TMSI-Part2*;

3> else:

4> set the *ng-5G-S-TMSI-Value* to *ng-5G-S-TMSI*;

2> set the *selectedPLMN-Identity* to the PLMN selected by upper layers (TS 24.501 [23]) from the PLMN(s) included in the *plmn-IdentityList* in *SIB1*;

...

1> submit the *RRCSetupComplete* message to lower layers for transmission, upon which the procedure ends

[TS 24.501 clause 5.3.1.1]

The UE NAS also provides the lower layers with the identity of the selected PLMN (see 3GPP TS 38.331 [30]). In a shared network, the UE shall choose one of the PLMN identities as specified in 3GPP TS 23.122 [5].

6.1.1.4.3 Test description

6.1.1.4.3.1 Pre-test conditions

System Simulator:

- NR Cells 1 and 2, as specified in TS 38.508-1 [4] clause 4.4.1.1.3 are configured according to Table 4.4.2-3 in TS 38.508-1 [4] except for multiple broadcasted PLMN identities as shown in Table 6.1.1.4.3.1-1: PLMN identifiers broadcasted by cells in shared network, and NR Cells 1 and 2 with different tracking area codes as shown in Table 6.1.1.4.3.1-2.

Table 6.1.1.4.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
| 1 | PLMN4 (for preamble) |
|  | PLMN15, PLMN1 (for test body) |
| 2 | PLMN15, PLMN1, PLMN16 |

Table 6.1.1.4.3.1-2: Tracking area codes

|  |  |  |
| --- | --- | --- |
| NR Cell | TAC | TAI |
| 1 | 1 | TAI-1 |
| 2 | 2 | TAI-2 |

UE:

- The UE is in Automatic PLMN selection mode.

- The UE is equipped with a USIM configuration as defined in TS 38.508-1 [4] Table 6.4.1-5.

- The UE is registered to PLMN4 before it is switched off.

Preamble:

- The UE is in state Switched OFF (state 0N-B) according to TS 38.508-1 [4].

6.1.1.4.3.2 Test procedure sequence

Table 6.1.1.4.3.2-1/2 shows the cell configurations used during the test. The configuration T0 indicates the initial conditions. Subsequent configuration marked “T1”is applied at the points indicated in the Main behaviour description in Table 6.1.1.4.3.2-2. Cell powers are chosen for a serving cell and a non-suitable cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.1.1.4.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | **NR Cell 1** | **NR Cell 2** | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3, |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | Close the NR Cell 1 to make sure the UE lose coverage. Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3, |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -88 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3, |

Table 6.1.1.4.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | **NR Cell 1** | **NR Cell 2** | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -95 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | Close the NR Cell 1 to make sure the UE lose coverage.  Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -95 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. |

Table 6.1.1.4.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts cell levels according to row T0 of table 6.1.1.4.3.2-1/2. | - | - | - | - |
| 2 | Power on the UE. | - | - | - | - |
| 3 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 4 | The SS transmits an RRCSetup message. | <-- | NR RRC: *RRCSetup* | - | - |
| 5 | Check: Does the UE transmit an *RRCSetupComplete* message indicating the HPLMN (second PLMN in the list)?  Note: This message contains an REGISTRATION REQUEST message according to default message contents. | --> | NR RRC: *RRCSetupComplete* | 1 | P |
| 6-21 | Steps 5 to 20 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed on NR Cell 1.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |
| 22 | The SS adjusts cell levels according to row T1 of table 6.1.1.4.3.2-1/2 to ensure UE to lose coverage. | - | - | - | - |
| 23 | Wait for 15s to allow UE to go out of service | - | - | - | - |
| 24 | The SS adjusts cell levels according to row T2 of table 6.1.1.4.3.2-1/2. | - | - | - | - |
| 25 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 2? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 26 | SS transmits an *RRCSetup* message. | <-- | NR RRC: *RRCSetup* | - | - |
| 27-30a1 | Steps 3 to 6a1 of the generic test procedure in TS 38.508-1 [4] subclause 4.9.5.2.2-1 are performed on NR Cell 2.  NOTE: The UE performs a registration for mobility procedure and the RRC connection is released. | - | - | - | - |

6.1.1.4.3.3 Specific message contents

Table 6.1.1.4.3.3-1: *SIB1* forNR Cell 1 (all steps, Table 6.1.1.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4] Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| CellAccessRelatedInfo SEQUENCE { |  |  |  |
| PLMN-IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 1 entry |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { | 2 entries |  |  |
| plmn-Identity[1] | PLMN15 | entry 1 |  |
| plmn-Identity[2] | PLMN1 | entry 2 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.1.4.3.3-2: *SIB1* forNR Cell 2 (all steps, Table 6.1.1.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4] Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| CellAccessRelatedInfo SEQUENCE { |  |  |  |
| PLMN-IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 1 entry |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { | 3 entries |  |  |
| plmn-Identity[1] | PLMN15 | entry 1 |  |
| plmn-Identity[2] | PLMN1 | entry 2 |  |
| plmn-Identity[3] | PLMN16 | entry 3 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.1.4.3.3-3: *RRCSetupComplete* (step 5 and 27, Table 6.1.1.4.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-22 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCSetupComplete ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcSetupComplete SEQUENCE { |  |  |  |
| selectedPLMN-Identity | 2 | PLMN1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.1.4a PLMN selection in shared network environment / Automatic mode / Cells broadcasting multiple PLMN IDs with unique TAC's, RAN areas, and cell identities

6.1.1.4a.1 Test Purpose (TP)

Same as TC 6.1.1.4.1

6.1.1.4a.2 Conformance requirements

Same as TC 6.1.1.4.2

6.1.1.4a.3 Test description

6.1.1.4a.3.1 Pre-test conditions

Same as TC 6.1.1.4.3.1

6.1.1.4a.3.2 Test procedure sequence

Same as TC 6.1.1.4.3.2

6.1.1.4a.3.3 Specific message contents

Table 6.1.1.4a.3.3-1: *SIB1* forNR Cell 1 (all steps, Table 6.1.1.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| plmn-IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 2 entries |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| PLMN-Identity[1] | PLMN15 |  |  |
| } |  |  |  |
| trackingAreaCode | '00000000 00000000 00000001'B |  |  |
| ranac | 1 |  |  |
| cellIdentity | '00000000 00000000 00000001 10000000 1011'B |  |  |
| } |  |  |  |
| PLMN-IdentityInfo[2] SEQUENCE { |  | entry 2 |  |
| PLMN-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| plmn-Identity[1] | PLMN1 |  |  |
| } |  |  |  |
| trackingAreaCode | '00000000 00000000 00000010'B |  |  |
| ranac | 2 |  |  |
| cellIdentity | '00000000 00000000 00000001 01000000 1010'B |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.1.4a.3.3-2: *SIB1* forNR Cell 2 (all steps, Table 6.1.1.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| plmn-IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 3 entries |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| PLMN-Identity[1] | PLMN15 |  |  |
| } |  |  |  |
| trackingAreaCode | '00000000 00000000 00000011'B |  |  |
| ranac | 3 |  |  |
| cellIdentity | '00000000 00000000 00000001 11000000 1101'B |  |  |
| } |  |  |  |
| PLMN-IdentityInfo[2] SEQUENCE { |  | entry 2 |  |
| PLMN-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| plmn-Identity[1] | PLMN1 |  |  |
| } |  |  |  |
| trackingAreaCode | '00000000 00000000 00000100'B |  |  |
| ranac | 4 |  |  |
| cellIdentity | '00000000 00000000 00000010 00000000 1110'B |  |  |
| } |  |  |  |
| PLMN-IdentityInfo[3] SEQUENCE { |  | entry 3 |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| PLMN-Identity[1] | PLMN16 |  |  |
| } |  |  |  |
| trackingAreaCode | '00000000 00000000 00000101'B |  |  |
| ranac | 5 |  |  |
| cellIdentity | '00000000 00000000 00000010 01000000 1111'B |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.1.4a.3.3-3: *RRCSetupComplete* (step 5 and 27, Table 6.1.1.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-22 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCSetupComplete ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcSetupComplete SEQUENCE { |  |  |  |
| selectedPLMN-Identity | 2 | PLMN1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.1.5 PLMN selection of RPLMN, HPLMN/EHPLMN, UPLMN and OPLMN / Automatic mode / User reselection

6.1.1.5.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode registered to UPLMN and RPLMN, UPLMN and OPLMN NG-RAN cells available }

**ensure that** {

**when** { UE is requested to initiate reselection and registration onto an available PLMN }

**then** { UE reselects to the cell which belongs to higher priority OPLMN }

}

(2)

**with** { UE in Automatic network selection mode registered to OPLMN and only RPLMN NG-RAN cells available }

**ensure that** {

**when** { UE is requested to initiate reselection and registration onto an available PLMN }

**then** { UE remains on the current cell which belongs to RPLMN }

}

(3)

**with** { UE in Automatic network selection mode registered to OPLMN and RPLMN, UPLMN and OPLMN NG-RAN cells available }

**ensure that** {

**when** { UE is requested to initiate reselection and registration onto an available PLMN }

**then** { UE reselects to the cell which belongs to UPLMN }

}

(4)

**with** { UE in Automatic network selection mode registered to UPLMN and RPLMN, UPLMN, OPLMN and HPLMN NG-RAN cells available }

**ensure that** {

**when** { UE is requested to initiate reselection and registration onto an available PLMN }

**then** { UE reselects to the cell which belongs to HPLMN }

}

6.1.1.5.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122 clauses 4.4.3.2 and 4.4.3.2.1. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.2]

At any time the user may request the MS to initiate reselection and registration onto an available PLMN, according to the following procedures, dependent upon the operating mode.

[TS 23.122, clause 4.4.3.2.1]

The MS selects and attempts registration on PLMN/access technology combinations, if available and allowable, in all of its bands of operation in accordance with the following order:

i) the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present);

ii) PLMN/access technology combinations contained in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order) excluding the previously selected PLMN/access technology combination;

iii) PLMN/access technology combinations contained in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order) excluding the previously selected PLMN/access technology combination;

iv) other PLMN/access technology combinations with the received high quality signal in random order excluding the previously selected PLMN/access technology combination;

v) other PLMN/access technology combinations, excluding the previously selected PLMN/access technology combination in order of decreasing signal quality or, alternatively, the previously selected PLMN/access technology combination may be chosen ignoring its signal quality;

vi) The previously selected PLMN/access technology combination.

The previously selected PLMN/access technology combination is the PLMN/access technology combination which the MS has selected prior to the start of the user reselection procedure.

NOTE 1: If the previously selected PLMN is chosen, and registration has not been attempted on any other PLMNs, then the MS is already registered on the PLMN, and so registration is not necessary.

The equivalent PLMNs list shall not be applied to the user reselection in Automatic Network Selection Mode.

When following the above procedure the requirements a), b), c), e), f), g), h), j), k) and l) in subclause 4.4.3.1.1 apply: Requirement d) shall apply as shown below:

d) In iv, v, and vi, the MS shall search for all access technologies it is capable of before deciding which PLMN/access technology combination to select.

NOTE 2: High quality signal is defined in the appropriate AS specification.

6.1.1.5.3 Test description

6.1.1.5.3.1 Pre-test conditions

6.1.1.5.3.1 Pre-test conditions

System Simulator:

- Four inter-frequency multi-PLMN cells as specified in TS 38.508-1 [4] clause 4.4.1.2 are configured broadcasting default NAS parameters as indicated in TS 38.508-1 [4] Table 4.4.2-3.

- The PLMNs are identified in the test by the identifiers in Table 6.1.1.5.3.1-1.

Table 6.1.1.5.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN name |
| 1 | PLMN1 |
| 12 | PLMN2 |
| 3 | PLMN3 |
| 13 | PLMN4 |

UE:

- The UE is in Automatic PLMN selection mode.

- The UE is equipped with a USIM configuration as defined in TS 38.508-1 [4] Table 6.4.1-6.

Preamble:

- The UE is in state Registered, Idle Mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4].

6.1.1.5.3.2 Test procedure sequence

Table 6.1.1.5.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 3 | NR Cell 13 | Remark |
| T1 | SS/PBCH  SSS EPRE | dBm/ SCS | -88 | -88 | "Off" | -88 | The power level values are assigned to satisfy RNRCell 1 = RNRCell 12 = RNRCell 13.  (NOTE 1). |
| T2 | SS/PBCH  SSS EPRE | dBm/ SCS | "Off" | -88 | "Off" | "Off" |  |
| T3 | SS/PBCH  SSS EPRE | dBm/ SCS | -88 | "Off" | -88 | -88 | The power level values are assigned to satisfy RNRCell 1 = RNRCell 3 = RNRCell 13.  (NOTE 1). |
| NOTE 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | | | |

Table 6.1.1.5.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 3 | NR Cell 13 | Remark |
| T1 | SS/PBCH  SSS EPRE | dBm/ SCS | -82 | -82 | "Off" | -82 | The power level values are assigned to satisfy RNRCell 1 = RNRCell 12 = RNRCell 13.  (NOTE 1). |
| T2 | SS/PBCH  SSS EPRE | dBm/ SCS | "Off" | -82 | "Off" | "Off" |  |
| T3 | SS/PBCH  SSS EPRE | dBm/ SCS | -82 | "Off" | -82 | -82 | The power level values are assigned to satisfy RNRCell 1 = RNRCell 3 = RNRCell 13.  (NOTE 1). |
| NOTE 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. | | | | | | | |

Table 6.1.1.5.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes the power level setting according to the row “T1” in table 6.1.1.5.3.2-1/2. | - | - | - | - |
| 2 | Cause the UE in Automatic network selection mode to initiate user reselection and registration onto an available PLMN. (Note 1) | - | - | - | - |
| 3 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 12? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 3A-3B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 2) | - | - | - | - |
| - | EXCEPTION: Steps 4a1 to 4b5a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | - | - | - |
| 4a1-4a16a1 | IF 5GS registration type is set as Initial Registration in step 3B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 12. | - | - | - | - |
| 4b1-4b2 | Void | - | - | - | - |
| 4b3-4b5a1 | IF 5GS registration type is set as Mobility Registration in step 3B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 12. | - | - | - | - |
| 5-8 | Void | - | - | - | - |
| 9 | The SS changes the power level setting according to the row “T2” in table 6.1.1.5.3.2-1/2. | - | - | - | - |
| 10 | Cause the UE in Automatic network selection mode to initiate user reselection and registration onto an available PLMN. (Note 1) | - | - | - | - |
| 11 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 12 within 90 s? | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| 12 | The SS changes the power level setting according to the row “T1” in table 6.1.1.5.3.2-1/2. | - | - | - | - |
| 13 | Cause the UE in Automatic network selection mode to initiate user reselection and registration onto an available PLMN. (Note 1) | - | - | - | - |
| 14 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 3 | P |
| 14A-14B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 2) | - | - | - | - |
| - | EXCEPTION: Steps 15a1 to 15b5a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | - | - | - |
| 15a1-15a16a1 | IF 5GS registration type is set as Initial Registration in step 14B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 1. | - | - | - | - |
| 151-15b2 | Void | - | - | - | - |
| 15b3-15b5a1 | IF 5GS registration type is set as Mobility Registration in step 14B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 1. | - | - | - | - |
| 16-19 | Void | - | - | - | - |
| 20 | The SS changes the power level setting according to the row “T3” in table 6.1.1.5.3.2-1/2. | - | - | - | - |
| 21 | Cause the UE in Automatic network selection mode to initiate user reselection and registration onto an available PLMN. (Note 1) | - | - | - | - |
| 22 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 3? | --> | NR RRC: *RRCSetupRequest* | 4 | P |
| 22A-22B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 2) | - | - | - | - |
| - | EXCEPTION: Steps 23a1 to 23b5a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | - | - | - |
| 23a1-23a16a1 | IF 5GS registration type is set as Initial Registration in step 22B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 3. | - | - | - | - |
| 23b1-23b2 | Void | - | - | - | - |
| 23b3-23b5a1 | IF 5GS registration type is set as Mobility Registration in step 22B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 3. | - | - | - | - |
| 24-27 | Void | - | - | - | - |
| Note 1: MMI command “TRIGGER\_USER\_RESELECTION” to be used. AT command AT+COPS is not suitable to achieve the test purpose.  Note 2: The 5GS registration type shall be only set as Mobility Registration for R16 UEs according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to R15 UEs. | | | | | |

6.1.1.5.3.3 Specific message contents

None

#### 6.1.1.6 PLMN selection / Periodic reselection / MinimumPeriodicSearchTimer

6.1.1.6.1 Test Purpose (TP)

(1)

***with*** { UE configured with “MinimumPeriodicSearchTimer” }

***ensure that*** {

***when*** { UE camps on an NG-RAN VPLMN cell upon switch on and cells of a higher priority NG-RAN PLMN available }

***then*** { the MS shall make the first attempt to access the HPLMN or an EHPLMN or higher priority PLMN after a period of at least 2 minutes }

}

(2)

***with*** { UE configured with “MinimumPeriodicSearchTimer”, having made first attempt to higher priority PLMN and camped on an NG-RAN VPLMN cell and cells of a higher priority NG-RAN PLMN available }

***ensure that*** {

***when*** { the higher priority PLMN search timer T stored in the USIM or the default value for T is less than the “MinimumPeriodicSearchTimer” }

***then*** { UE shall not use a value for T that is less than the “MinimumPeriodicSearchTimer” and selects and camps on a cell of the highest priority PLMN and attempts a location registration on the selected cell upon expiry of “MinimumPeriodicSearchTimer” }

}

6.1.1.6.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 23.122, clause 4.4.3.3.1 Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.3.1]

If the MS is configured with the MinimumPeriodicSearchTimer as specified in 3GPP TS 24.368 [50] or 3GPP TS 31.102 [40], the MS shall not use a value for T that is less than the MinimumPeriodicSearchTimer. If the value stored in the SIM, or the default value for T (when no value is stored in the SIM), is less than the MinimumPeriodicSearchTimer, then T shall be set to the MinimumPeriodicSearchTimer.

The MS does not stop timer T, as described in 3GPP TS 24.008 [23] and 3GPP TS 24.301 [23A], when it activates power saving mode (PSM) (see 3GPP TS 23.682 [27A]) or mobile initiated connection only mode (MICO) as described in 3GPP TS 24.501 [64].

The MS can be configured for Fast First Higher Priority PLMN search as specified in 3GPP TS 31.102 [40] or 3GPP TS 24.368 [50]. Fast First Higher Priority PLMN search is enabled if the corresponding configuration parameter is present and set to enabled. Otherwise, Fast First Higher Priority PLMN search is disabled.

The attempts to access the HPLMN or an EHPLMN or higher priority PLMN shall be as specified below:

a) The periodic attempts shall only be performed in automatic mode when the MS is roaming, and not while the MS is attached for emergency bearer services, is registered for emergency services, has a PDU session for emergency services or has a PDN connection for emergency bearer services;

b) The MS shall make the first attempt after a period of at least 2 minutes and at most T minutes:

- only after switch on if Fast First Higher Priority PLMN search is disabled; or

- after switch on or upon selecting a VPLMN if Fast First Higher Priority PLMN search is enabled.

c) The MS shall make the following attempts if the MS is on the VPLMN at time T after the last attempt;

6.1.1.6.3 Test Description

6.1.1.6.3.1 Pre-test conditions

System Simulator:

- 3 NR cells: NR Cell 11, 12 and 13 as specified in TS 38.508-1 [4] table 4.4.2-3 are configured as shown in Table 6.1.1.6.3.1–1.

- PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.1.1.6.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
|
| NR Cell 11 | PLMN1 |
| NR Cell 12 | PLMN15 |
| NR Cell 13 | PLMN16 |

UE:

- The UE is in Automatic PLMN selection mode.

- The UE is configured with a value of MinimumPeriodicSearchTimer set to 7 minutes.

- The UE is equipped with a USIM configuration 11 as per TS 38.508-1 [4] Table 6.4.1-11.

Preamble:

- The UE performs a successful registration on PLMN15 after which it is switched OFF (State 0N-B) as per TS 38.508-1 [4] table 4.4A.2-0.

6.1.1.6.3.2 Test procedure sequence

Table 6.1.1.6.3.2-1 and Table 6.1.1.6.3.2-2 shows the cell configurations used during the test. The configuration T0 indicates the initial conditions. Subsequent configurations marked “T1” & “T2” are applied at the point indicated in the Main behaviour description in Table 6.1.1.6.3.2-3. Cell powers are chosen for a serving cell and a non-suitable "Off" cell as defined in TS 38.508-1 [4] table 6.2.2.1-3.

Table 6.1.1.6.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 11 | NR Cell 12 | NR Cell  13 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -88 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -88 | -88 |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | -88 |  |

Table 6.1.1.6.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 11 | NR Cell 12 | NR Cell  13 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -82 | Off |  |
|  | Qrxlevmin | dBm | - | -91+ Delta(NRf2) | - |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -82 | -82 |  |
|  | Qrxlevmin |  | - | -91+ Delta(NRf2) | -91+ Delta(NRf3) |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | -82 |  |
|  | Qrxlevmin |  | -91+ Delta(NRf1) | -91+ Delta(NRf2) | -91+ Delta(NRf3) |  |

Table 6.1.1.6.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS adjusts cell levels according to row T1 of table 6.1.1.6.3.2-1/2. | - | - | - | - |
| 2 | Power on the UE. | - | - | - | - |
| 3-22a1 | Steps 1 to 20a1 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-2 are performed on NR Cell 12. | - | - | - | - |
| 23 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 13 after 120 seconds, but before 720 seconds (“MinimumPeriodicSearchTimer”) from power on? (Note 1 and Note 3) | --> | *NR RRC: RRCSetupRequest* | 1 | P |
| 23A-23B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 2) | - | *-* | - | - |
| - | EXCEPTION: Steps 23Ca1 to 23Cb3a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | *-* | - | - |
| 23Ca1-23Ca16a1 | IF 5GS registration type is set as Initial Registration in step 23B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 13. | - | *-* | - | - |
| 23Cb1-23Cb3a1 | IF 5GS registration type is set as Mobility Registration in step 23B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 13. | - | *-* | - | - |
| 24-28a1 | Void | - | - | - | - |
| 29 | SS adjusts cell levels according to row T2 of table 6.1.1.6.3.2-1/2. | - | - | - | - |
| 30 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 11 after 420 seconds (“MinimumPeriodicSearchTimer”) from step 24? (Note 1) | --> | *NR RRC: RRCSetupRequest* | 2 | P |
| 30A-30B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 2) | - | *-* | - | - |
| - | EXCEPTION: Steps 30Ca1 to 30Cb3a1 describe behaviour that depends on events happening prior to their execution; the "lower case letter" identifies a step sequence that take place if a specific prior event takes place. | - | *-* | - | - |
| 30Ca1-30Ca16a1 | IF 5GS registration type is set as Initial Registration in step 30B, THEN Steps 5 to 20a1of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 11. | - | *-* | - | - |
| 30Cb1-30Cb3a1 | IF 5GS registration type is set as Mobility Registration in step 30B, THEN Steps 4 to 6a1 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 are performed on NR Cell 11. | - | *-* | - | - |
| 31-35a1 | Void | - | - | - | - |
| Note 1: Timers in Steps 23 and 30 are derived from the value defined by the “MinimumPeriodicSearchTimer”.  Note 2: The 5GS registration type shall be only set as Mobility Registration for R16 UEs according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to R15 UEs.  Note 3: Tolerance of 5min is added to allow time for the UE to find the proper PLMN. | | | | | |

6.1.1.6.3.3 Specific message contents

None

#### 6.1.1.7 PLMN selection of RPLMN or (E)HPLMN; Automatic mode

6.1.1.7.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode **and** RPLMN, EHPLMN and HPLMN cells available **and** UE is fitted with a USIM containing the EHPLMN list **and** the USIM indicates RPLMN or (E)HPLMN should be selected }

**ensure that** {

**when** { UE is switched on }

**then** { UE selects a cell of the RPLMN or EHPLMN. }

}

(2)

**with** { UE in Automatic network selection mode **and** RPLMN, HPLMN and VPLMN cells available **and** UE is fitted with a USIM not containing or containing empty EHPLMN list **and** the USIM indicates RPLMN or (E)HPLMN should be selected }

**ensure that** {

**when** { UE is switched on }

**then** { UE selects a cell of the RPLMN or HPLMN. }

}

6.1.1.7.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.304 clause 5.1.2.2, TS 23.122 clauses 1.2, 4.4.3.1 and 4.4.3.1.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304 clause 5.1.2.2]

The UE shall scan all RF channels in the NR bands according to its capabilities to find available PLMNs. On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which PLMN(s) the cell belongs to. If the UE can read one or several PLMN identities in the strongest cell, each found PLMN (see the PLMN reading in TS 38.331 [3]) shall be reported to the NAS as a high quality PLMN (but without the RSRP value), provided that the following high-quality criterion is fulfilled:

1. For an NR Cell, the measured RSRP value shall be greater than or equal to -110 dBm.

...

Once the UE has selected a PLMN, the cell selection procedure shall be performed in order to select a suitable cell of that PLMN to camp on.

[TS 23.122, clause 1.2]

**Equivalent HPLMN list:** To allow provision for multiple HPLMN codes, PLMN codes that are present within this list shall replace the HPLMN code derived from the IMSI for PLMN selection purposes. This list is stored on the USIM and is known as the EHPLMN list. The EHPLMN list may also contain the HPLMN code derived from the IMSI. If the HPLMN code derived from the IMSI is not present in the EHPLMN list then it shall be treated as a Visited PLMN for PLMN selection purposes.

[TS 23.122 clause 4.4.3.1]

At switch on, or following recovery from lack of coverage, the MS selects the registered PLMN or equivalent PLMN (if it is available) using all access technologies that the MS is capable of and if necessary (in the case of recovery from lack of coverage, see subclause 4.5.2) attempts to perform a Location Registration.

NOTE 1: The MS in automatic network selection mode can end the PLMN search procedure once the registered PLMN or equivalent PLMN is found on an access technology.

NOTE 2: An MS in automatic network selection mode can use location information to determine which PLMNs can be available in its present location.

EXCEPTION: As an alternative option to this, if the MS is in automatic network selection mode and it finds coverage of an EHPLMN, the MS may register to that EHPLMN and not return to the registered PLMN or equivalent PLMN. If the EHPLMN list is not present or is empty, and the HPLMN is available, the MS may register on the HPLMN and not return to the registered PLMN or equivalent PLMN. The operator shall be able to control by SIM configuration whether an MS that supports this option is permitted to perform this alternative behaviour.

[TS 23.122 clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present);

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

6.1.1.7.3 Test description

6.1.1.7.3.1 Pre-test conditions

System Simulator:

- 4 NR Cells as specified in TS 38.508-1 [4] table 4.4.2-3 are configured as shown in Table 6.1.1.7.3.1–1. PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.1.1.7.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
|
| NR Cell 12 | PLMN4 |
| NR Cell 1 | PLMN1 |
| NR Cell 11 | PLMN15 |
| NR Cell 13 | PLMN3 |

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configurations 2 and 3 will be used as specified in tables 6.4.1-2 and 6.4.1-3 in TS 38.508-1 [4]. The points at which each USIM configuration is used is specified in 6.1.1.7.3.2-2.

Preamble:

- The UE performs a successful registration on PLMN4 after which the UE is brought into the state Switched OFF (state 0N-B) according to Table 4.4A.2-0 TS 38.508-1 [4].

6.1.1.7.3.2 Test procedure sequence

Table 6.1.1.7.3.2-1 for FR1 and table 6.1.1.7.3.2-2 for FR2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.1.1.7.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 11 | NR Cell 13 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | -88 | "Off" | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | "Off" | -88 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |

Table 6.1.1.7.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 11 | NR Cell 13 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -82 | -82 | "Off" | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
|  | Qrxlevmin | dBm | - | -91+ Delta(NRf2) | -91+ Delta(NRf1) | - |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | "Off" | -82 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | -91+ Delta(NRf2) | - | -91+ Delta(NRf3) |  |

Table 6.1.1.7.3.2-3 Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE with the USIM configuration 2 specified in table 6.4.1-2 TS 38.508-1 [4]. | - | - | - | - |
| 2 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 12 or NR Cell 11? | --> | NR RRC:*RRCSetupRequest* | 1 | P |
| 3-20 | Steps 3-20a1 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-2 are performed on NR Cell 12 or NR Cell 11.  NOTE: The UE performs registration with valid stored security context (see preamble) and the RRC connection is released. | - | - | - | - |
| 21 | Void | - | - | - | - |
| 22 | The generic test procedure in TS 38.508-1 [4] Table 4.9.6.1-1 of Switch off procedure in RRC\_IDLE are performed. | - | - | - | - |
| 23 | Void | - | - | - | - |
| 24 | The SS adjusts cell levels according to row T1 of table 6.1.1.7.3.2-1. | - | - | - | - |
| 25 | The UE is brought back to operation with the USIM configuration 3 specified in table 6.4.1-3 TS 38.508-1 [4]. | - | - | - | - |
| 26 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 12 or NR Cell 1? | --> | NR RRC:*RRCSetupRequest* | 2 | P |
| 27-44 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-2 are performed on NR Cell 12 or NR Cell 1. | - | - | - | - |

6.1.1.7.3.3 Specific message contents

None

#### 6.1.1.8 PLMN selection of RPLMN or (E)HPLMN; Manual mode

6.1.1.8.1 Test Purpose (TP)

(1)

**with** { UE in Manual network selection mode **and** EHPLMN and HPLMN cells available **and** (E)RPLMN cell is not available **and** UE is fitted with a USIM containing the EHPLMN list **and** the UE supports the exception to manual mode selection mode }

**ensure that** {

t**hen** { UE is switched on }

**then** { UE selects a cell of the highest priority EHPLMN. }

}

(2)

**with** { UE in Manual network selection mode **and** HPLMN and VPLMN cells available **and** (E)RPLMN cell is not available **and** UE is fitted with a USIM not containing or containing empty EHPLMN list **and** the UE supports the exception to manual mode selection mode }

**ensure that** {

**when** { UE is switched on }

**then** { UE selects a cell of the HPLMN. }

}

6.1.1.8.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.304 clause 5.1.2.2, TS 23.122 clauses 1.2, 4.4.3.1 and 4.4.3.1.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304 clause 5.1.2.2]

The UE shall scan all RF channels in the NR bands according to its capabilities to find available PLMNs. On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which PLMN(s) the cell belongs to. If the UE can read one or several PLMN identities in the strongest cell, each found PLMN (see the PLMN reading in TS 38.331 [3]) shall be reported to the NAS as a high quality PLMN (but without the RSRP value), provided that the following high-quality criterion is fulfilled:

1. For an NR cell, the measured RSRP value shall be greater than or equal to -110 dBm.

...

Once the UE has selected a PLMN, the cell selection procedure shall be performed in order to select a suitable cell of that PLMN to camp on.

[TS 23.122, clause 1.2]

**Equivalent HPLMN list:** To allow provision for multiple HPLMN codes, PLMN codes that are present within this list shall replace the HPLMN code derived from the IMSI for PLMN selection purposes. This list is stored on the USIM and is known as the EHPLMN list. The EHPLMN list may also contain the HPLMN code derived from the IMSI. If the HPLMN code derived from the IMSI is not present in the EHPLMN list then it shall be treated as a Visited PLMN for PLMN selection purposes.

[TS 23.122 clause 4.4.3.1]

At switch on, or following recovery from lack of coverage, the MS selects the registered PLMN or equivalent PLMN (if it is available) using all access technologies that the MS is capable of and if necessary (in the case of recovery from lack of coverage, see subclause 4.5.2) attempts to perform a Location Registration.

NOTE 1: The MS in automatic network selection mode can end the PLMN search procedure once the registered PLMN or equivalent PLMN is found on an access technology.

NOTE 2: An MS in automatic network selection mode can use location information to determine which PLMNs can be available in its present location.

EXCEPTION: As an alternative option to this, if the MS is in automatic network selection mode and it finds coverage of an EHPLMN, the MS may register to that EHPLMN and not return to the registered PLMN or equivalent PLMN. If the EHPLMN list is not present or is empty, and the HPLMN is available, the MS may register on the HPLMN and not return to the registered PLMN or equivalent PLMN. The operator shall be able to control by SIM configuration whether an MS that supports this option is permitted to perform this alternative behaviour.

[TS 23.122 clause 4.4.3.1.2]

The MS indicates whether there are any PLMNs, which are available using all supported access technologies. This includes PLMNs in the "forbidden PLMNs" list, "forbidden PLMNs for GPRS service" list and PLMNs which only offer services not supported by the MS. An MS which supports GSM COMPACT shall also indicate GSM COMPACT PLMNs (which use PBCCH).

If displayed, PLMNs meeting the criteria above are presented in the following order:

i)- either the HPLMN (if the EHPLMN list is not present or is empty) or, if one or more of the EHPLMNs are available then based on an optional data field on the SIM either only the highest priority available EHPLMN is to be presented to the user or all available EHPLMNs are presented to the user in priority order. If the data field is not present on the SIM, then only the highest priority available EHPLMN is presented;

ii)- PLMN/access technology combinations contained in the " User Controlled PLMN Selector with Access Technology " data file in the SIM (in priority order);

iii)- PLMN/access technology combinations contained in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv)- other PLMN/access technology combinations with received high quality signal in random order;

v)- other PLMN/access technology combinations in order of decreasing signal quality.

6.1.1.8.3 Test description

6.1.1.8.3.1 Pre-test conditions

System Simulator:

- 3 NR cells: NR Cells 1, 13 and 12 as specified in TS 38.508-1 [4] table 6.3.2.2-1 are configured as shown in Table 6.1.1.8.3.1–1. PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.1.1.8.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
|
| NR Cell 1 (configured during preamble) | PLMN4 |
| NR Cell 1 (configured in test body all steps) | PLMN1 |
| NR Cell 13 | PLMN15 |
| NR Cell 12 | PLMN3 |

UE:

- The UE is in Manual PLMN selection mode.

- USIM configurations 2 and 3 will be used as specified in tables 6.4.1-2 and 6.4.1-3 in TS 38.508-1 [4]. The points at which each USIM configuration is used is specified in 6.1.1.8.3.2-2.

Preamble:

- The UE performs a successful registration on PLMN4 after which the UE is brought into the state Switched OFF (state 0N-B) according to Table 4.4A.2-0 TS 38.508-1 [4].

6.1.1.8.3.2 Test procedure sequence

Table 6.1.1.8.3.2-1 for FR1 and table 6.1.1.8.3.2-2 for FR2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.1.1.8.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 13 | NR Cell 12 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | "Off" | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | -88 | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |

Table 6.1.1.8.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 13 | NR Cell 12 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | "Off" | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | -91+ Delta(NRf3) | - |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | "Off" | -82 | Power level “Off” is defined in TS 38.508-1 Table 6.2.2.1-3 |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | - | -91+ Delta(NRf2) |  |

Table 6.1.1.8.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE with the USIM configuration 2 specified in table 6.4.1-2 TS 38.508-1 [4].. | - | - | - | - |
| 2 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 13? | --> | NR RRC:*RRCSetupRequest* | 1 | P |
| 3 - 20 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-2 are performed on NR Cell 13.  NOTE: The UE performs registration with valid stored security context (see preamble) and the RRC connection is released. | - | - | - | - |
| 21 | Void | - | - | - | - |
| 22 | The generic test procedure in TS 38.508-1 [4] Table 4.9.6.1-1 of Switch off procedure in RRC\_IDLE are performed. | - | - | - | - |
| 23 | Void | - | - | - | - |
| 24 | The SS adjusts cell according to row T1 of table 6.1.1.8.3.2-1. | - | - | - | - |
| 25 | The UE is brought back to operation with the USIM configuration 3 specified in table 6.4.1-3 TS 38.508-1 [4]. | - | - | - | - |
| 26 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC:*RRCSetupRequest* | 2 | P |
| 27- 44 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-2 are performed on NR Cell 1. | - | - | - | - |

6.1.1.8.3.3 Specific message contents

None

### 6.1.2 NG-RAN Only Cell Selection

#### 6.1.2.1 Cell selection / Qrxlevmin & Cell reselection (Intra NR)

6.1.2.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { a cell fulfils all requirements for a suitable cell except the cell selection criteria which are not fulfilled (Srxlev<0) }

**then** { the UE does not consider the cell suitable and no camping on this cell can take place }

}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { a cell fulfils all requirements for a suitable cell including the cell selection criteria for a cell which are also fulfilled (Srxlev>0) }

**then** { the UE considers the cell suitable and camps on it }

}

(3)

**with** { UE in NR RRC\_IDLE state }

**ensure** **that** {

**when** { UE detects the cell ranked as the best cell }

**then** { UE reselects the new cell }

}

(4)

**with** { UE in NR RRC\_IDLE state }

**ensure** **that** {

**when** { a cell fulfils cell selection criteria but trackingAreaCode is not provided for that PLMN }

**then** { the UE considers the cell as barred and no camping on this cell can take place }

}

6.1.2.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.300 clauses 9.2.1.1, 3GPP TS 38.304 clause 4.1, 4.5, 5.2.1, 5.2.3.1, 5.2.3.2 , 5.2.4.6 and 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.300, clause 9.2.1.1]

The principles of PLMN selection in NR are based on the 3GPP PLMN selection principles. Cell selection is required on transition from RM-DEREGISTERED to RM-REGISTERED, from CM-IDLE to CM-CONNECTED and from CM-CONNECTED to CM-IDLE and is based on the following principles:

- The UE NAS layer identifies a selected PLMN and equivalent PLMNs;

- Cell selection is always based on CD-SSBs located on the synchronization raster (see subclause 5.2.4):

- The UE searches the NR frequency bands and for each carrier frequency identifies the strongest cell as per the CD-SSB. It then reads cell system information broadcast to identify its PLMN(s):

- The UE may search each carrier in turn ("initial cell selection") or make use of stored information to shorten the search ("stored information cell selection").

- The UE seeks to identify a suitable cell; if it is not able to identify a suitable cell it seeks to identify an acceptable cell. When a suitable cell is found or if only an acceptable cell is found it camps on that cell and commence the cell reselection procedure:

- A suitable cell is one for which the measured cell attributes satisfy the cell selection criteria; the cell PLMN is the selected PLMN, registered or an equivalent PLMN; the cell is not barred or reserved and the cell is not part of a tracking area which is in the list of "forbidden tracking areas for roaming";

- An acceptable cell is one for which the measured cell attributes satisfy the cell selection criteria and the cell is not barred.

Transition to RRC\_IDLE:

On transition from RRC\_CONNECTED to RRC\_IDLE, a UE should camp on the last cell for which it was in RRC\_CONNECTED or a cell/any cell of set of cells or frequency be assigned by RRC in the state transition message.

Recovery from out of coverage:

The UE should attempt to find a suitable cell in the manner described for stored information or initial cell selection above. If no suitable cell is found on any frequency or RAT, the UE should attempt to find an acceptable cell.

In multi-beam operations, the cell quality is derived amongst the beams corresponding to the same cell (see subclause 9.2.4).

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE.

When a UE is switched on, a public land mobile network (PLMN) is selected by NAS. For the selected PLMN, associated RAT(s) may be set 3GPP TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN then becomes the registered PLMN 3GPP TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in 3GPP TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

[TS 38.304, clause 4.5]

The cells are categorised according to which services they offer:

**acceptable cell:**

An "acceptable cell" is a cell on which the UE may camp to obtain limited service (originate emergency calls and receive ETWS and CMAS notifications). Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call and to receive ETWS and CMAS notification in an NR network:

- The cell is not barred, see subclause 5.3.1;

- The cell selection criteria are fulfilled, see subclause 5.2.3.2.

**suitable cell:**

A cell is considered as suitable if the following conditions are fulfilled:

- The cell is part of either the selected PLMN or the registered PLMN or PLMN of the Equivalent PLMN list and *trackingAreaCode* is provided for that PLMN;

- The cell selection criteria are fulfilled, see subclause 5.2.3.2.

According to the latest information provided by NAS:

- The cell is not barred, see subclause 5.3.1;

- The cell is part of at least one TA that is not part of the list of "Forbidden Tracking Areas" (TS 22.261 [12]), which belongs to a PLMN that fulfils the first bullet above.

**barred cell:**

A cell is barred if it is so indicated in the system information, as specified in TS 38.331 [3].

**reserved cell:**

A cell is reserved if it is so indicated in system information, as specified in TS 38.331 [3].

Following exception to these definitions are applicable for UEs:

- if a UE has an ongoing emergency call, all acceptable cells of that PLMN are treated as suitable for the duration of the emergency call.

[TS 38.304, clause 5.2.1]

UE shall perform measurements for cell selection and reselection purposes as specified in TS 38.133 [8].

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on RRC\_IDLE or RRC\_INACTIVE state measurements and cell selection criteria.

In order to expedite the cell selection process, stored information for several RATs, if available, may be used by the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT. Details on performance requirements for cell reselection can be found in TS 38.133 [8].

The NAS is informed if the cell selection and reselection result in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, monitor control channel(s) of that cell so that the UE can:

- receive system information from the PLMN; and

- receive registration area information from the PLMN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN; and

- initiate transfer to Connected mode.

For cell selection in multi-beam operations, measurement quantity of a cell is up to UE implementation.

For cell reselection in multi-beam operations, using a maximum number (*nrofSS-BlocksToAverage*) of beams to be considered and a threshold (*absThreshSS-BlocksConsolidation*) which are configured for a cell*,* the measurement quantity of this cell is derived amongst the beams corresponding to the same cell based on SS/PBCH block as follows:

- if the highest beam measurement quantity value is below the threshold:

- derive a cell measurement quantity as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [11].

- else:

- derive a cell measurement quantity as the linear average of the power values of up to the maximum number of highest beam measurement quantity values above the threshold.

[TS 38.304, clause 5.2.3.1]

Cell selection is performed by one of the following two procedures:

a) Initial cell selection (no prior knowledge of which RF channels are NR frequencies):

1. The UE shall scan all RF channels in the NR bands according to its capabilities to find a suitable cell.

2. On each frequency, the UE need only search for the strongest cell.

3. Once a suitable cell is found, this cell shall be selected.

b) Cell selection by leveraging stored information:

1. This procedure requires stored information of frequencies and optionally also information on cell parameters from previously received measurement control information elements or from previously detected cells.

2. Once the UE has found a suitable cell, the UE shall select it.

3. If no suitable cell is found, the initial cell selection procedure in a) shall be started.

NOTE: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

Srxlev > 0 AND Squal > 0

where:Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp

Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in SIB3 and SIB4 for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in SIB3 and SIB4 for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN 3GPP TS 23.122 [9] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN 3GPP TS 23.122 [9] |
| Pcompensation | If the UE supports the additionalPmax in the NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)* |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101 [15] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (3GPP TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

Rs = Qmeas,s +Qhyst - Qoffsettemp

Rn = Qmeas,n -Qoffset - Qoffsettemp

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

[TS 38.304, clause 5.3.1]

Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of three fields:

- *cellBarred* (IE type: "barred" or "not barred")   
Indicated in *MIB* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")   
Indicated in *SIB1* message*.* In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN.

- *cellReservedForOtherUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

When cell status is indicated as "not barred" and "not reserved" for operator use and not "true" for other use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is indicated as "true" for other use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN and not "true" for other use,

- UEs assigned to Access Identity 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Identity 0, 1, 2 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in TS 22.261 [12].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1* or due to *trackingAreaCode* being absent in *SIB1* as specified in TS 38.331 [3]:

- The UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

- The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT.

6.1.2.1.3 Test description

6.1.2.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 11.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None.

Preamble:

- The UE is in state Switched OFF (state 0-A) according to TS 38.508-1 [4].

6.1.2.1.3.2 Test procedure sequence

Table 6.1.2.1.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configurations marked "T1", "T2", "T3" and "T4" are applied at the points indicated in the Main behaviour description in Table 6.1.2.1.3.2-3.

Table 6.1.2.1.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 11** | **Remark** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -98 | Off | The power level value is such to satisfy SrxlevNRCell1 < 0 but the UE is able to read the PLMN identity |
| Qrxlevmin | dBm | -90 | - |  |
| Qrxlevminoffset | dB | 0 | - |  |
| Pcompensation | dB | 0 | - |  |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -80 | Off | The power level is such that SrxlevNRCell1 > 0 |
|  | Qrxlevmin | dBm | -90 | - |  |
|  | Qrxlevminoffset | dB | 0 | - |  |
|  | Pcompensation | dB | 0 | - |  |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | -87 | -78 | The power level values are assigned to satisfy RNRCell 1 < RNRCell 11. |
|  | Qrxlevmin | dBm | -90 | -90 |  |
|  | Qrxlevminoffset | dB | 0 | 0 |  |
|  | Pcompensation | dB | 0 | 0 |  |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | -78 | -85 | The power level values are assigned to satisfy RNRCell 1 > RNRCell 11. |
|  | Qrxlevmin | dBm | -90 | -90 |  |
|  | Qrxlevminoffset | dB | 0 | 0 |  |
|  | Pcompensation | dB | 0 | 0 |  |
| Note: The downlink signal level uncertainty is specified in TS 38.508-1 [4] clause 6.2.2.1. | | | | | |

Table 6.1.2.1.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 11** | **Remark** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -100 | Off | The power level value is such to satisfy SrxlevNRCell1 < 0 but the UE is able to read the PLMN identity |
| Qrxlevmin | dBm | -91+Delta(NRf1) | - |  |
| Qrxlevminoffset | dB | 0 | - |  |
| Pcompensation | dB | 0 | - |  |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -82 | Off | The power level is such that SrxlevNRCell1 > 0 |
|  | Qrxlevmin | dBm | -91+Delta(NRf1) | - |  |
|  | Qrxlevminoffset | dB | 0 | - |  |
|  | Pcompensation | dB | 0 | - |  |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | The power level values are assigned to satisfy RNRCell 1 < RNRCell 11. |
|  | Qrxlevmin | dBm | -100+Delta(NRf1) | -100+Delta(NRf1) |  |
|  | Qrxlevminoffset | dB | 0 | 0 |  |
|  | Pcompensation | dB | 0 | 0 |  |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -91 | The power level values are assigned to satisfy RNRCell 1 > RNRCell 11. |
|  | Qrxlevmin | dBm | -100+Delta(NRf1) | -100+Delta(NRf1) |  |
|  | Qrxlevminoffset | dB | 0 | 0 |  |
|  | Pcompensation | dB | 0 | 0 |  |

Table 6.1.2.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts the SS/PBCH EPRE level of NR Cell 1 according to row "T1" in table 6.1.2.1.3.2-1/2. | - | - | - | - |
| 2 | The UE is switched on. | - | - | - | - |
| 3 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 4 | SS re-adjusts the SS/PBCH EPRE level of NR Cell 1 level according to row "T2" in table 6.1.2.1.3.2-1/2. | - | - | - | - |
| 5 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 6-23 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |
| - | EXCEPTION: Step 23Aa1 should be executed in case of FR2 | - | - | - | - |
| 23Aa1 | SS change NR Cell 1 SIB1 with modification of Qrxlevmin. | - | - | - | - |
| 24 | The SS changes SS/PBCH  EPRE level of NR Cell 11 according to the row "T3" in table 6.1.2.1.3.2-1/2. | - | - | - | - |
| 25-31 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.5 indicate that the UE is camped on NR Cell 11?  NOTE 1: The UE performs registration and the RRC connection is released. | - | - | 3 | - |
| - | EXCEPTION: Steps 32-34 are not applicable when pc\_SNPN\_only is set to TRUE. | - | - | - | - |
| 32 | SS change NR Cell 1 SIB1. | - | - | - | - |
| 32A | Wait for 2.1\* modification period second for the SS to transmit modified system information  (Note 1) |  |  |  |  |
| 33 | The SS changes SS/PBCH  EPRE level of NR Cell 1 and 11 according to the row "T4" in table 6.1.2.1.3.2-1/2. | - | - | - | - |
| 34 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1 within the next 60 s? | - | - | 4 | F |
| Note 1: The modification period, expressed in number of radio frames = modificationPeriodCoeff \* defaultPagingCycle. | | | | | |

6.1.2.1.3.3 Specific message contents

Table 6.1.2.1.3.3-1: *SIB1* for NR Cell 1 (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| SIB1 ::= SEQUENCE { | |  |  |  |
| cellSelectionInfo SEQUENCE { | |  |  |  |
| q-RxLevMin | | -45 | -90 dBm | FR1 |
| q-RxLevMin | | ROUND((-91+Delta(NRf1))/2) |  | FR2 |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.1.3.3-1A: *SIB1* for NR Cell 1 (Step 23Aa1, Table 6.1.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| SIB1 ::= SEQUENCE { | |  |  |  |
| cellSelectionInfo SEQUENCE { | |  |  |  |
| q-RxLevMin | | ROUND([-100+Delta(NRf1)]/2) |  | FR2 |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.1.3.3-2: *SIB1* for NR Cell 1 (Step 32, Table 6.1.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| SIB1 ::= SEQUENCE { | |  |  |  |
| cellSelectionInfo SEQUENCE { | |  |  |  |
| q-RxLevMin | | -45 | -90 dBm | FR1 |
| q-RxLevMin | | ROUND((-100+Delta(NRf1))/2) | -100+Delta(NRf1) dBm | FR2 |
| } | |  |  |  |
| cellAccessRelatedInfo | | CellAccessRelatedInfo |  |  |
| } | |  |  |  |

Table 6.1.2.1.3.3-3: *CellAccessRelatedInfo* (Table 6.1.2.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path:TS 38.508-1 [4], Table 4.6.3-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellAccessRelatedInfo ::= SEQUENCE { |  |  |  |
| plmn-IdentityList | PLMN-IdentityInfoList |  |  |
| cellReservedForOtherUse | Not present |  |  |
| } |  |  |  |

Table 6.1.2.1.3.3-4: *PLMN-IdentityInfoList* (Table 6.1.2.1.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-108 | | | |
| Information Element | Value/remark | Comment | Condition |
| PLMN-IdentityInfoList ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 1 entry |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| trackingAreaCode | Not present |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.2 Cell selection / Qqualmin / Intra NR / Serving cell becomes non-suitable (Srxlev > 0, Squal < 0)

6.1.2.2.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { a cell fulfils all requirements for a suitable cell except the cell selection criteria which are not fulfilled (Srxlev>0 AND Squal<0) }

**then** { the UE does not consider the cell suitable and no camping on this cell can take place }

}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { a cell fulfils all requirements for a suitable cell including the cell selection criteria for a cell which are also fulfilled (Srxlev>0 AND Squal>0) }

**then** { the UE considers the cell suitable and camps on it }

}

(3)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes non-suitable (Srxlev > 0 and Squal < 0)and there is a suitable neighbour cell (Srxlev > 0 and Squal > 0) }

**then** { UE selects the suitable neighbour cell }

}

6.1.2.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.300 clauses 9.2.1.1, 3GPP TS 38.304 clause 4.1, 4.5, 5.2.1, 5.2.3.1, 5.2.3.2, 5.2.4.6 and 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.300, clause 9.2.1.1]

The principles of PLMN selection in NR are based on the 3GPP PLMN selection principles. Cell selection is required on transition from RM-DEREGISTERED to RM-REGISTERED, from CM-IDLE to CM-CONNECTED and from CM-CONNECTED to CM-IDLE and is based on the following principles:

- The UE NAS layer identifies a selected PLMN and equivalent PLMNs;

- Cell selection is always based on CD-SSBs located on the synchronization raster (see subclause 5.2.4):

- The UE searches the NR frequency bands and for each carrier frequency identifies the strongest cell as per the CD-SSB. It then reads cell system information broadcast to identify its PLMN(s):

- The UE may search each carrier in turn ("initial cell selection") or make use of stored information to shorten the search ("stored information cell selection").

- The UE seeks to identify a suitable cell; if it is not able to identify a suitable cell it seeks to identify an acceptable cell. When a suitable cell is found or if only an acceptable cell is found it camps on that cell and commence the cell reselection procedure:

- A suitable cell is one for which the measured cell attributes satisfy the cell selection criteria; the cell PLMN is the selected PLMN, registered or an equivalent PLMN; the cell is not barred or reserved and the cell is not part of a tracking area which is in the list of "forbidden tracking areas for roaming";

- An acceptable cell is one for which the measured cell attributes satisfy the cell selection criteria and the cell is not barred.

Transition to RRC\_IDLE:

On transition from RRC\_CONNECTED to RRC\_IDLE, a UE should camp on the last cell for which it was in RRC\_CONNECTED or a cell/any cell of set of cells or frequency be assigned by RRC in the state transition message.

Recovery from out of coverage:

The UE should attempt to find a suitable cell in the manner described for stored information or initial cell selection above. If no suitable cell is found on any frequency or RAT, the UE should attempt to find an acceptable cell.

In multi-beam operations, the cell quality is derived amongst the beams corresponding to the same cell (see subclause 9.2.4).

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE.

When a UE is switched on, a public land mobile network (PLMN) is selected by NAS. For the selected PLMN, associated RAT(s) may be set 3GPP TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN then becomes the registered PLMN 3GPP TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in 3GPP TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

[TS 38.304, clause 4.5]

The cells are categorised according to which services they offer:

**acceptable cell:**

An "acceptable cell" is a cell on which the UE may camp to obtain limited service (originate emergency calls and receive ETWS and CMAS notifications). Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call and to receive ETWS and CMAS notification in an NR network:

- The cell is not barred, see subclause 5.3.1;

- The cell selection criteria are fulfilled, see subclause 5.2.3.2.

**suitable cell:**

A cell is considered as suitable if the following conditions are fulfilled:

- The cell is part of either:

- the selected PLMN, or:

- the registered PLMN, or:

- a PLMN of the Equivalent PLMN list.

- The cell selection criteria are fulfilled, see subclause 5.2.3.2;

According to the latest information provided by NAS:

- The cell is not barred, see subclause 5.3.1;

- The cell is part of at least one TA that is not part of the list of "Forbidden Tracking Areas" TS 22.261 [12], which belongs to a PLMN that fulfils the first bullet above.

**barred cell:**

A cell is barred if it is so indicated in the system information TS 38.331 [3].

**reserved cell:**

A cell is reserved if it is so indicated in system information TS 38.331 [3].

Following exception to these definitions are applicable for UEs:

- if a UE has an ongoing emergency call, all acceptable cells of that PLMN are treated as suitable for the duration of the emergency call.

[TS 38.304, clause 5.2.1]

UE shall perform measurements for cell selection and reselection purposes as specified in TS 38.133 [8].

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on RRC\_IDLE or RRC\_INACTIVE state measurements and cell selection criteria.

In order to expedite the cell selection process, stored information for several RATs, if available, may be used by the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT. Details on performance requirements for cell reselection can be found in TS 38.133 [8].

The NAS is informed if the cell selection and reselection result in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, monitor control channel(s) of that cell so that the UE can:

- receive system information from the PLMN; and

- receive registration area information from the PLMN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN; and

- initiate transfer to Connected mode.

For cell selection in multi-beam operations, measurement quantity of a cell is up to UE implementation.

For cell reselection in multi-beam operations, using a maximum number (*nrofSS-BlocksToAverage*) of beams to be considered and a threshold (*absThreshSS-BlocksConsolidation*) which are configured for a cell*,* the measurement quantity of this cell is derived amongst the beams corresponding to the same cell based on SS/PBCH block as follows:

- if the highest beam measurement quantity value is below the threshold:

- derive a cell measurement quantity as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [11].

- else:

- derive a cell measurement quantity as the linear average of the power values of up to the maximum number of highest beam measurement quantity values above the threshold.

[TS 38.304, clause 5.2.3.1]

Cell selection is performed by one of the following two procedures:

a) Initial cell selection (no prior knowledge of which RF channels are NR frequencies):

1. The UE shall scan all RF channels in the NR bands according to its capabilities to find a suitable cell.

2. On each frequency, the UE need only search for the strongest cell.

3. Once a suitable cell is found, this cell shall be selected.

b) Cell selection by leveraging stored information:

1. This procedure requires stored information of frequencies and optionally also information on cell parameters from previously received measurement control information elements or from previously detected cells.

2. Once the UE has found a suitable cell, the UE shall select it.

3. If no suitable cell is found, the initial cell selection procedure in a) shall be started.

NOTE: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

Srxlev > 0 AND Squal > 0

Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp

where:

Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in SIB3 and SIB4 for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in SIB3 and SIB4 for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN 3GPP TS 23.122 [9] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN 3GPP TS 23.122 [9] |
| Pcompensation | If the UE supports the additionalPmax in the NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)* |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101 [15] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (3GPP TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

Rs = Qmeas,s +Qhyst - Qoffsettemp

Rn = Qmeas,n -Qoffset - Qoffsettemp

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

[TS 38.304, clause 5.3.1]

Cell status and cell reservations are indicated in the *MIB or SIB1* message TS 38.331 [3] by means of three fields:

- *cellBarred* (IE type: "barred" or "not barred")   
Indicated in *MIB* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")   
Indicated in *SIB1* message*.* In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN.

- *cellReservedForOtherUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

When cell status is indicated as "not barred" and "not reserved" for operator use and not "true" for other use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is indicated as "true" for other use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN and not "true" for other use,

- UEs assigned to Access Identity 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Identity in the range of 0 to 10 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in 3GPP TS 22.261 [12].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB* or the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else

- If the field *intraFreqReselection* in *MIB* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

- The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT.

6.1.2.2.3 Test description

6.1.2.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 11 have different tracking areas according to TS 38.508-1 [4] Table 4.4.2-3.

- NR Cell 1 and NR Cell 11 are configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2, and message contents defined in is used in NR cells.

UE:

- None.

Preamble:

- The UE is in state Switched OFF (state 0-A) according to TS 38.508-1 [4].

6.1.2.2.3.2 Test procedure sequence

Table 6.1.2.2.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configurations marked "T1" "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.1.2.2.3.2-3.

Table 6.1.2.2.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 11 | Remark |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | Off | The power level value is such to satisfy SrxlevNRCell1 > 0 and SqualNRCell1< 0 but the UE is able to read the PLMN identity |
| RSRQ | dB | -13.78 | - |  |
| Noc | dBm/SCS | -94 | | Noc is applied for NRf1 |
| Qrxlevmin | dBm | -110 | - |  |
| Qrxlevminoffset | dB | 0 | - |  |
| Qqualmin | dB | -12 | - |  |
| Qqualminoffset | dB | 0 | - |  |
| Pcompensation | dB | 0 | - |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -78 | -115 | The power level is such that SrxlevNRCell1 > 0 and SqualNRCell1 > 0 |
|  | RSRQ | dB | -10.89 | -31.83 |  |
|  | Noc | dBm/SCS | -94 | |  |
|  | Qrxlevmin | dBm | -110 | -110 |  |
|  | Qrxlevminoffset | dB | 0 | 0 |  |
|  | Qqualmin | dB | -12 | -12 |  |
|  | Qqualminoffset | dB | 0 | -0 |  |
|  | Pcompensation | dB | 0 | -0 |  |
| T3 | SS/PBCH SSS EPRE | dBm/SCS | -91 | -78 | SrxlevNRCell1 > 0 and SqualNRCell1 < 0 |
|  | RSRQ | dB | -12.56 | -10.89 |  |
|  | Noc | dBm/SCS | -94 | |  |
|  | Qrxlevmin | dBm | -110 | -110 |  |
|  | Qrxlevminoffset | dB | 0 | 0 |  |
|  | Qqualmin | dB | -12 | -12 |  |
|  | Qqualminoffset | dB | 0 | 0 |  |
|  | Pcompensation | dB | 0 | 0 |  |
|  | Srxlev\* | dB | 19 | 32 | NR Cell 11 is suitable cell |
|  | Squal\* | dB | -0.56 | 1.11 |  |
| Note: The downlink signal level uncertainty is specified in TS 38.508-1 [4] clause 6.2.2.1 | | | | | |

Table 6.1.2.2.3.2-2: Void

Table 6.1.2.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS adjusts the SS/PBCH EPRE level of NR Cell 1 according to row "T1" in table 6.1.2.2.3.2-1. | - | - | - | - |
| 2 | The UE is switched on. | - | - | - | - |
| 3 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 3A | The UE is switched off. | - | - | - | - |
| 4 | SS re-adjusts the SS/PBCH EPRE level of NR Cell 1 level according to row "T2" in table 6.1.2.2.3.2-1. | - | - | - | - |
| 4A | The UE is switched on. | - | - | - | - |
| 5 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 6-23 | Steps 3 to 20 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |
| 24 | SS adjusts the SS/PBCH EPRE level of NR Cell 1 and NR Cell 11 according to row "T3" in table 6.1.2.2.3.2-1. | - | - | - | - |
| 25 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 11?  NOTE: The UE performs a registration for mobility procedure and the RRC connection is released. | - | - | 3 | P |

6.1.2.2.3.3 Specific message contents

Table 6.1.2.2.3.3-1: *SIB1* (NR Cell 1, Preamble and all steps of Table 6.1.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 with Condition QBASED | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| cellSelectionInfo SEQUENCE { | |  |  |  |
| q-QualMin | | -12 |  | FR1 |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.2.3.3-2: *SIB2* (NR Cell 1, Preamble and all steps of Table 6.1.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 with Condition QBASED | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| intraFreqCellReselectionInfo SEQUENCE { |  |  |  |
| q-QualMin | -12 | -12dB | FR1 |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.3 Cell selection / Intra NR / Serving cell becomes non-suitable (S<0, MIB Indicated barred)

6.1.2.3.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes non-suitable (S<0)and there is a suitable neighbour cell (S>0) }

**then** { UE selects the suitable neighbour cell }

}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes barred and there is a suitable neighbour cell }

**then** { UE selects the suitable neighbour cell }

}

6.1.2.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304 clause 4.1, 5.2.3.2 and 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE.

When a UE is switched on, a public land mobile network (PLMN) is selected by NAS. For the selected PLMN, associated RAT(s) may be set 3GPP TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN then becomes the registered PLMN 3GPP TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in 3GPP TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

Srxlev > 0 AND Squal > 0

where:

Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp

Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in SIB3 and SIB4 for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in SIB3 and SIB4 for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN 3GPP TS 23.122 [9] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN 3GPP TS 23.122 [9] |
| Pcompensation | If the UE supports the additionalPmax in the NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)* |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101 [15] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (3GPP TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

[TS 38.304, clause 5.3.1]

Cell status and cell reservations are indicated in the *MIB or SIB1* message TS 38.331 [3] by means of three fields:

- *cellBarred* (IE type: "barred" or "not barred")   
Indicated in *MIB* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")   
Indicated in *SIB1* message*.* In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN.

- *cellReservedForOtherUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

When cell status is indicated as "not barred" and "not reserved" for operator use and not "true" for other use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is indicated as "true" for other use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN and not "true" for other use,

- UEs assigned to Access Identity 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Identity in the range of 0 to 10 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in 3GPP TS 22.261 [12].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB* or the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else

- If the field *intraFreqReselection* in *MIB* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

- The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT.

6.1.2.3.3 Test description

6.1.2.3.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 11 have different tracking areas according to TS 38.508-1 [4] Table 4.4.2-3.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

- SIB1 of NR Cell 1 is broadcasted in slot#2 in frames with even SFN.

NOTE: As per TS 38.523-3 [3] clause 7.3.3.2, SIB1 of NR Cell 11 is broadcasted in slot#1 in frames with even SFN.

UE:

None.

Preamble:

- UE is in state 1N-A on NR Cell 1(serving cell) according to 38.508-1 [4].

6.1.2.3.3.2 Test procedure sequence

Table 6.1.2.3.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration T0 indicates the initial conditions for preamble. Configurations marked "T1"and "T2"are applied at the points indicated in the Main behaviour description in Table 6.1.2.3.3.2-3.

Table 6.1.2.3.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 11** | **Remark** |
| **T0** | SS/PBCH SSS EPRE | dBm/SCS | -88 | "Off" | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| Qrxlevmin | dBm | -110 | - |  |
| **T1** | SS/PBCH SSS EPRE | dBm/SCS | "Off" | -88 | SrxlevNRCell 1 < 0 (NOTE 1) |
| Qrxlevmin | dBm | - | -110 |  |
| **T2** | SS/PBCH SSS EPRE | dBm/SCS | -94 | -88 | SrxlevNRCell 11 > 0, SrxlevNRCell 1 > 0 |
| Qrxlevmin | dBm | -110 | -110 |  |
| cellBarred | - | notBarred | barred | Serving cell becomes barred |
| NOTE 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.1.2.3.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 11** | **Remark** |
| **T0** | SS/PBCH SSS EPRE | dBm/SCS | -82 | "Off" | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| Qrxlevmin | dBm | -110+Delta(NRf1) | - |  |
| **T1** | SS/PBCH SSS EPRE | dBm/SCS | "Off" | -82 | SrxlevNRCell 1 < 0 (NOTE 1) |
| Qrxlevmin | dBm | - | -110+Delta(NRf1) |  |
| **T2** | SS/PBCH SSS EPRE | dBm/SCS | -91 | -82 | SrxlevNRCell 11 > 0, SrxlevNRCell 1 > 0 |
| Qrxlevmin | dBm | -110+Delta(NRf1) | -110+Delta(NRf1) |  |
| cellBarred | - | notBarred | barred | Serving cell becomes barred |
| NOTE 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. | | | | | |

NOTE: If the UE fails the test because of a failure to detect and reselect to a right cell, then the operator may re-run the test.

Table 6.1.2.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS re-adjusts the SS/PBCH EPRE level of NR Cell 1 and NR Cell 11 according to row "T1" in table 6.1.2.3.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.5 indicate that the UE is camped on NR Cell 11?  NOTE: The UE performs a registration for mobility procedure and the RRC connection is released. | - | - | 1 | - |
| 3 | SS changes NR Cell 11 SS/PBCH EPRE level and MIB IE *cellBarred* according to row "T2" in table 6.1.2.3.3.2-1/2. And SS transmits Short Message on PDCCH addressed to P-RNTI using Short Message field in DCI format 1\_0. Bit 1 of Short Message field is set to 1 to indicate the SysInfo Modification. | - | - | - | - |
| 4 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.5 indicate that the UE is camped on NR Cell 1?  NOTE: The RRC connection is released and UE is in RRC\_IDLE mode. | - | - | 2 | - |

6.1.2.3.3.3 Specific message contents

Table 6.1.2.3.3.3-1: *SIB1* for NR Cells 1 and 11 *(*Preamble and all steps, table 6.1.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| SIB1 ::= SEQUENCE { | |  |  |  |
| cellSelectionInfo SEQUENCE { | |  |  |  |
| q-RxLevMin | | -55 | -110 dBm | FR1 |
|  | | ROUND((-110+Delta(NRf1))/2) | 110+Delta(NRf1) dBm | FR2 |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.3.3.3-2: *SIB2* for NR Cells 1 and 11 *(*Preamble and all steps, table 6.1.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionInfoCommon SEQUENCE { |  |  |  |
| rangeToBestCell | Not present |  |  |
| } |  |  |  |
| intraFreqCellReselectionInfo SEQUENCE { |  |  |  |
| q-RxLevMin | -55 | -110 dBm | FR1 |
|  | ROUND((-110+Delta(NRf1))/2) | 110+Delta(NRf1) dBm | FR2 |
| t-ReselectionNR | 7 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.3.3.3-3: *MIB* for NR Cell 11 (step 3, Table 6.1.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-6 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| MIB ::= SEQUENCE { | |  |  |  |
| cellBarred | | barred |  |  |
| } | |  |  |  |

#### 6.1.2.3a Intra frequency reselection not allowed

6.1.2.3a.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes barred and broadcasting *intraFreqReselection* to "not allowed" and UE detects both intra-frequency and equal priority inter-frequency neighbour cells and the intra-frequency cell is the highest ranked cell }

**then** { UE reselects the inter-frequency cell }

}

6.1.2.3a.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304, clause 5.2.4.6 and 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

[TS 38.304, clause 5.3.1]

…

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

- If the field *intraFreqReselection* in *MIB* message is set to "allowed":

- the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds;

- else:

- the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed":

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds;

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds;

- else:

- the UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

NOTE 2: If barring of a cell is triggered by the condition of *trackingAreaCode* not being provided, as specified in TS 38.331 [3], the barring only applies to this PLMN and the UE can re-evaluate the barring condition again due to selection of another PLMN.

The cell selection of another cell may also include a change of RAT.

6.1.2.3a.3 Test description

6.1.2.3a.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 11 and NR Cell 12 have different tracking areas according to TS 38.508-1 [4] Table 4.4.2-3.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cells.

UE:

None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.3a.3.2 Test procedure sequence

Table 6.1.2.3a.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configuration marked "T0” is applied at the point indicated in the Main behaviour description in Table 6.1.2.3a.3.2-3.

Table 6.1.2.3a.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 11 | NR Cell 12 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -78 | -94 | The power level values are set so that RNRCell 1 < RNRCell 3 < R NRCell 2. |

Table 6.1.2.3a.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 11 | NR Cell 12 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS |  |

Table 6.1.2.3a.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits Short Message on PDCCH addressed to P-RNTI using Short Message field in DCI format 1\_0. Bit 1 of Short Message field is set to 1 to indicate the SysInfo Modification and SS changes NR Cell 1 SS/PBCH EPRE level according to row "T0" in table 6.1.2.3a.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 12? | - | *-* | 1 | - |

6.1.2.3a.3.3 Specific message contents

Table 6.1.2.3a.3.3-1: MIB for NR Cell 1 (All steps, Table 6.1.2.3a.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.6.1-6 | | | |
| Information Element | | Value/remark | Comment | Condition |
| MIB ::= SEQUENCE { | |  |  |  |
| cellBarred | | barred |  |  |
| intraFreqReselection | | notAllowed |  |  |
| } | |  |  |  |

Table 6.1.2.3a.3.3-2: *SIB1* for NR Cell 1(step 1, Table 6.1.2.3a.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| intraFreqReselectionRedCap-r17 | | notAllowed |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.1.2.4 Cell reselection for interband operation

6.1.2.4.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell on the different frequency band }

**then** { UE reselects the new cell }

}

6.1.2.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 5.2.3.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

|  |
| --- |
| Srxlev > 0 AND Squal > 0 |

where:

|  |
| --- |
| Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp  Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9] |
| Pcompensation | If the UE supports the additionalPmax in the NR-NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)* |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. If UE supports SUL frequency for this cell, PEMAX1 and PEMAX2 are obtained from the *p-Max* for SUL in *SIB1* and *NR-NS-PmaxList* for SUL respectively in *SIB1, SIB2* and *SIB4* as specified in TS 38.331 [3], else PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NR-NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* for regular UL as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101 [15] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in subclause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

6.1.2.4.3 Test description

6.1.2.4.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 10.

- System information combination NR-4 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

UE:

None.

Preamble:

- The UE is in state 1N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.4.3.2 Test procedure sequence

Table 6.1.2.4.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1" is applied at the points indicated in the Main behaviour description in Table 6.1.2.4.3.2-3.

Table 6.1.2.4.3.2-1: Time instances of cell power level and parameter changes for conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 10 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | NR Cell 10 become stronger than ThreshNR Cell 10, high. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.1.2.4.3.2-2: Time instances of cell power level and parameter changes for OTA test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 10 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | NR Cell 10 become stronger than ThreshNR Cell 10, high. |
| Note: The downlink signal level uncertainty is specified in TS 38.508-1 [4] clause 6.2.2.2. | | | | | |

Table 6.1.2.4.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes NR Cell 10 SS/PBCH EPRE level according to the row "T1" in table 6.1.2. 4.3.2-1/2. | - | - | - | - |
| 2 | Wait for 34 seconds to allow UE to recognise the change. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 10? | - | - | 1 | - |

6.1.2.4.3.3 Specific message contents

Table 6.1.2.4.3.3-1: Conditions for specific message contents in Tables below

|  |  |
| --- | --- |
| Condition | Explanation |
| NR Cell 1 | This condition applies to system information transmitted on NR Cell 1. |
| NR Cell 10 | This condition applies to system information transmitted on NR Cell 10. |

Table 6.1.2.4.3.3-2: SIB2 of NR Cell 1 and NR Cell10 (preamble and all steps, Table 6.1.2.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE{ |  |  |  |
| cellReselectionPriority | 1 |  | NR Cell 1 |
|  | 5 |  | NR Cell 10 |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.4.3.3-3: SIB4 of NR Cell 1 and NR Cell 10 (preamble and all steps, Table 6.1.2.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4::= SEQUENCE { |  |  |  |
| InterFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 10 |  | NR Cell 1 |
|  | Same downlink ARFCN as used for NR Cell 1 |  | NR Cell 10 |
| t-ReselectionNR | 7 | seconds |  |
| threshX-HighP | 10 | 20 dB |  |
| cellReselectionPriority | 5 |  | NR Cell 1 |
|  | 1 |  | NR Cell 10 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.5 Cell reselection for interband operation using Pcompensation / Between FDD and TDD

6.1.2.5.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state on a FDD band }

**ensure that** {

**when** { UE detects the cell selection using Pcompensation & reselection criteria is met for the cell on a TDD band }

**then** { UE reselects the new cell }

}

6.1.2.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 5.2.3.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

|  |
| --- |
| Srxlev > 0 AND Squal > 0 |

where:

|  |
| --- |
| Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp  Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9] |
| Pcompensation | If the UE supports the additionalPmax in the NR-NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)* |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. If UE supports SUL frequency for this cell, PEMAX1 and PEMAX2 are obtained from the *p-Max* for SUL in *SIB1* and *NR-NS-PmaxList* for SUL respectively in *SIB1, SIB2* and *SIB4* as specified in TS 38.331 [3], else PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NR-NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* for regular UL as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101 [15] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in subclause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

6.1.2.5.3 Test description

6.1.2.5.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 is set to NR FDD mode and NR Cell 10 is set to NR TDD mode.

- System information combination NR-4 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

UE:

None.

Preamble:

- The UE is in state 1N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.5.3.2 Test procedure sequence

Table 6.1.2.5.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configuration marked "T1" is applied at the points indicated in the Main behaviour description in Table 6.1.2.5.3.2-3.

Table 6.1.2.5.3.2-1: Time instances of cell power level and parameter changes for conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 10** | **Remark** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -80 | NR Cell 1 become lower than Threshserving, low and NR Cell 10 become stronger than ThreshNR Cell 10, low. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.1.2.5.3.2-2: Time instances of cell power level and parameter changes for OTA test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 10** | **Remark** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | NR Cell 1 become lower than Threshserving, low and NR Cell 10 become stronger than ThreshNR Cell 10, low. |
| Note: The downlink signal level uncertainity is specified in TS 38.508-1 [4] section 6.2.2.2. | | | | | |

Table 6.1.2.5.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The SS changes NR Cell 10 SS/PBCH EPRE level according to the row "T1" in table 6.1.2.5.3.2-1/2. | - | - | - | - |
| 2 | Wait for 34 seconds to allow UE to recognise the change. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 10? | - | - | 1 | - |

6.1.2.5.3.3 Specific message contents

Table 6.1.2.5.3.3-1: Conditions for specific message contents in Tables below

|  |  |
| --- | --- |
| **Condition** | **Explanation** |
| NR Cell 1 | This condition applies to system information transmitted on NR Cell 1. |
| NR Cell 10 | This condition applies to system information transmitted on NR Cell 10. |

Table 6.1.2.5.3.3-2: SIB1 of NR Cell 1 (preamble and all steps, Table 6.1.2.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SIB1::= SEQUENCE { |  |  |  |
| servingCellConfigCommon SEQUENCE{ |  |  |  |
| uplinkConfigCommon SEQUENCE{ |  |  |  |
| FrequencyInfoUL SEQUENCE { |  |  |  |
| p-Max | 33dBm |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.5.3.3-3: SIB2 of NR Cell 1 and NR Cell10 (preamble and all steps, Table 6.1.2.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SIB2::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE{ |  |  |  |
| threshServingLowP | 9 | 18 dB | NR Cell 1 |
| cellReselectionPriority | 5 |  | NR Cell 1 |
|  | 1 |  | NR Cell 10 |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.5.3.3-4: SIB4 of NR Cell 1 and NR Cell 10 (preamble and all steps, Table 6.1.2.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4::= SEQUENCE { |  |  |  |
| InterFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 10 |  | NR Cell 1 |
|  | Same downlink ARFCN as used for NR Cell 1 |  | NR Cell 10 |
| p-Max | 33dBm |  | NR Cell 1 |
| t-ReselectionNR | 7 | seconds |  |
| threshX-HighP | 14 | 28 dB |  |
| threshX-LowP | 6 | 12 dB |  |
| cellReselectionPriority | 1 |  | NR Cell 1 |
|  | 5 |  | NR Cell 10 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.6 Void

#### 6.1.2.7 Cell reselection / Equivalent PLMN

6.1.2.7.1 Test Purpose (TP)

(1)

**with** { UE camped normally on a cell and network has downloaded a list of equivalent PLMNs during the Registration procedure}

**ensure that** {

**when** { a suitable neighbour cell on an equivalent PLMN becomes better ranked than the suitable Serving cell}

**then** { UE reselects to this equivalent PLMN cell}

}

(2)

**with** { UE camped normally on a cell and network has downloaded a list of equivalent PLMNs during the Registration procedure}

**ensure that** {

**when** { the Serving cell becomes unsuitable due to S<0 and a suitable cell exists on an equivalent PLMN}

**then** {UE reselects to this equivalent PLMN cell}

}

(3)

**with** { UE camped normally on a cell and network has downloaded a list of equivalent PLMNs during the Registration procedure}

**ensure that** {

**when** { the UE evaluates cells for reselection}

**then** { UE ignores suitable cells for which the UE has no reselection priority provided}

}

6.1.2.7.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 23.122, clause 4.4.3, TS 38.304, clause 5.2.4.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

[TS 23.122, clause 4.4.3]

The Mobile Equipment stores a list of "equivalent PLMNs". This list is replaced or deleted at the end of each location update procedure, routing area update procedure, GPRS attach procedure, tracking area update procedure, EPS attach procedure, and registration procedure. The list is deleted by an MS attached for emergency bearer services after detach or registered for emergency services after deregistration. The stored list consists of a list of equivalent PLMNs as downloaded by the network plus the PLMN code of the registered PLMN that downloaded the list. All PLMNs in the stored list, in all access technologies supported by the PLMN, are regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover.

6.1.2.7.3 Test Description

6.1.2.7.3.1 Pre-test conditions

System Simulator:

Three inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 Table 4.4.2.1 are configured broadcasting PLMNs as indicated in Table 6.1.2.7.3.1-1.

The PLMNs are identified in the test by the identifiers in Table 6.1.2.7.3.1-1.

Table 6.1.2.7.3.1-1: PLMN identifiers

|  |  |  |  |
| --- | --- | --- | --- |
| NR Cell | PLMN name | MCC | MNC |
| 11 | PLMN1 | 001 | 11 |
| 12 | PLMN2 | 002 | 21 |
| 13 | PLMN3 | 003 | 31 |

All NR cells are high quality.

All cells are suitable cells.

System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells

UE:

The UE is in Automatic PLMN selection mode.

Preamble:

The UE is registered on PLMN1 (NR Cell 11) using the procedure described in TS 38.508-1 [4] clause 4.5.2.2 except that the REGISTRATION ACCEPT message indicates PLMN3 in the Equivalent PLMN list as described in Table 6.1.2.7.3.3-1.

The UE is in state Registered, Idle Mode (State 1N-A) on NR Cell 11 according to 38.508-1 [4];

6.1.2.7.3.2 Test procedure sequence

Table 6.1.2.7.3.2-1 for FR1 and Table 6.1.2.7.3.2-2 for FR2 illustrates the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" and "T2" are to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.1.2.7.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 11 | NR Cell 12 | NR Cell 13 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -78 | -89 | -100 | All NR cells S>0 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -89 | -100 | NR Cell 11 S < 0 as described in TS 38.508-1 clause 6.2.2.1 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -78 | -100 | -89 | All NR cells S>0 |
| Note 1: The default values (including “not present”) for all other parameters influencing cell reselection are suitable for this test. The values are defined in TS 38.508-1 clauses 6.2.2.1. | | | | | | |

Table 6.1.2.7.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 11 | NR Cell 12 | NR Cell 13 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -91 | -100 | All NR cells S>0 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | ”Off” | -91 | -100 | NR Cell 1 S < 0 as described in TS 38.508-1 clause 6.2.2.2 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -100 | -91 | All NR cells S>0 |
| Note 1: The default values (including “not present”) for all other parameters influencing cell reselection suitable for this test. The values are defined in TS 38.508-1 clauses 6.2.2.2. | | | | | | |

Table 6.1.2.7.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does the UE transmit an *RRCSetupRequest* message within T seconds? (Note 1) | --> | NR RRC*: RRCSetupRequest* | 1 | F |
| 2 | SS adjusts cell levels according to row T1 of table 6.1.2.7.3.2-1 for FR1 (or table 6.1.2.7.3.2-2 for FR2) | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 13?  NOTE: The UE performs a " REGISTRATION REQUEST procedure with type "mobility registration updating” with PLMN1 and PLMN2 listed as an Equivalent PLMN in the REGISTRATION ACCEPT message; the RRC connection is released. | - |  | 2 | - |
| 4 | Check: Does the test result of generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 12?  NOTE: The UE performs a " REGISTRATION REQUEST procedure with type "mobility registration updating” with PLMN1 and PLMN3 listed as an Equivalent PLMN in the REGISTRATION ACCEPT message; the RRC connection is released. | - |  | 1 | - |
| 5 | SS adjusts cell levels according to row T0 of table 6.1.2.7.3.2-1 for FR1 (or table 6.1.2.7.3.2-2 for FR2) | - |  | - | - |
| 6 | Check: Does the UE transmit an *RRCSetupRequest* message within T seconds? (Note 1) | --> | NR RRC *RRCSetupRequest* | 1,3 | F |
| 7 | SS adjusts cell levels according to row T2 of table 6.1.2.7.3.2-1 for FR1 (or table 6.1.2.7.3.2-2 for FR2) | - | - | - | - |
| 8 | Check: Does the test result of generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 13?  NOTE: The UE performs a " REGISTRATION REQUEST procedure with type "mobility registration updating” with PLMN1 and PLMN2 listed as an Equivalent PLMN in the REGISTRATION ACCEPT message; the RRC connection is released. (Note 2) | - |  | 3 | P |
| Note 1: In Steps 1 and 6, wait T seconds to ensure that the UE has detected, measured and evaluated the neighbour inter-frequency NR cells is provided, see TS 38.133 clause 4.2.2.4, where in T = 100sec for FR1 and 300sec for FR2  Note 2: In Step 8, the UE moves to Cell 13 because no reselection priority is defined for Cell 1, see Table 6.1.2.7.3.3-4. | | | | | |

6.1.2.7.3.3 Specific message contents

Table 6.1.2.7.3.3-1: REGISTRATION ACCEPT for NR Cell 11 (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| Equivalent PLMNs | PLMN3 |  |  |

Table 6.1.2.7.3.3-2: REGISTRATION ACCEPT for NR Cell 13 (step 3 and 18, Table 6.1.2.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| Equivalent PLMNs | PLMN1, 2 |  |  |

Table 6.1.2.7.3.3-3: REGISTRATION ACCEPT for NR Cell 12 (step 4, Table 6.1.2.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| Equivalent PLMNs | PLMN1, 3 |  |  |

Table 6.1.2.7.3.3-4: *SystemInformationBlockType4* for Cell 12 (preamble and all steps, Table 6.1.2.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries | *n* denotes the index of the entry |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink EARFCN as used for Cell 11 |  |  |
| cellReselectionPriority | Not present | UE does not have a priority for frequency of Cell 11 |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink EARFCN as used for Cell 13 |  |  |
| } |  |  |  |
| lateNonCriticalExtension | Not present |  |  |
| } |  |  |  |

Table 6.1.2.7.3.3-5: *SystemInformationBlockType4* for Cell 13 (preamble and all steps, Table 6.1.2.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries | *n* denotes the index of the entry |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink EARFCN as used for Cell 11 |  |  |
| cellReselectionPriority | Not present | UE does not have a priority for frequency of Cell 11 |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink EARFCN as used for Cell 12 |  |  |
| } |  |  |  |
| lateNonCriticalExtension | Not present |  |  |
| } |  |  |  |

#### 6.1.2.8 Cell reselection / Equivalent PLMN / Single Frequency operation

6.1.2.8.1 Test Purpose (TP)

(1)

**with** { UE camped normally on a cell **and** network has downloaded a list of equivalent PLMNs during the Registration procedure }

**ensure** **that** {

**when** { a suitable neighbour cell on an equivalent PLMN becomes better ranked than the suitable Serving cell }

**then** { UE reselects to this equivalent PLMN cell }

}

(2)

**with** { UE camped normally on a cell **and** network has downloaded a list of equivalent PLMNs during the Registration procedure }

**ensure** **that** {

**when** { the Serving cell becomes unsuitable due to S<0 **and** a suitable cell exists on an equivalent PLMN }

**then** { UE reselects to this equivalent PLMN cell }

}

6.1.2.8.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 5.2.4.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

6.1.2.8.3 Test description

6.1.2.8.3.1 Pre-test conditions

System Simulator:

- Three intra-frequency multi-PLMN cells.

- The PLMNs are identified in the test by the identifiers in Table 6.1.2.8.3.1-1.

- System information combination NR-3 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells

Table 6.1.2.8.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| Cell | PLMN name |
| 1 | PLMN1 |
| 2 | PLMN2 |
| 4 | PLMN3 |

- All cells are high quality.

- All cells are suitable cells.

UE:

- The UE is in Automatic PLMN selection mode.

Preamble:

- The UE is registered on PLMN1 (NR Cell 1) using the procedure described in TS 38.508-1 [4] clause 4.5.2.2 except that the REGISTRATION ACCEPT message indicates PLMN3 in the Equivalent PLMN list as described in Table 6.1.2.8.3.3-1.

- The UE is in state Registered, Idle Mode (State 1N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.8.3.2 Test procedure sequence

Table 6.1.2.8.3.2-1 for FR1 and Table 6.1.2.8.3.2-2 for FR2 illustrates the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" and "T2" are to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.1.2.8.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -78 | -84 | -90 | All NR cells S > 0 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -88 | -82 | NR Cell 1 S < 0 as described in TS 38.508-1 [4] clause 6.2.2.1 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -82 | -88 |  |

Table 6.1.2.8.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -91 | -100 | All NR cells S > 0 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | ”Off” | -91 | -82 | NR Cell 1 S < 0 as described in TS 38.508-1 [4] clause 6.2.2.2 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -120 | -82 | -91 |  |

Table 6.1.2.8.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does the UE send an *RRCSetupRequest* within the next T seconds?  NOTE: The wait period of T seconds is to ensure that the UE has detected, measured and evaluated the neighbour inter-frequency NR cells is provided, see TS 38.133[30] clause 4.2.2.4, where in T = 100sec for FR1 and 300sec for FR2. | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 2 | SS adjusts cell levels according to row T1 of table 6.1.2.8.3.2-1 for FR1 (or table 6.1.2.8.3.2-2 for FR2). | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] subclause 4.9.5 indicate that the UE is camped on NR Cell 4?  NOTE: The UE performs a Registration procedure for mobility registration update with PLMN1 and PLMN2 listed as an Equivalent PLMN in the REGISTRATION ACCEPT message. | - | - | 2 | - |
| 4 | SS adjusts cell levels according to row T2 of table 6.1.2.8.3.2-1 for FR1 (or table 6.1.2.8.3.2-2 for FR2). | - | - | - | - |
| 5 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] subclause 4.9.5 indicate that the UE is camped on NR Cell 2?  NOTE: The UE performs a Registration procedure for mobility registration update with PLMN1 and PLMN3 listed as an Equivalent PLMN in the REGISTRATION ACCEPT message. | - | - | 1 | - |
| 6 | SS adjusts cell levels according to row T1 of table 6.1.2.8.3.2-1 for FR1 (or table 6.1.2.8.3.2-2 for FR2). | - | - | - | - |
| 7 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] subclause 4.9.5 indicate that the UE is camped on NR Cell 4, '*connected without release*'?  NOTE: The UE performs a Registration procedure for mobility registration update with PLMN1 and PLMN2 listed as an Equivalent PLMN in the REGISTRATION ACCEPT message. | - | - | 1 | - |

6.1.2.8.3.3 Specific message contents

Table 6.1.2.8.3.3-1: REGISTRATION ACCEPT for NR Cell 1 (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| Equivalent PLMNs | PLMN3 |  |  |

Table 6.1.2.8.3.3-2: REGISTRATION ACCEPT for NR Cell 4 (steps 3 & 7, Table 6.1.2.8.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| Equivalent PLMNs | PLMN1, 2 |  |  |
| Allowed NSSAI |  |  |  |
| S-NSSAI |  |  |  |
| Length of S-NSSAI contents | ‘0000 0010’B |  |  |
| Mapped HPLMN SST | Same as SST |  |  |

Table 6.1.2.8.3.3-3: REGISTRATION ACCEPT for NR Cell 2 (step 5, Table 6.1.2.8.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| Equivalent PLMNs | PLMN1, 3 |  |  |
| Allowed NSSAI |  |  |  |
| S-NSSAI |  |  |  |
| Length of S-NSSAI contents | ‘0000 0010’B |  |  |
| Mapped HPLMN SST | Same as SST |  |  |

#### 6.1.2.9 Cell reselection using Qhyst, Qoffset and Treselection

6.1.2.9.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

**ensure that** {

**when** { Qhyst is non-zero or its value changes in system information }

**then** { UE reselects the highest ranked cell taking the actual Qhyst value into account }

}

(2)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility }

**ensure that** {

**when** { cell reselection criteria are fulfilled during a time interval Treselection }

**then** { UE reselects the highest ranked cell after the Treselection interval expires }

}

(3)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility }

**ensure that** {

**when** { Qoffset is non-zero or its value changes in system information }

**then** { UE reselects the highest ranked cell taking the actual Qoffset value into account }

}

6.1.2.9.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 5.2.4.6. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

6.1.2.9.3 Test description

6.1.2.9.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 11.

- System information combination NR-3 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

UE:

None.

Preamble:

- The UE is in state 1N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.9.3.2 Test procedure sequence

Table 6.1.2.9.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1", "T2" and so on are applied at the points indicated in the Main behaviour description in Table 6.1.2.9.3.2-3.

Table 6.1.2.9.3.2-1: Time instances of cell power level and parameter changes For FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 11 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| Qhysts | dB | 24 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -88 | Off | NR Cell 2 becomes stronger than NR Cell 1 but NR Cell 1 remains the highest ranked one due to Qhysts NR Cell 1 |
| Qhysts | dB | 24 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -88 | Off | Qhysts NR Cell 1 change causes NR Cell 2 to become highest ranked cell |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -94 | Off | NR Cell 1 becomes the strongest and highest ranked one due to power adjustment |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T4 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -94 | Off | Qoffsets,n NR Cell1 change to 24dB, Qoffsets,n NR Cell 2 remains zero |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 24 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T5 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -88 | Off | NR Cell 1 becomes weaker but it remains the highest ranked one due to Qoffsets,n NR Cell 1 |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 24 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T6 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -88 | Off | NR Cell 2 becomes the highest ranked one due to Qoffsets,n NR Cell 1 change |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T7 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -94 | Off | NR Cell 1 becomes the highest ranked one |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T8 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | -94 | TreselectionNR of NR Cell 1 change to 7S |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 7 | 0 | 0 |
| T9 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | Off | -88 | NR Cell 11 becomes the highest ranked one |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 7 | 0 | 0 |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.1.2.9.3.2-2: Time instances of cell power level and parameter changes For FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 11 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| Qhysts | dB | 24 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | Off | NR Cell 2 becomes stronger than NR Cell 1 but NR Cell 1 remains the highest ranked one due to Qhysts NR Cell 1 |
| Qhysts | dB | 24 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | Off | Qhysts NR Cell 1 change causes NR Cell 2 to become highest ranked cell |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -91 | Off | NR Cell 1 becomes the strongest and highest ranked one due to power adjustment |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T4 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -91 | Off | Qoffsets,n NR Cell1 change to 24dB, Qoffsets,n NR Cell 2 remains zero |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 24 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T5 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | Off | NR Cell 1 becomes weaker but it remains the highest ranked one due to Qoffsets,n NR Cell 1 |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 24 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T6 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | Off | NR Cell 2 becomes the highest ranked one due to Qoffsets,n NR Cell 1 change |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T7 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -91 | Off | NR Cell 1 becomes the highest ranked one |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 0 | 0 | 0 |
| T8 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | Off | -94 | TreselectionNR of NR Cell 1 change to 7S |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 7 | 0 | 0 |
| T9 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | -82 | NR Cell 11 becomes the highest ranked one |
| Qhysts | dB | 0 | 0 | 0 |
| Qoffsets,n | dB | 0 | 0 | 0 |
| TreselectionNR | S | 7 | 0 | 0 |

Table 6.1.2.9.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS re-adjusts the SSS levels according to row "T1" in table 6.1.2.9.3.2-1/2. | - | - | - | - |
| 1A | Wait for 34[FR1]/130[FR2] seconds, the SS transmits a Paging message on NR Cell 2. | <-- | NR RRC: *Paging* | - | - |
| 2 | Check: Does the UE send an *NR: RRCSetupRequest* on NR Cell 2 within the next 10 seconds? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 2A | SS resets Qhysts NR Cell 1 according to row "T2" in table 6.1.2.9.3.2-1/2, The *ValueTag* of *SIB2* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 1. | - | - | - | - |
| 3 | SS notifies UE of the system information change on NR Cell 1 by send Short Message on PDCCH using P-RNTI. | <-- | NR RRC: *Paging* | - | - |
| 4 | Void | - | - | - | - |
| 5 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | - | - | - |
| 5A | Wait for 8[FR1]/27[FR2] seconds. | - | - | - | - |
| 6 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 2? | - | - | 1 | - |
| 7 | SS re-adjusts SSS levels according to rows "T3" in table 6.1.2.9.3.2-1/2. | - | - | - | - |
| 8 | Wait for 8[FR1]/27[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 9 | The test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 1. | - | - | - | - |
| 9A | SS changes Qoffsets,n NR Cell 1 according to rows "T4" in table 6.1.2.9.3.2-1/2. The *ValueTag* of *SIB3* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 1. | - | - | - | - |
| 10 | SS notifies UE of the system information change on NR Cell 1 by send Short Message on PDCCH using P-RNTI. | <-- | NR RRC: *Paging* | - | - |
| 11 | Void | - | - | - | - |
| 12 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | - | - | - |
| 13 | SS re-adjusts SSS levels according to row "T5" in table 6.1.2.9.3.2-1/2. | - | - | - | - |
| 14 | Wait for 8[FR1]/27[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 15 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is still camped on NR Cell 1? | - | - | 3 | - |
| 15A | SS resets Qoffsets,n NR Cell1 according to row "T6" in table 6.1.2.9.3.2-1/2, The *ValueTag* of *SIB3* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 1. | - | - | - | - |
| 16 | SS notifies UE of the system information change on NR Cell 1 by send Short Message on PDCCH using P-RNTI. | <-- | NR RRC: *Paging* | - | - |
| 17 | Void | - | - | - | - |
| 18 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | - | - | - |
| 18A | Wait for 8[FR1]/27[FR2] seconds. | - | - | - | - |
| 19 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 2? | - | - | 3 | - |
| 20 | SS re-adjusts SSS levels according to rows "T7" in table 6.1.2.9.3.2-1/2. | - | - | - | - |
| 21 | Wait for 8[FR1]/27[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 22 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 1? | - | - | 3 | - |
| 22A | SS changes TreselectionNR Cell 1 according to rows "T8" in table 6.1.2.9.3.2-1/2, The *ValueTag* of *SIB2* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 1. | - | - | - | - |
| 23 | SS sends notification of the system information change on NR Cell 1 by send Short Message on PDCCH using P-RNTI. | <-- | NR RRC: *Paging* | - | - |
| 24 | Void | - | - | - | - |
| 25 | SS re-adjusts cell power levels according to rows "T8" in table 6.1.2.9.3.2-1/2. | - | *-* | - | - |
| 26 | Wait for 34[FR1]/130[FR2] seconds to allow UE to detect Cell 11. | - | - | - | - |
| 27 | SS re-adjusts SSS levels according to rows "T9" in table 6.1.2.9.3.2-1/2. | - | - | - | - |
| 28 | Check: Does the UE send an *NR: RRCSetupRequest* on NR Cell 11 within Timer=TreselectionNR from step 27? | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| 29 | SS waits for Timer=TreselectionNR Cell 1 expires after step 27 |  |  |  |  |
| 30 | Check: Does the UE send an *NR: RRCsetupRequest* on NR Cell 11? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 31-34 | Steps 2 to 5 of the generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 11. | - | - | - | - |
| Note: The wait time at steps 2 and 26 is Tdetect,NR\_Intra and at Steps 8,14 and 21 it is Tevaluate,NR\_Intra (as per TS 38.133 [30], clause 4.2.2.3) plus the time to read the system information TSI-NR. | | | | | |

6.1.2.9.3.3 Specific message contents

Table 6.1.2.9.3.3-1: SIB1 of NR Cell 1 (preamble and all steps, Table 6.1.2.9.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

Table 6.1.2.9.3.3-2: SI-SchedulingInfo (si-SchedulingInfo in Table 6.1.2.9.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 2 entries |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| Type[1] | sibType2 |  |  |
| valueTag[1] | 0 | The value is increased by 1 in step 4 and step 24 |  |
| } |  |  |  |
| SIB-TypeInfo[2] SEQUENCE { |  | entry 2 |  |
| Type[2] | sibType3 |  |  |
| valueTag[2] | 0 | The value is increased by 1 in step 11 and step 17 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.9.3.3-3: SIB2 of NR Cell 1 (preamble, Table 6.1.2.9.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionInfoCommon SEQUENCE { |  |  |  |
| q-Hyst | dB24 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.9.3.3-4: SIB2 of NR Cell 1 (step 2A, Table 6.1.2.9.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionInfoCommon SEQUENCE { |  |  |  |
| q-Hyst | dB0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.9.3.3-5: SIB3 of NR Cell 1 (step 9A, Table 6.1.2.9.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE (SIZE (1.. maxCellIntra)) OF IntraFreqNeighCellInfo { | 1 entry |  |  |
| IntraFreqNeighCellInfo[1] SEQUENCE{ |  | entry 1 |  |
| q-OffsetCell | dB24 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.9.3.3-6: SIB3 of NR Cell 1 (step 15A, Table 6.1.2.9.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE (SIZE (1.. maxCellIntra)) OF IntraFreqNeighCellInfo { | 1 entry |  |  |
| IntraFreqNeighCellInfo[1] SEQUENCE { |  | entry 1 |  |
| q-OffsetCell | dB0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.9.3.3-7: SIB2 of NR Cell 1 (step 22A, Table 6.1.2.9.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| intraFreqCellReselectionInfo SEQUENCE { |  |  |  |
| t-ReselectionNR | 7 | seconds |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.10 Void

#### 6.1.2.11 Area Specific SIBs using systemInformationAreaID

6.1.2.11.1 Test Purpose (TP)

(1)

**with** { UE is in NR RRC\_IDLE state }

**ensure that** {

**when** { SIB1 does not include si-RequestConfig and si-BroadcastStatus set to notBroadcasting }

**then** { UE sends RRCSystemInfoRequest message and acquires the necessary SIBs }

}

(2)

**with** { UE in NR\_RRC Idle State }

**ensure that** {

**when** { UE reselects to neighbour cell with same systemInformationAreaID and SIB1 does not include si-RequestConfig and si-BroadcastStatus set to notBroadcasting }

**then** { UE applies system information parameters of previous cell for reselection purposes }

}

6.1.2.11.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.4, 5.2.4.6 and 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.6]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

[TS 38.331, clause 5.2.2.2.1]

The UE shall apply the SI acquisition procedure as defined in clause 5.2.2.3 upon cell selection (e.g. upon power on), cell-reselection, return from out of coverage, after reconfiguration with sync completion, after entering the network from another RAT, upon receiving an indication that the system information has changed, upon receiving a PWS notification; and whenever the UE does not have a valid version of a stored SIB.

When the UE acquires a *MIB* or a *SIB1* or an SI message in a serving cell as described in clause 5.2.2.3, and if the UE stores the acquired SIB, then the UE shall store the associated *areaScope*, if present, the first *PLMN-Identity* in the *PLMN-IdentityInfoList*, the *cellIdentity*, the *systemInformationAreaID*, if present, and the *valueTag*, if present, as indicated in the *si-SchedulingInfo* for the SIB. The UE may use a valid stored version of the SI except *MIB*, *SIB1*, *SIB6*, *SIB7* or *SIB8* e.g. after cell re-selection, upon return from out of coverage or after the reception of SI change indication.

NOTE: The storage and management of the stored SIBs in addition to the SIBs valid for the current serving cell is left to UE implementation.

The UE shall:

1> delete any stored version of a SIB after 3 hours from the moment it was successfully confirmed as valid;

1> for each stored version of a SIB:

2> if the *areaScope* is associated and its value for the stored version of the SIB is the same as the value received in the *si-SchedulingInfo* for that SIB from the serving cell:

3> if the first *PLMN-Identity* included in the *PLMN-IdentityInfoList*, the *systemInformationAreaID* and the v*alueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity*, the *systemInformationAreaID* and the *valueTag* associated with the stored version of that SIB:

4> consider the stored SIB as valid for the cell;

…

[TS 38.331, clause 5.2.2.3.3]

The UE shall:

…

1> else:

2> apply the *timeAlignmentTimerCommon* included in *SIB1*;

2> apply the CCCH configuration as specified in 9.1.1.2;

2> initiate transmission of the *RRCSystemInfoRequest* message in accordance with 5.2.2.3.4;

2> if acknowledgement for *RRCSystemInfoRequest* message is received from lower layers:

3> acquire the requested SI message(s) as defined in subclause 5.2.2.3.2, immediately;

….

[TS 38.331, clause 5.2.2.3.4]

The UE shall set the contents of *RRCSystemInfoRequest* message as follows:

1> set the *requested-SI-List* to indicate the SI message(s) that the UE requires to operate within the cell, and for which *si-BroadcastStatus* is set to *notBroadcasting*.

The UE shall submit the *RRCSystemInfoRequest* message to lower layers for transmission.

6.1.2.11.3 Test description

6.1.2.11.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR Cells.

UE:

None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1 according to 38.508-1 [4] Table 4.4A.2-1.

6.1.2.11.3.2 Test procedure sequence

Table 6.1.2.11.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration T0 indicates the initial conditions for preamble. Configurations marked "T1" and "T2" is applied at the points indicated in the Main behaviour description in Table 6.1.2.11.3.2-3.

Table 6.1.2.11.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -95 | -80 | Off | The power level values are assigned to satisfy SrxlevNRCell3 > ThreshX, HighP |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -88 | -80 | The power level values are assigned to satisfy RNRCell 3 < RNRCell 6 |

Table 6.1.2.11.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | Off | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | Off | The power level values are assigned to satisfy SrxlevNRCell3 > ThreshX, HighP |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | FFS | FFS | The power level values are assigned to satisfy RNRCell 3 < RNRCell 6 |

Table 6.1.2.11.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0 | The SS changes SIB1 as specified as Table 6.1.2.11.3.3-1.  Note: The sysinfo combination of NR cell 1 is changed to NR-4. | - | - | - | - |
| 0A | The SS notifies the UE of change of System Information on NR Cell 1 by send Short Message on PDCCH using P-RNTI. | <-- | NR PDCCH (DCI 1\_0): Short Message | - | - |
| 1 | Void | - | - | - | - |
| 2 | UE sends *RRCSystemInfoRequest* message to NR Cell 1 to request SIB4. | --> | NR RRC: *RRCSystemInfoRequest* | 1 | P |
| - | EXCEPTION: After receving *RRCSystemInfoRequest* message in step 2, the SS ignores the reception of subsequent RRCSystemInfoRequest. | - | - | - | - |
| 3 | NR Cell 1 starts broadcasting *SystemInformation* message which including SIB4. | <-- | NR RRC: *SystemInformation* | - | - |
| 3A | The SS re-adjusts the SS/PBCH EPRE levels and according to row "T1" in table 6.1.2.11.3.2-1/2. | - | - | - | - |
| 4 | Wait 34s to let UE to perform inter-frequency cell reselection to NR Cell 3 (Note 1). | - | - | - | - |
| 4A | Does the UE send *RRCSystemInfoRequest* message on NR Cell 3 to request SIB4 in the next 5s? |  |  | 2 | F |
| 4B | The test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3. | - | - | - | - |
| 5 | The SS re-adjusts the SS/PBCH EPRE levels and according to row "T2" in table 6.1.2.11.3.2-1/2. | - | - | - | - |
| 6 | Void |  |  |  |  |
| 6A | Wait 34s to let UE to perform inter-frequency cell reselection to NR Cell 6.(Note 1) | - | - | - | - |
| 7 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 6? | - | - | 2 | P |
| Note 1: The wait time for cell reselection procedure is selected to cover Tdetect, NR\_inter (32s) + TSI-NR (1280 ms) = 33.28s rounded up to 34s. | | | | | |

6.1.2.11.3.3 Specific message contents

Table 6.1.2.11.3.3-1: *SIB1* of NR cell 1 and NR cell 3 (All steps in Table 6.1.2.11.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 with Condition SIG AND FR1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| cellSelectionInfo SEQUENCE { | |  |  |  |
| si-SchedulingInfo | | SI-SchedulingInfo-Area | Table 6.1.2.11.3.3-2 |  |
| } | |  |  |  |

Table 6.1.2.11.3.3-2: SI-SchedulingInfo-Area (Table 6.1.2.11.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 with Condition FR1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfo { | 2 entries |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| si-BroadcastStatus | broadcasting |  |  |
| si-Periodicity | rf32 |  |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| SchedulingInfo[2] SEQUENCE { |  | entry 2 |  |
| si-BroadcastStatus | not broadcasting |  |  |
| si-Periodicity | rf64 |  |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType4 |  |  |
| valueTag | 0 |  |  |
| areaScope | true |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| systemInformationAreaID | ’0000 0000 0000 0000 0000 0011’B |  |  |
| } |  |  |  |

Table 6.1.2.11.3.3-3: *RRCSystemInfoRequest* (Step 2, Table 6.1.2.11.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-24 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCSystemInfoRequest ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcSystemInfoRequest-r15 SEQUENCE { | |  |  |  |
| requested-SI-List | | 01000000000000000000000000000000 | Bit corresponds to SIB4 in *schedulingInfoList* |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.11.3.3-4: *SystemInformation* (Step 3, Table 6.1.2.11.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-29 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SystemInformation ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| systemInformation-r15 SEQUENCE { | |  |  |  |
| sib-TypeAndInfo SEQUENCE (SIZE (1..maxSIB)) OF CHOICE { | | 1 entry |  |  |
| SIB4 SEQUENCE { | | As per TS 38.508-1 [4] Table 4.6.2-3 |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { | |  | entry 1 |  |
| dl-CarrierFreq | | Same downlink NR ARFCN as used for NR Cell 3 |  |  |
| smtc | | SSB-MTC as defined in TS 38.508-1 [4] Table 4.6.3-185 with condition INTER-FREQ\_ODD |  |  |
| } | |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { | |  | entry 2 |  |
| dl-CarrierFreq | | Same downlink NR ARFCN as used for NR Cell 6 |  |  |
| smtc | | SSB-MTC as defined in TS 38.508-1 [4] Table 4.6.3-185 with condition INTER-FREQ\_ODD | smtc of the inter-freq carrier for NR Cell 6 is calculated with respect to NR Cell 3 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.1.2.12 Cell reselection using cell status and cell reservations / cellReservedForOtherUse

6.1.2.12.1 Test Purpose (TP)

(1)

**with** { UE camped normally in state NR RRC\_IDLE }

**ensure that** {

**when** { A higher ranked cell is found with cell status "true" for other use }

**then** { UE does not attempt to reselect to the higher ranked cell }

}

6.1.2.12.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.4, 5.2.4.6 and 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.4]

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in subclause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in subclause 5.2.4.5, the UE shall check if the access is restricted according to the rules in subclause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in subclause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to being part of the "list of 5GS forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for a maximum of 300 seconds. If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under NR control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

If the highest ranked cell or best cell according to absolute priority reselection rules is an inter-RAT cell which is not suitable due to being part of the "list of forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for a maximum of 300 seconds. If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under NR control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

[TS 38.304, clause 5.3.1]

Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of three fields:

- *cellBarred* (IE type: "barred" or "not barred")   
Indicated in *MIB* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")   
Indicated in *SIB1* message*.* In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN.

- *cellReservedForOtherUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

When cell status is indicated as "not barred" and "not reserved" for operator use and not "true" for other use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is indicated as "true" for other use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN and not "true" for other use,

- UEs assigned to Access Identity 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Identity 1, 2 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in TS 22.261 [12].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- The UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

- The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT.

6.1.2.12.3 Test description

6.1.2.12.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 11 in different tracking areas.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR Cells.

UE:

None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1 according to 38.508-1 [4] Table 4.4A.2-1.

6.1.2.12.3.2 Test procedure sequence

Table 6.1.2.12.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration T0 indicates the initial conditions for preamble. Configurations marked "T1" is applied at the points indicated in the Main behaviour description in Table 6.1.2.12.3.2-3.

Table 6.1.2.12.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 11 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -80 | The power level values are assigned to satisfy RNRCell 1 < RNRCell 11 |
|  | cellReservedForOtherUse | - | - | True |  |

Table 6.1.2.12.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 11 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | The power level values are assigned to satisfy RNRCell 1 < RNRCell 11 |
|  | cellReservedForOtherUse | - | - | True |  |

Table 6.1.2.12.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS re-adjusts the SS/PBCH EPRE levels and according to row "T1" in table 6.1.2.12.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the UE initiate a random access procedure on NR Cell 11 within the next 120s? | - | - | 1 | F |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that check UE is in state NR RRC\_IDLE on NR Cell 1? | - | - | 1 | - |

6.1.2.12.3.3 Specific message contents

Table 6.1.2.12.3.3-1: *SIB1* for NR Cell 11 (Preamble, Table 6.1.2.12.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-5 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.13 Cell reselection using cell status and cell reservations / Access Identity 0, 1, 2 and 12 to 14 – cellReservedForOperatorUse

6.1.2.13.1 Test Purpose (TP)

(1)

**with** { UE camped normally in state NR RRC\_IDLE and UE fitted with a USIM with at least one of the following Access Identities set: 0,1,2,12,13,14}

**ensure that** {

**when** { a higher ranked cell is found "reserved" for Operator use }

**then** { UE does not attempt to reselect to the higher ranked cell }

}

6.1.2.13.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.3.1]

Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of three fields:

- *cellBarred* (IE type: "barred" or "not barred")   
Indicated in *MIB* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")   
Indicated in *SIB1* message*.* In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN.

- *cellReservedForOtherUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

When cell status is indicated as "not barred" and "not reserved" for operator use and not "true" for other use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is in+dicated as "true" for other use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN and not "true" for other use,

- UEs assigned to Access Identity 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Identity 0, 1, 2 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in TS 22.261 [12].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1* or due to *trackingAreaCode* being absent in *SIB1* as specified in TS 38.331 [3]:- The UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

- The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT.

6.1.2.13.3 Test description

6.1.2.13.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 12 with different tracking areas.

- NR Cell 1 and NR Cell 12 are HPLMN.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR Cells.

UE:

None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-1.

- The UE switches off and then switches on.

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.13.3.2 Test procedure sequence

Table 6.1.2.13.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configurations marked "T0" is applied for Preamble. Configurations marked "T1 is applied at the points indicated in the Main behaviour description in Table 6.1.2.13.3.2-3.

Table 6.1.2.13.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -80 | The power level values are assigned to satisfy RNRCell 1 < RNRCell 12 |
|  | cellReservedForOperatorUse | - | - | Reserved |  |

Table 6.1.2.13.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | The power level values are assigned to satisfy RNRCell 1 < RNRCell 12 |
|  | cellReservedForOperatorUse | - | - | Reserved |  |

Table 6.1.2.13.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.1.2.13.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the UE initiate a random access procedure on NR Cell 12 within the next 120s? | - | - | 1 | F |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that check UE is in state NR RRC\_IDLE on NR Cell 1? | - | - | 1 | - |

6.1.2.13.3.3 Specific message contents

Table 6.1.2.13.3.3-1: *SIB1* for NR Cell 12 (Preamble, Table 6.1.2.13.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-5 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { | 1 entry |  |  |
| PLMN-Identity[1] | Set to the same PLMN-Identity with NR Cell 1 | entry 1 |  |
| cellReservedForOperatorUse | Reserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.14 Cell reselection using cell status and cell reservations / Access Identity 11 or 15 - cellReservedForOperatorUse

6.1.2.14.1 Test Purpose (TP)

(1)

**with** { UE camped normally in state NR RRC\_IDLE operating in their HPLMN/EHPLMN and fitted with a USIM with access class11 or 15}

**ensure that** {

**when** { a higher ranked cell is found "reserved" for Operator use }

**then** { UE re-selects to the higher ranked cell }

}

6.1.2.14.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.3.1]

Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of three fields:

- *cellBarred* (IE type: "barred" or "not barred")  
Indicated in *MIB* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")   
Indicated in *SIB1* message*.* In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN.

- *cellReservedForOtherUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

When cell status is indicated as "not barred" and "not reserved" for operator use and not "true" for other use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is indicated as "true" for other use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN and not "true" for other use,

- UEs assigned to Access Identity 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Identity 1, 2 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in TS 22.261 [12].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- The UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

- The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT.

6.1.2.14.3 Test description

6.1.2.14.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 3 in different tracking areas.

- NR Cell 1 and NR Cell 3 are HPLMN.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR Cells.

UE:

- The UE is equipped with a USIM containing default values and USIM Configuration 17.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.14.3.2 Test procedure sequence

Table 6.1.2.14.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configurations marked "T0" is applied for Preamble. Configurations marked "T1 is applied at the points indicated in the Main behaviour description in Table 6.1.2.14.3.2-3.

Table 6.1.2.14.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -80 | The power level values are assigned to satisfy RNRCell 1 < RNRCell 3 |
|  | cellReservedForOperatorUse | - | - | Reserved |  |

Table 6.1.2.14.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | The power level values are assigned to satisfy RNRCell 1 < RNRCell 3 |
|  | cellReservedForOperatorUse | - | - | Reserved |  |

Table 6.1.2.14.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.1.2.14.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the test result of test steps 1 to 5 of generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 3? | - | - | 1 | P |

6.1.2.14.3.3 Specific message contents

Table 6.1.2.14.3.3-1: *SIB1* for NR Cell 3 (Preamble, Table 6.1.2.14.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-5 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| cellReservedForOperatorUse | Reserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.14.3.3-2:SERVICE REQUEST (Preamble, Table 6.1.2.14.3.2-3; step 4 ,Table 4.5.2.2-4, TS 38.508-1 [4])

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table 4.7.1-16. | | | |
| Information Element | | Value/remark | Comment | Condition |
| Service type | | ‘0101’B | high priority access |  |

#### 6.1.2.15 Cell reselection in shared network environment

6.1.2.15.1 Test Purpose (TP)

(1)

**with** { the UE is in NR RRC\_Idle and registered on the HPLMN }

**ensure that** {

**when** { a cell of a different PLMN but shared with the HPLMN becomes highest ranked cell }

**then** { the UE reselects the cell shared with the HPLMN }

}

6.1.2.15.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 23.122, clause 4.4.3, and TS 38.304, clause 5.2.4.6. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3]

The registration on the selected PLMN and the location registration are only necessary if the MS is capable of services which require registration. Otherwise, the PLMN selection procedures are performed without registration.

The ME shall utilise all the information stored in the SIM related to the PLMN selection; e.g. "HPLMN Selector with Access Technology", "User Controlled PLMN Selector with Access Technology", "Forbidden PLMNs", "Equivalent HPLMN", see 3GPP TS 31.102 [40].

The ME shall either utilise the "Operator controlled PLMN Selector with Access Technology" that it has stored locally on the ME, or the Operator controlled PLMN Selector with Access Technology" stored in the SIM, for the purposes of PLMN selection.

The "HPLMN Selector with Access Technology", "User Controlled PLMN Selector with Access Technology" and "Operator Controlled PLMN Selector with Access Technology" data files in the SIM include associated access technologies for each PLMN entry, see 3GPP TS 31.102 [40]. The PLMN/access technology combinations are listed in priority order. If an entry indicates more than one access technology, then no priority is defined for the access technologies within this entry and the priority applied to each access technology within this entry is an implementation issue. If no particular access technology is indicated in an entry, it shall be assumed that all access technologies supported by the ME apply to the entry. If an entry only indicates access technologies not supported by the ME, the entry shall be ignored. If an entry indicates at least one access technology supported by the ME, the entry shall be used in the PLMN selection procedures if the other criteria defined for the specific PLMN selection procedures are fulfilled.

The Mobile Equipment stores a list of "equivalent PLMNs". This list is replaced or deleted at the end of each location update procedure, routing area update procedure, GPRS attach procedure, tracking area update procedure, EPS attach procedure, and registration procedure. The list is deleted by an MS attached for emergency bearer services after detach or registered for emergency services after deregistration. The stored list consists of a list of equivalent PLMNs as downloaded by the network plus the PLMN code of the registered PLMN that downloaded the list. All PLMNs in the stored list, in all access technologies supported by the PLMN, are regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover.

When the MS reselects to a cell in a shared network, and the cell is a suitable cell for multiple PLMN identities received on the BCCH or on the EC-BCCH the AS indicates these multiple PLMN identities to the NAS according to 3GPP TS 44.018 [34], 3GPP TS 44.060 [39], 3GPP TS 25.304 [32] and 3GPP TS 36.304 [43]. The MS shall choose one of these PLMNs. If the registered PLMN is available among these PLMNs, the MS shall not choose a different PLMN.

The MS shall not use the PLMN codes contained in the "HPLMN Selector with Access Technology" data file.

It is possible for the home network operator to identify alternative Network IDs as the HPLMN. If the EHPLMN list is present, and not empty, the entries in the EHPLMN list are used in the network selection procedures. When attempting to select a network the highest priority EHPLMN that is available shall be selected. If the EHPLMN list is present and is empty or if the EHPLMN list is not present, the HPLMN derived from the IMSI is used for network selection procedures.

NOTE 1: The "HPLMN Selector with Access Technology" data file is only used by the MS to get the HPLMN access technologies related to the HPLMN code which corresponds to the PLMN code included in the IMSI if the EHPLMN list is not present or is empty. If the EHPLMN list is present then this data field is applicable to all the entries within the EHPLMN list.

NOTE 2: Different GSM frequency bands (e.g. 900, 1800, 1900, 400) are all considered GSM access technology. An MS supporting more than one band should scan all the bands it’s supports when scanning for GSM frequencies. However GSM COMPACT systems which use GSM frequency bands but with the CBPCCH broadcast channel are considered as a separate access technology from GSM.

NOTE 3: The inclusion of the HPLMN derived from the IMSI in the EHPLMN list is allowed. The priority of the HPLMN derived from the IMSI is given by its position in the EHPLMN list, see 3GPP TS 31.102 [40]

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

6.1.2.15.3 Test description

6.1.2.15.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 (HPLMN)

- NR Cell 11 (primary PLMN: same MCC like HPLMN but different MNC, secondary PLMN: HPLMN)

- System information combination NR-3 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cells.

UE:

- None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1 according to 38.508-1 [4] Table 4.4A.2-1

6.1.2.15.3.2 Test procedure sequence

Table 6.1.2.15.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions after the preamble. Configurations marked "T1" is applied at the points indicated in the Main behaviour description in Table 6.1.2.15.3.2-3.

Table 6.1.2.15.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 11** | **Remark** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off |  |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | The power level values are assigned to satisfy SrxlevNRCell 11 > SrxlevNRCell 1 |

Table 6.1.2.15.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 11** | **Remark** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off |  |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | The power level values are assigned to satisfy SrxlevNRCell 11 > SrxlevNRCell 1 |

Table 6.1.2.15.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts the SS/PBCH EPRE level of NR Cell 1 and NR Cell 11 according to row "T1" in table 6.1.2.1.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the UE transmit an *RRCSetupRequest* message on NR Cell 11? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 3 | The SS transmits an *RRCSetup* message*.* | <-- | NR RRC: *RRCSetup* | - | - |
| 4 | Check; Does the UE transmit an *RRCSetupComplete* message indicating the HPLMN (second PLMN in the list)?  Note: this message contains an REGISTRATION REQUEST message indicating "mobility registration updating" to update the registration of the actual tracking area according to default message contents. | --> | NR RRC: *RRCSetupComplete* | 1 | P |
| 5 - 7 | Steps 4 to 6 of the registration procedure described in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 11. | - | - | - | - |

6.1.2.15.3.3 Specific message contents

Table 6.1.2.15.3.3-1: *SIB1* for NR Cell 1 (Preamble and all steps, Table 6.1.2.15.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** | |
| SIB1 ::= SEQUENCE { |  |  |  | |
| cellAccessRelatedInfo SEQUENCE { |  |  |  | |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  | |
| plmn-Identity[1] | Set to the same Mobile Country Code and Mobile Network Code stored in EFIMSI on the test USIM card |  |  | |
| } |  |  |  | |
| } |  |  |  | |
| } |  |  |  | |

Table 6.1.2.15.3.3-2: *SIB1* for NR Cell 11 (Preamble and all steps, Table 6.1.2.15.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| plmn-Identity[1] | Set to the same Mobile Country Code stored in EFIMSI on the test USIM, MNC=02 | Same MCC like PLMN for NR Cell 1 but different MNC |  |
| plmn-Identity[2] | Set to the same Mobile Country Code and Mobile Network Code stored in EFIMSI on the test USIM card | This is the same PLMN as NR Cell 1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.15.3.3-3: *RRCSetupComplete* (step 4, Table 6.1.2.15.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-22 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| RRCSetupComplete::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcSetupComplete SEQUENCE { | |  |  |  |
| selectedPLMN-Identity | | 2 | HPLMN |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.1.2.15a Cell reselection in shared network environment / Cells broadcasting multiple PLMN IDs with unique TAC's, RAN areas, and cell identities

6.1.2.15a.1 Test Purpose (TP)

Same as TC 6.1.2.15.1

6.1.2.15a.2 Conformance requirements

Same as TC 6.1.2.15.2

6.1.2.15a.3 Test description

6.1.2.15a.3.1 Pre-test conditions

Same as TC 6.1.2.15.3.1

6.1.2.15a.3.2 Test procedure sequence

Same as TC 6.1.2.15.3.2

6.1.2.15a.3.3 Specific message contents

Table 6.1.2.15a.3.3-1: *SIB1* for NR Cell 1 (Preamble and all steps, Table 6.1.2.15.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** | |
| SIB1 ::= SEQUENCE { |  |  |  | |
| cellAccessRelatedInfo SEQUENCE { |  |  |  | |
| plmn-IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { |  |  |  | |
| PLMN-IdentityInfo[1] |  |  |  | |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  | |
| PLMN-Identity[1] | Set to the same Mobile Country Code and Mobile Network Code stored in EFIMSI on the test USIM card |  |  | |
| plmn} |  |  |  | |
| } |  |  |  | |
| } |  |  |  | |

Table 6.1.2.15a.3.3-2: *SIB1* for NR Cell 11 (Preamble and all steps, Table 6.1.2.15.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| -IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 2 entries |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { | entry 1 |  |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| PLMN-Identity[1] | Set to the same Mobile Country Code stored in EFIMSI on the test USIM, MNC=02 | Same MCC like PLMN for NR Cell 1 but different MNC |  |
| } |  |  |  |
| trackingAreaCode | '00000000 00000000 00000010'B |  |  |
| ranac | 2 |  |  |
| cellIdentity | '00000000 00000000 00000001 10000000 1011'B |  |  |
| } |  |  |  |
| PLMN-IdentityInfo[2] SEQUENCE { | entry 2 |  |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { |  |  |  |
| PLMN-Identity[1] | Set to the same Mobile Country Code and Mobile Network Code stored in EFIMSI on the test USIM card | This is the same PLMN as NR Cell 1 |  |
| } |  |  |  |
| trackingAreaCode | ''00000000 00000000 00000011'B |  |  |
| ranac | 1 |  |  |
| cellIdentity | ''00000000 00000000 00000001 01000000 1010'B |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.15a.3.3-3: *RRCSetupComplete* (step 4, Table 6.1.2.15.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-22 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| RRCSetupComplete::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcSetupComplete SEQUENCE { | |  |  |  |
| selectedPLMN-Identity | | 2 | HPLMN |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.1.2.16 Inter-frequency cell reselection (equal priority)

6.1.2.16.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects both intra-frequency and equal priority inter-frequency neighbour cells and the inter-frequency cell is the highest ranked cell }

**then** { UE reselects the inter-frequency cell }

}

6.1.2.16.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.6. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

6.1.2.16.3 Test description

6.1.2.16.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 3 have different tracking areas.

- System information combination NR-5 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cells.

UE:

None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1(according to 38.508-1 [4] Table 4.4A.2-1.

6.1.2.16.3.2 Test procedure sequence

Table 6.1.2.16.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions after the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.1.2.16.3.2-3.

Table 6.1.2.16.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 3 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -94 | -78 | The power level values are set so that RNRCell 2 < RNRCell 1 < R NRCell 3. |

Table 6.1.2.16.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 3 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS |  |

Table 6.1.2.16.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T0" in table 6.1.2.16.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 3? | - | *-* | 1 | - |

6.1.2.16.3.3 Specific message contents

None.

#### 6.1.2.17 Cell reselection / Cell-specific reselection parameters provided by the network in a neighbouring cell list

6.1.2.17.1 Test Purpose (TP)

(1)

**with** { the UE is in NR RRC\_IDLE and SystemInformationBlockType3 contain a cell-specific Qoffset for a neighbour intra frequency cell }

**ensure that** {

**when** { the neighbour cell has lower power than the serving cell but it is higher ranked due to the cell-specific Qoffset }

**then** { the UE reselects the neighbour cell with cell-specific Qoffset }

}

(2)

**with** { the UE is in RRC\_IDLE and SystemInformationBlockType3 contain a exclude-listed cell }

**ensure that** {

**when** { a exclude-listed intra-freq cell becomes higher ranked than the serving cell }

**then** { the UE remains camped on the serving cell }

}

6.1.2.17.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.6. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

6.1.2.17.3 Test description

6.1.2.17.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 4 in different tracking areas.

- System information combination NR-3 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cells.

- NR Cell 1 is transmitting *SIB3* according to specific message contents (Qoffset1,2 is -24dB).

- NR Cell 2 is transmitting *SIB3* according to specific message contents (NR Cell 4 is an exclude-listed cell)

UE:

None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1(according to 38.508-1 [4] Table 4.4A.2-1.

6.1.2.17.3.2 Test procedure sequence

Table 6.1.2.15.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions after the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.1.2.15.3.2-3.

Table 6.1.2.17.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | Only NR Cell 1 is on |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -94 | Off | NR Cell 2 has lower power but is higher ranked due to cell-specific Qoffset1,2 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -94 | Off |  |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -94 | -88 | NR Cell 4 has higher power than NRCell 2 but is exclude-listed |

Table 6.1.2.17.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | Off | Off | Only NR Cell 1 is on |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -91 | Off | NR Cell 2 has lower power but is higher ranked due to cell-specific Qoffset1,2 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -91 | Off |  |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -91 | -82 | NR Cell 4 has higher power than NRCell 2 but is exclude-listed |

Table 6.1.2.17.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.1.2.17.3.2-1/2. | - | - | - | - |
| 2-6 | Check: Does the test result of test steps 1 to 5 of generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 2? | - | *-* | 1 | P |
| 7 | The SS re-adjusts the SS/PBCH EPRE levels according to row "T2" in table 6.1.2.17.3.2-1/2. | - | - | - | - |
| 8 | Wait for 1 second to allow UE to recognise the change. | - | - | - | - |
| 9 | The SS transmits an *RRCRelease* message to release RRC connection and move to RRC\_IDLE. | <-- | NR RRC: *RRCRelease* | - | - |
| 10 | The SS re-adjusts the SS/PBCH EPRE levels according to row "T3" in table 6.1.2.17.3.2-1/2. | - | - | - | - |
| 11 | Check: Does the UE initiate a random access procedure on NR Cell 4 within the next 120s? | - | - | 2 | F |

6.1.2.17.3.3 Specific message contents

Table 6.1.2.17.3.3-1: *SIB3* for NR Cell 1 (all steps, Table 6.1.2.17.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE { |  |  |  |
| physCellId | The cell identity of NR Cell 2 defined in 38.508-1 [4] clause 4.4.2 |  |  |
| q-OffsetCell | dB-24 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.17.3.3-2: *SIB3* for NR Cell 2 (all steps, Table 6.1.2.17.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqExcludedCellList SEQUENCE { | 1 entry |  |  |
| start | PhysicalCellID of NR Cell 4 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.18 Cell reselection, Sintrasearch, Snonintrasearch

6.1.2.18.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

**ensure that** {

**when** { Sintrasearch is non-zero in system information }

**then** { UE performs measurement and reselects the highest ranked cell upon Srxlev < Sintrasearch }

}

(2)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

**ensure that** {

**when** { Snonintrasearch is non-zero in system information }

**then** { UE perform measurement and reselects the cell which belong to the equal priority frequency cell upon Srxlev < Snonintrasearch }

}

(3)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

**ensure that** {

**when** { Snonintrasearch is non-zero in system information }

**then** { UE perform measurement and reselects the cell which belong to the high priority frequency cell upon Srxlev > Snonintrasearch }

}

6.1.2.18.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304, clauses 5.2.4.1, 5.2.4.5 and 5.2.4.6.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the RRCRelease message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field cellReselectionPriority is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in camped on any cell state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and deprioritisationReq received in RRCRelease unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

NOTE: If rangeToBestCell is configured but absThreshSS-BlocksConsolidation is not configured on an NR frequency, the UE considers that there is one beam above the threshold for each cell on that frequency.

6.1.2.18.3 Test description

6.1.2.18.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 3 as defined in TS 38.508-1 [4] Table 4.4.2-2 is used.

- NR Cell 1 uses System information combination NR-3 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

- NR Cell 2 and NR Cell 3 uses System information combination NR-4 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

UE:

- None.

Preamble:

- The UE is in state 1N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.18.3.2 Test procedure sequence

Table 6.1.2.18.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.1.2.13.3.2-2.

Table 6.1.2.18.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 3 | Remark |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -102 | -94 | -118 | Srxlev of NR Cell 1 is less than Sintrasearch. |
| SIntraSearch | dB | 20 | 20 | 20 |
| Srxlev | dB | 8 | 16 | -8 |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -118 | -102 | -94 | Srxlev of NR Cell 2 is less than Snonintrasearch. |
| SnonIntraSearch | dB | 20 | 20 | 20 |
| Srxlev | dB | -8 | 8 | 16 |
| **T3** | SnonIntraSearch | dB | 20 | 20 | 2 |  |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -118 | -88 | Srxlev of NR Cell 3 is greater than Snonintrasearch but Cell 1 is high priority cell. |
| Srxlev | dB | 22 | 22 | 22 |
| Note: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.1.2.18.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 3 | Remark |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS | Srxlev of NR Cell 1 is less than Sintrasearch. |
| SIntraSearch | dB | 20 | 20 | 20 |
| Srxlev | dB | FFS | FFS | FFS |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS | Srxlev of NR Cell 2 is less than Snonintrasearch. |
| SnonIntraSearch | dB | 20 | 20 | 20 |
| Srxlev | dB | FFS | FFS | FFS |
| **T3** | SnonIntraSearch | dB | 20 | 20 | 2 |  |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS | Srxlev of NR Cell 3 is greater than Snonintrasearch but Cell 1 is high priority cell. |
| Srxlev | dB | FFS | FFS | FFS |
| Note: The uncertain downlink signal level is specified in TS 38.508-1 [4] section FFS | | | | | | |

Table 6.1.2.18.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS re-adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.1.2.18.3.2-1/2. | - | - | - | - |
| 2 | Wait for 34 seconds to allow UE to recognise the change. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 2? | - | - | 1 | - |
| 4 | The SS re-adjusts the SSS levels according to row "T2" in table 6.1.2.18.3.2-1/2. | - | - | - | - |
| 5 | Wait for 34 seconds to allow UE to recognise the change. | - | - | - | - |
| 6 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3? | - | - | 2 | - |
| 6A | The SS changes the SnonIntraSearch for NR Cell 3 according to row "T3" in table 6.1.2.18.3.2-1/2, The ValueTag of SIB2 in the SI-SchedulingInfo of SIB1 is increased on NR Cell 3. | - | - | - | - |
| 7 | The SS notifies the UE of change of System Information on NR Cell 3 by sending Short Message on PDCCH using P-RNTI. | <-- | NR RRC: Paging | - | - |
| 8 | Void | - | - | - | - |
| 9 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | - | - |  |
| 10 | The SS re-adjusts the SSS levels according to row "T4" in table 6.1.2.18.3.2-1/2. | - | - | - | - |
| 11 | Wait for 120 seconds to allow UE to recognise the change. | - | - | - | - |
| 12 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 1? | - | - | 3 | - |

6.1.2.18.3.3 Specific message contents

Table 6.1.2.18.3.3-1: Conditions for specific message contents in Tables below

|  |  |
| --- | --- |
| Condition | Explanation |
| NR Cell 1 | This condition applies to system information transmitted on NR Cell 1. |
| NR Cell 2 | This condition applies to system information transmitted on NR Cell 2. |
| NR Cell 3 | This condition applies to system information transmitted on NR Cell 3. |

Table 6.1.2.18.3.3-2: SIB2 of NR Cell 1, NR Cell 2 and NR Cell 3 (preabmle and all steps, Table 6.1.2.18.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| s-NonIntraSearch | 10 | 20 dB |  |
| cellReselectionPriority | 5 |  | NR Cell 1 |
|  | 1 |  | NR Cell 2 and Cell 3 |
| } |  |  |  |
| intraFreqCellReselectionInfo SEQUENCE { |  |  |  |
| s-IntraSearchP | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.18.3.3-3: SIB4 of NR Cell 2 and NR Cell 3 (preabmle and all steps, Table 6.1.2.18.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  | NR Cell 2 |
|  | Same downlink ARFCN as used for NR Cell 1 |  | NR Cell 3 |
| t-ReselectionNR | 1 |  |  |
| threshX-HighP | 7 | 14 dBm | NR Cell 3 |
| cellReselectionPriority | 5 |  | NR Cell 3 |
|  | 1 |  | NR Cell 2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.18.3.3-4: SIB1 of NR Cell 3 (step 6A, Table 6.1.2.18.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

Table 6.1.2.18.3.3-5: SI-SchedulingInfo (si-SchedulingInfo in Table 6.1.2.18.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType2 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.18.3.3-6: SIB2 of NR Cell 3 (step 6A, Table 6.1.2.18.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| s-NonIntraSearchP | 1 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.19 Speed-dependent cell reselection

6.1.2.19.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state and in high mobility state }

**ensure that** {

**when** { UE detects the cell ranked as the best cell taking into account scaling factor }

**then** { UE reselects the new cell }

}

(2)

**with** { UE in NR RRC\_IDLE state and in medium mobility state }

**ensure that** {

**when** { UE detects the cell ranked as the best cell taking into account scaling factor }

**then** { UE reselects the new cell }

}

6.1.2.19.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.304, clauses 5.2.4.3.0 and 5.2.4.3.1. TS 38.133, clause 4.2.2.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.3.0]

The UE mobility state is determined if the parameters (TCRmax, NCR\_H, NCR\_M and TCRmaxHyst) are broadcasted in system information for the serving cell.

**State detection criteria:**

…

Medium-mobility state criteria:

- If number of cell reselections during time period TCRmax is greater than or equal to NCR\_M but less than or equal to NCR\_H.

High-mobility state criteria:

- If number of cell reselections during time period TCRmax is greater than NCR\_H.

The UE shall not consider consecutive reselections where a cell is reselected again right after one reselection for mobility state detection criteria.

**State transitions:**

The UE shall:

- if the criteria for High-mobility state is detected:

- enter High-mobility state.

- else if the criteria for Medium-mobility state is detected:

- enter Medium-mobility state.

…

If the UE is in High- or Medium-mobility state, the UE shall apply the speed dependent scaling rules as defined in subclause 5.2.4.3.1.

[TS 38.304, clause 5.2.4.3.1]

UE shall apply the following scaling rules:

- If neither Medium- nor High-mobility state is detected:

- no scaling is applied.

- If High-mobility state is detected:

- Add the *sf-High* of "Speed dependent ScalingFactor for Qhyst" to Qhyst if broadcasted in system information;

- For NR cells, multiply TreselectionNR by the *sf-High* of "Speed dependent ScalingFactor for TreselectionNR" if broadcasted in system information;

…

- If Medium-mobility state is detected:

- Add the *sf-Medium* of "Speed dependent ScalingFactor for Qhyst" to Qhyst if broadcasted in system information;

- For NR cells, multiply TreselectionNR by the *sf-Medium* of "Speed dependent ScalingFactor for TreselectionNR" if broadcasted in system information;

…

In case scaling is applied to any TreselectionRAT parameter, the UE shall round up the result after all scalings to the nearest second.

[TS 38.133, clause 4.2.2.3]

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS38.304 within Tdetect,NR\_Intrawhen that Treselection= 0. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.2 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every Tmeasure,NR\_Intra (see table 4.2.2.3-1) for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NR\_Intra/2.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,NR\_Intra when Treselection = 0as specified in table 4.2.2.3-1 provided that:

- when *rangeToBestCell* is not configured, the cell has at least [3]dB in FR1 or [TBD]dB in FR2 better ranked or

- when *rangeToBestCell* is configured, the cell which has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among the cells whose cell-ranking criterion R value as specified in TS 38.304 [1, Section 5.2.4.6] is within *rangeToBestCell* of the R value of the best cell where the best cell has at least [TBD] in FR1 or [TBD]dB in FR2 better ranked, and if there are multiple such cells the UE shall perform cell reselection to the highest ranked cell among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If Treselection timer has a non-zero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS38.304 [1], the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2.2.3-1: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | | **Tdetect,NR\_Intra [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra**  **[s] (number of DRX cycles)** |
| **FR1** | **FR2Note1** |
| 0.32 | 1 | [8] | 11.52 x N1 x M2 (36 x N1 x M2) | 1.28 x N1 x M2 (4 x N1 x M2) | 5.12 x N1 x M2 (16 x N1 x M2) |
| 0.64 | [5] | 17.92 x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | [4] | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | [TBD] | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = [8] for all DRX cycle length.  Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. | | | | | |

6.1.2.19.3 Test Description

6.1.2.19.3.1 Pre-test conditions

System Simulator:

- 3 NR Cells: NR Cell 1, 2 and 4 as specified in TS 38.508-1 [4] table 4.4.2-3.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cell.

UE:

- None.

Preamble:

- NR Cell 1 is set to "Serving Cell" and NR Cell 2 and NR Cell 4 are set to non-suitable "Off" as defined in TS 38.508-1 [4] table 6.2.2.1-3 for FR1 and table 6.2.2.2-2 for FR2.

- The UE is in NR RRC\_IDLE state (state 1N-A with PDU session inactive) as defined in TS 38.508-1 [4], table 4.4A.2-1 on NR Cell 1.

6.1.2.19.3.2 Test procedure sequence

Table 6.1.2.19.3.2-1 and Table 6.1.2.19.3.2-2 illustrates the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.1.2.19.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | Remark |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -88 | -94 | NR Cell 2 becomes the highest ranked cell. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -94 | -88 | NR Cell 4 becomes the highest ranked cell. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -94 | -94 | NR Cell 1 becomes the highest ranked cell. |

Table 6.1.2.19.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | Remark |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS | NR Cell 2 becomes the highest ranked cell. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS | NR Cell 4 becomes the highest ranked cell. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS | NR Cell 1 becomes the highest ranked cell. |

Table 6.1.2.19.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes the power level setting  according to the row "T1". | - | - | - | - |
| 2 | Wait for 40s for FR1 or 136s for FR2 for the UE to perform cell reselection procedure. (Note 1, Note 5) | - | - | - | - |
| 3 | The SS changes the power level setting  according to the row "T2". | - | - | - | - |
| 4 | Wait for 14s for FR1 or 33s for FR2 for the UE to perform cell reselection procedure. (Note 2, Note 6) | - | - | - | - |
| 5 | The SS changes the power level setting  according to the row "T3". | - | - | - | - |
| 6 | Wait for 14s for FR1 or 33s for FR2 for the UE to perform cell reselection procedure. (Note 3, Note 6) | - | - | - | - |
| 7-8 | Void | - | - | - | - |
| 9 | The SS changes the TAC of NR Cell 2 to 2. | - | - | - | - |
| 10 | The SS changes the power level setting  according to the row "T1". | - | - | - | - |
| 11 | Check: Does the UE send an  *RRCSetupRequest* on NR Cell 2 within 3s? (Note 7) | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| 12 | Check: Does the UE send an  *RRCSetupRequest* on NR Cell 2 within 6s for FR1 and 27s for FR2 after step 11? (Note 8, Note 9) | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 13-17 | Steps 2 to 6 of the mobility registration updating procedure described in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 2. | - | - | - | - |
| 18 | Void | - | - | - | - |
| 19 | The SS changes the power level setting  according to the row "T2". | - | - | - | - |
| 20-25 | Void | - | - | - | - |
| 26 | Check: Does the UE send an  *RRCSetupRequest* on NR Cell 4 within 2s? (Note 12) | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 27 | Check: Does the UE send an  *RRCSetupRequest* on NR Cell 4 within 7s for FR1 and 26s for FR2 after step 26? (Note 13) | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 28-32 | Steps 2 to 6 of the mobility registration updating procedure described in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 4. | - | - | - | - |
| Note 1: NCR (number of cell reselection) is 1.  Note 2: NCR is 2.  Note 3: NCR is 3 and the UE enters medium mobility state because number of cell reselections during time period TCRmax equals NCR\_M.  Note 4: Void.  Note 5: The wait time for reselection to a newly detected intra frequency cell is selected to cover Tdetect,NR\_Intra(25\*1280ms=32s for FR1 and 25\*4\*1280ms=128s for FR2) + Treselection (7s) + 320 ms system information block type scheduling = 39.32s rounded up to 40s for FR1 and 135.32s rounded up to 136s for FR2.  Note 6: The wait time for reselection to an already detected intra frequency cell is selected to cover Tevaluate,NR\_intra(6.4s for FR1 and 25.6 for FR2) + Treselection (7s) + 320 ms system information block type scheduling = 13.72s rounded up to 14s for FR1 and 32.92s rounded up to 33s for FR2.  Note 7: The wait time for evaluating an intra-frequency cell is Treselection after scaling (3.5s). This wait time is rounded down to nearest second (i.e. 3s in this case).  Note 8: The wait time for cell reselection procedure is selected to cover Tevaluate,NR\_intra (6.4s for FR1 and 25.6 for FR2) + Treselection after scaling (7\*0.5) + 320 ms system information block type scheduling = 10.22s rounded up to 11s for FR1 and 29.42s rounded up to 30s for FR2. The actual wait time is 6s which covers 9s - 3s (wait time in step 11) for FR1 and 27s which covers 30s – 3s (wait time in step 11) for FR2.  Note 9: NCR is 4 and the UE enters high mobility state because number of cell reselections during time period TCRmax greater than NCR\_H  Note 10: Void.  Note 11: Void.  Note 12: The wait time for evaluating an intra-frequency cell is Treselection after scaling (2s).  Note 13: The wait time for cell reselection procedure is selected to cover Tevaluate,NR\_intra (6.4s for FR1 and 25.6 for FR2) + Treselection after scaling (7\*0.25) + 320 ms system information block type scheduling = 8.47s rounded up to 9s for FR1 and 27.92s rounded up to 28s for FR2. The actual wait time is 7s which covers 9s - 2s (wait time in step 26) for FR1 and 26s which covers 28s – 2s (wait time in step 26) for FR2. | | | | | |

6.1.2.19.3.3 Specific message contents

Table 6.1.2.19.3.3-1: SystemInformationBlockType2 for NR Cell 1, NR Cell 2, and NR Cell 4 (preamble and all steps, Table 6.1.2.19.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionInfoCommon SEQUENCE { |  |  |  |
| speedStateReselectionPars SEQUENCE { |  |  |  |
| MobilityStateParameters SEQUENCE { |  |  |  |
| t-Evaluation | s240 |  |  |
| t-HystNormal | s240 |  |  |
| n-CellChangeMedium | 3 |  |  |
| n-CellChangeHigh | 3 |  |  |
| } |  |  |  |
| q-HystSF SEQUENCE { |  |  |  |
| sf-Medium | dB0 |  |  |
| sf-High | dB0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| intraFreqCellReselectionInfo SEQUENCE { |  |  |  |
| t-ReselectionNR | 7 |  |  |
| t-ReselectionNR-SF SEQUENCE { |  |  |  |
| sf-Medium | oDot50 |  |  |
| sf-High | oDot25 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.19.3.3-2: SystemInformationBlockType1 for NR Cell 4 (step 9, Table 6.1.2.19.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-5 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| PLMN-IdentityInfoList SEQUENCE { |  |  |  |
| trackingAreaCode | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.20 Inter-frequency cell reselection according to cell reselection priority provided by SIBs

6.1.2.20.1 Test Purpose (TP)

(1)

with { UE in NR RRC\_IDLE state }

ensure that {

when { UE detects the cell re-selection criteria are met for the cell which belongs to the equal priority frequency }

then { UE reselects the cell which belongs to the equal priority frequency }

}

(2)

with { UE in NR RRC\_IDLE state }

ensure that {

when { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority frequency }

then { UE reselects the cell which belongs to the higher priority frequency }

}

(3)

with { UE in NR RRC\_IDLE state }

ensure that {

when { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority frequency }

then { UE reselects the cell which belongs to the lower priority frequency }

}

6.1.2.20.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 5.2.4.1, 5.2.4.2, 5.2.4.5 and 5.2.4.6. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

6.1.2.20.3 Test description

6.1.2.20.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- System information combination NR-4 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

UE:

None.

Preamble:

- The UE is in state 1N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.20.3.2 Test procedure sequence

Table 6.1.2.20.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.1.2.20.3.2-3.

Table 6.1.2.20.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -78 | -78 | The power level values are assigned to satisfy SrxlevNR Cell 1 < 0 and SrxlevNR Cell 6 > ThreshNR Cell 6, high. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -78 | -98 | The power level values are assigned to satisfy SrxlevNR Cell 6 < Threshserving, low and SrxlevNR Cell 3 > ThreshNR Cell 3, low, SrxlevNR Cell 1< 0. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.1.2.20.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -82 | -82 | The power level values are assigned to satisfy SrxlevNR Cell 1 < 0 and SrxlevNR Cell 6 > ThreshNR Cell 6, high. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -82 | -100 | The power level values are assigned to satisfy SrxlevNR Cell 6 < Threshserving, low and SrxlevNR Cell 3 > ThreshNR Cell 3, low, SrxlevNR Cell 1< 0. |

Table 6.1.2.20.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes NR Cell 3 SS PBCH SSS EPRE level according to the row "T1" in table 6.1.2.20.3.2-1/2. | - | - | - | - |
| 2 | Wait for 66[FR1]/258[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3? | - | - | 1 | - |
| 4 | The SS changes NR Cell 1 and NR Cell 6 SSS levels according to the row "T2" in table 6.1.2.20.3.2-1/2. | - | - | - | - |
| 5 | Wait for 34[FR1]/130[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 6 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 6? | - | - | 2 | - |
| 7 | The SS changes NR Cell 6 SSS level according to the row "T3" in table 6.1.2.20.3.2-1/2. | - | - | - | - |
| 8 | Wait for 8[FR1]/27[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 9 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3? | - | - | 3 | - |
| Note: The wait time at steps 2 and 5 is Kcarrier\*Tdetect,NR\_Inter and at Step 8 it is Kcarrier\*Tevaluate,NR\_Inter (as per TS 38.133 [30], clause 4.2.2.4) plus the time to read the system information TSI-NR. | | | | | |

6.1.2.20.3.3 Specific message contents

Table 6.1.2.20.3.3-1: Conditions for specific message contents in Tables below

|  |  |
| --- | --- |
| Condition | Explanation |
| NR Cell 1 | This condition applies to system information transmitted on NR Cell 1. |
| NR Cell 3 | This condition applies to system information transmitted on NR Cell 3. |
| NR Cell 6 | This condition applies to system information transmitted on NR Cell 6. |

Table 6.1.2.20.3.3-2: SIB2 of NR Cell 6 (preamble and all steps, Table 6.1.2.20.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 10 | 20 dB |  |
| cellReselectionPriority | 5 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.20.3.3-3: SIB4 of NR Cell 1, NR Cell 3 and NR Cell 6 (preamble and all steps, Table 6.1.2.20.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE SIZE (1..maxFreq) OF SEQUECNCE { | 2 entry |  |  |
| dl-CarrierFreq[1] | Same downlink ARFCN as used for NR Cell 6 |  | NR Cell 1 |
|  | Same downlink ARFCN as used for NR Cell 6 |  | NR Cell 3 |
|  | Same downlink ARFCN as used for NR Cell 3 |  | NR Cell 6 |
| threshX-HighP[1] | 10 | 20 dB | NR Cell 3 and FR1 |
| 9 | 18 dB | NR Cell 3 and FR2 |
| cellReselectionPriority[1] | 5 |  | NR Cell 1 |
|  | 5 |  | NR Cell 3 |
| dl-CarrierFreq[2] | Same downlink ARFCN as used for NR Cell 3 |  | NR Cell 1 |
| cellReselectionPriority[2] | 4 |  | NR Cell 1 |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.21 Cell reselection, SIntraSearchQ and SnonIntraSearchQ

6.1.2.21.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

**ensure that** {

**when** { UE receives non-zero SIntraSearchQ in system information }

**then** { UE performs measurement and reselects the highest ranked cell upon Squal < SIntraSearchQ }

}

(2)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

ensure that {

when { UE receives non-zero SnonIntraSearchQ in system information }

then { UE performs measurement and reselects the cell which belongs to the equal priority frequency cell upon Squal < SnonIntraSearchQ }

}

(3)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

**ensure that** {

**when** { UE receives non-zero SnonIntraSearchQ in system information }

**then** { UE performs measurement and reselects the cell which belongs to the high priority frequency cell upon Squal > SnonIntraSearchQ }

}

6.1.2.21.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 5.2.4.1, 5.2.4.2, 5.2.4.5, 5.2.4.6 and 5.2.4.7. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

[TS 38.304, clause 5.2.4.7]

5.2.4.7.0 General reselection parameters

Cell reselection parameters are broadcast in system information and are read from the serving cell as follows:

**absThreshSS-BlocksConsolidation**

This specifies minimum threshold of the beam which can be used for selection of the highest ranked cell, if *rangeToBestCell* is configured.

**cellReselectionPriority**

This specifies the absolute priority for NR frequency or E-UTRAN frequency.

**cellReselectionSubPriority**

This specifies the fractional priority value added to cellReselectionPriority for NR frequency or E-UTRAN frequency.

**Qoffsets,n**

This specifies the offsetbetween the two cells.

**Qoffsetfrequency**

Frequency specific offset for equal priority NR frequencies.

**Qhyst**

This specifies the hysteresis value for ranking criteria.

**Qoffsettemp**

This specifies the additional offset to be used for cell selection and re-selection. It is temporarily used in case the RRC Connection Establishment fails on the cell as specified in TS 38.331 [3].

**Qqualmin**

This specifies the minimum required quality level in the cell in dB.

**Qrxlevmin**

This specifies the minimum required Rx level in the cell in dBm.

**Qrxlevminoffsetcell**

This specifies the cell specific Rx level offset in dB to Qrxlevmin.

**Qqualminoffsetcell**

This specifies the cell specific quality level offset in dB to Qqualmin.

**rangeToBestCell**

This specifies the R value range which the cells whose R value is within the range can be a candidate for the highest ranked cell.

**TreselectionRAT**

This specifies the cell reselection timer value. For each target NR frequency and for each RAT other than NR, a specific value for the cell reselection timer is defined, which is applicable when evaluating reselection within NR or towards other RAT (i.e. TreselectionRAT for NR is TreselectionNR, for E-UTRAN TreselectionEUTRA).

NOTE: TreselectionRAT is not broadcast in system information but used in reselection rules by the UE for each RAT.

**TreselectionNR**

This specifies the cell reselection timer value TreselectionRAT for NR. The parameter can be set per NR frequency as specified in TS 38.331 [3].

**TreselectionEUTRA**

This specifies the cell reselection timer value TreselectionRAT for E-UTRAN.

**ThreshX, HighP**

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, HighQ**

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, LowP**

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, LowQ**

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshServing, LowP**

This specifies the Srxlev threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

**ThreshServing, LowQ**

This specifies the Squal threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

**SIntraSearchP**

This specifies the Srxlev threshold (in dB) for intra-frequency measurements.

**SIntraSearchQ**

This specifies the Squal threshold (in dB) for intra-frequency measurements.

**SnonIntraSearchP**

This specifies the Srxlev threshold (in dB) for NR inter-frequency and inter-RAT measurements.

**SnonIntraSearchQ**

This specifies the Squal threshold (in dB) for NR inter-frequency and inter-RAT measurements.

5.2.4.7.1 Speed dependent reselection parameters

Speed dependent reselection parameters are broadcast in system information and are read from the serving cell as follows:

**TCRmax**

This specifies the duration for evaluating allowed amount of cell reselection(s).

**NCR\_M**

This specifies the maximum number of cell reselections to enter Medium-mobility state.

**NCR\_H**

This specifies the maximum number of cell reselections to enter High-mobility state.

**TCRmaxHyst**

This specifies the additional time period before the UE can enter Normal-mobility state.

**Speed dependent ScalingFactor for Qhyst**

This specifies scaling factor for Qhyst in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state.

**Speed dependent ScalingFactor for TreselectionNR**

This specifies scaling factor for TreselectionNR in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state.

**Speed dependent ScalingFactor for TreselectionEUTRA**

This specifies scaling factor for TreselectionEUTRA in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state.

6.1.2.21.3 Test description

6.1.2.21.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 3.

- NR Cell 1, NR Cell 2 and NR Cell 3 are configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination NR-4 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1, and message contents defined in clause 4.6.1 and clause 4.6.2 with QBASED condition is used in NR cells.

UE:

None.

Preamble:

- The UE is in state 1N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.21.3.2 Test procedure sequence

Table 6.1.2.21.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1", "T2", "T3" and "T4" are applied at the points indicated in the Main behaviour description in Table 6.1.2.21.3.2-3.

Table 6.1.2.21.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **NR Cell 3** | **Remark** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -80 | -118 | Squal of NR Cell 1 is less than SIntraSearchQ. |
| RSRQ | dB | -13.78 | -10.96 | -34.81 |
| Qrxlevmin | dBm | -110 | -110 | -110 |
| Qqualmin | dB | -20 | -20 | -20 |
| SIntraSearchQ | dB | 20 | 20 | 20 |
| Noc | dBm/SCS | -94 | -94 | -94 |
| Srxlev | dB | 16 | 30 | -8 |
| Squal | dB | 6.22 | 9.04 | -14.81 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -118 | -94 | -80 | Squal of NR Cell 2 is less than SnonIntraSearchQ. |
| RSRQ | dB | -34.81 | -13.78 | -10.96 |
| Qrxlevmin | dBm | -110 | -110 | -110 |
| Qqualmin | dB | -20 | -20 | -20 |
| SnonIntraSearchQ | dB | 20 | 20 | 20 |
| Noc | dBm/SCS | -94 | -94 | -94 |
| Srxlev | dB | -8 | 16 | 30 |
| Squal | dB | -14.81 | 6.22 | 9.04 |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | -118 | -118 | -80 |  |
|  | RSRQ | dB | -34.81 | -34.81 | -10.96 |  |
|  | Qrxlevmin | dBm | -110 | -110 | -110 |  |
|  | Qqualmin | dB | -20 | -20 | -20 |  |
|  | SnonIntraSearchQ | dB | 20 | 20 | 2 |  |
|  | Noc | dBm/SCS | -94 | -94 | -94 |  |
|  | Srxlev | dB | -8 | -8 | 30 |  |
|  | Squal | dB | -14.81 | -14.81 | 9.04 |  |
| T4 | SS/PBCH  SSS EPRE | dBm/SCS | -80 | -118 | -80 | Squal of NR Cell 3 is greater than SnonIntraSearchQ but NR Cell 1 is high priority cell. |
| RSRQ | dB | -10.96 | -34.81 | -10.96 |
| Qrxlevmin | dBm | -110 | -110 | -110 |
| Qqualmin | dB | -20 | -20 | -20 |
| SnonIntraSearchQ | dB | 20 | 20 | 2 |
| Noc | dBm/SCS | -94 | -94 | -94 |
| Srxlev | dB | 30 | -8 | 30 |
| Squal | dB | 9.04 | -14.81 | 9.04 |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.1.2.21.3.2-2: Void

Table 6.1.2.21.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The SS re-adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.1.2.21.3.2-1. | - | - | - | - |
| 2 | Wait for 34 seconds to allow UE to recognise the change. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 2? | - | *-* | 1 | - |
| 4 | The SS re-adjusts the SSS levels according to row "T2" in table 6.1.2.21.3.2-1. | - | *-* | - | - |
| 5 | Wait for 34 seconds to allow UE to recognise the change. | - | *-* | - | - |
| 6 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3? | - | *-* | 2 | - |
| 6A | The SS re-adjusts the SSS levels according to row "T3" in table 6.1.2.21.3.2-1. | - | *-* | - | - |
| 7 | Void |  |  |  |  |
| 8 | The SS changes the SnonIntraSearchQ for NR Cell 3 according to row "T3" in table 6.1.2.21.3.2-1/2, The *ValueTag* of *SIB2* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 3. | - | *-* | - | - |
| 8A | The SS notifies the UE of change of System Information on NR Cell 3 by send Short Message on PDCCH using P-RNTI. | <-- | NR RRC: *Paging* | - | - |
| 9 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | *-* | - | - |
| 10 | The SS re-adjusts the SSS levels according to row "T4" in table 6.1.2.21.3.2-1. | - | *-* | - | - |
| 11 | Wait for 120 seconds to allow UE to recognise the change. | - | *-* | - | - |
| 12 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 1? | - | - | 3 | - |

6.1.2.21.3.3 Specific message contents

Table 6.1.2.21.3.3-1: Conditions for specific message contents in Tables below

|  |  |
| --- | --- |
| **Condition** | **Explanation** |
| NR Cell 1 | This condition applies to system information transmitted on NR Cell 1. |
| NR Cell 2 | This condition applies to system information transmitted on NR Cell 2. |
| NR Cell 3 | This condition applies to system information transmitted on NR Cell 3. |

Table 6.1.2.21.3.3-2: SIB2 of NR Cell 1, NR Cell 2 and NR Cell 3 (preabmle, Table 6.1.2.21.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| s-NonIntraSearchP | 0 | 0 dB |  |
| s-NonIntraSearchQ | 20 | 20 dB |  |
| cellReselectionPriority | 5 |  | NR Cell 1 |
|  | 1 |  | NR Cell 2 and Cell 3 |
| } |  |  |  |
| intraFreqCellReselectionInfo SEQUENCE { |  |  |  |
| s-IntraSearchP | 0 | 0 dB |  |
| s-IntraSearchQ | 20 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.21.3.3-3: SIB4 of NR Cell 2 and NR Cell 3 (preabmle and all steps, Table 6.1.2.21.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  | NR Cell 2 |
|  | Same downlink ARFCN as used for NR Cell 1 |  | NR Cell 3 |
| t-ReselectionNR | 1 |  |  |
| threshX-HighP | 7 | 14 dBm | NR Cell 3 |
| threshX-Q SEQUENCE { |  |  | NR Cell 3 |
| threshX-HighQ | 20 |  |  |
| threshX-LowQ | 5 |  |  |
| } |  |  |  |
| cellReselectionPriority | 5 |  | NR Cell 3 |
|  | 1 |  | NR Cell 2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.21.3.3-4: SIB1 of NR Cell 3 (step 8, Table 6.1.2.21.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SIB1 ::= SEQUENCE { |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

**Table 6.1.2.21.3.3-4a: SIB4 of NR Cell 3 (step 8, Table 6.1.2.21.3.2-3)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| threshX-Q SEQUENCE { |  |  | NR Cell 3 |
| threshX-HighQ | 5 |  |  |
| threshX-LowQ | 5 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.21.3.3-5: SI-SchedulingInfo (si-SchedulingInfo in Table 6.1.2.21.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 2 entries |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType2 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| SIB-TypeInfo[2] SEQUENCE { |  | entry 2 |  |
| type | sibType4 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.21.3.3-6: SIB2 of NR Cell 3 (step 8, Table 6.1.2.21.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| s-NonIntraSearchQ | 2 | 2 dB |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.22 Inter-frequency cell reselection based on common priority information with parameters ThreshX, HighQ, ThreshX, LowQ and ThreshServing, LowQ

6.1.2.22.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority frequency }

**then** { UE reselects the cell which belongs to the higher priority frequency }

}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority frequency }

**then** { UE reselects the cell which belongs to the lower priority frequency }

}

6.1.2.22.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 5.2.4.5, and 5.2.4.7. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

[TS 38.304, clause 5.2.4.7]

5.2.4.7.0 General reselection parameters

Cell reselection parameters are broadcast in system information and are read from the serving cell as follows:

**absThreshSS-BlocksConsolidation**

This specifies minimum threshold of the beam which can be used for selection of the highest ranked cell, if *rangeToBestCell* is configured.

**cellReselectionPriority**

This specifies the absolute priority for NR frequency or E-UTRAN frequency.

**cellReselectionSubPriority**

This specifies the fractional priority value added to cellReselectionPriority for NR frequency or E-UTRAN frequency.

**Qoffsets,n**

This specifies the offsetbetween the two cells.

**Qoffsetfrequency**

Frequency specific offset for equal priority NR frequencies.

**Qhyst**

This specifies the hysteresis value for ranking criteria.

**Qoffsettemp**

This specifies the additional offset to be used for cell selection and re-selection. It is temporarily used in case the RRC Connection Establishment fails on the cell as specified in TS 38.331 [3].

**Qqualmin**

This specifies the minimum required quality level in the cell in dB.

**Qrxlevmin**

This specifies the minimum required Rx level in the cell in dBm.

**Qrxlevminoffsetcell**

This specifies the cell specific Rx level offset in dB to Qrxlevmin.

**Qqualminoffsetcell**

This specifies the cell specific quality level offset in dB to Qqualmin.

**rangeToBestCell**

This specifies the R value range which the cells whose R value is within the range can be a candidate for the highest ranked cell.

**TreselectionRAT**

This specifies the cell reselection timer value. For each target NR frequency and for each RAT other than NR, a specific value for the cell reselection timer is defined, which is applicable when evaluating reselection within NR or towards other RAT (i.e. TreselectionRAT for NR is TreselectionNR, for E-UTRAN TreselectionEUTRA).

NOTE: TreselectionRAT is not broadcast in system information but used in reselection rules by the UE for each RAT.

**TreselectionNR**

This specifies the cell reselection timer value TreselectionRAT for NR. The parameter can be set per NR frequency as specified in TS 38.331 [3].

**TreselectionEUTRA**

This specifies the cell reselection timer value TreselectionRAT for E-UTRAN.

**ThreshX, HighP**

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, HighQ**

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, LowP**

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, LowQ**

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshServing, LowP**

This specifies the Srxlev threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

**ThreshServing, LowQ**

This specifies the Squal threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

**SIntraSearchP**

This specifies the Srxlev threshold (in dB) for intra-frequency measurements.

**SIntraSearchQ**

This specifies the Squal threshold (in dB) for intra-frequency measurements.

**SnonIntraSearchP**

This specifies the Srxlev threshold (in dB) for NR inter-frequency and inter-RAT measurements.

**SnonIntraSearchQ**

This specifies the Squal threshold (in dB) for NR inter-frequency and inter-RAT measurements.

5.2.4.7.1 Speed dependent reselection parameters

Speed dependent reselection parameters are broadcast in system information and are read from the serving cell as follows:

**TCRmax**

This specifies the duration for evaluating allowed amount of cell reselection(s).

**NCR\_M**

This specifies the maximum number of cell reselections to enter Medium-mobility state.

**NCR\_H**

This specifies the maximum number of cell reselections to enter High-mobility state.

**TCRmaxHyst**

This specifies the additional time period before the UE can enter Normal-mobility state.

**Speed dependent ScalingFactor for Qhyst**

This specifies scaling factor for Qhyst in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state.

**Speed dependent ScalingFactor for TreselectionNR**

This specifies scaling factor for TreselectionNR in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state.

**Speed dependent ScalingFactor for TreselectionEUTRA**

This specifies scaling factor for TreselectionEUTRA in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state.

6.1.2.22.3 Test description

6.1.2.22.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 3.

- System information combination NR-4 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1, and message contents defined in clause 4.6.1 and clause 4.6.2 with QBASED condition is used in NR cells.

UE:

None.

Preamble:

- The UE is in state 1N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-1.

6.1.2.22.3.2 Test procedure sequence

Table 6.1.2.22.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1" and "T2" are applied at the points indicated in the Main behaviour description in Table 6.1.2.22.3.2-3.

Table 6.1.2.22.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | The power level values are assigned to satisfy SrxlevNR Cell 1 > 0, SrxlevNR Cell 3 < ThreshNR Cell 3, highP, SqualNR Cell 1 > 0 and SqualNR Cell 3 > ThreshNR Cell 3, highQ. |
| RSRQ | dB | -10.76 | -10.76 |
| Qqualmin | dB | -20 | -20 |
| Qrxlevmin | dBm | -106 | -106 |
| Noc | dBm/SCS | -145 | -145 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -94 | The power level values are assigned to satisfy SrxlevNR Cell 3 > Threshserving, lowP and SqualNR Cell 1 > ThreshNR Cell 1, lowQ. But SqualNR Cell 3 is larger than Threshserving, lowQ |
| RSRQ | dB | -10.76 | -10.76 |
| Qqualmin | dB | -20 | -20 |
| Qrxlevmin | dBm | -106 | -106 |
| Noc | dBm/SCS | -145 | -145 |
| T3 | threshServingLowQ | dB | 4 | 26 | The values are assigned to satisfy SqualNR Cell 3 < Threshserving, lowQ and SqualNR Cell 3 < ThreshNR Cell 3, highQ. |
| threshX-HighQ | dB | 20 | - |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.1.2.22.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | The power level values are assigned to satisfy SrxlevNR Cell 1 > 0, SrxlevNR Cell 3 < ThreshNR Cell 3, highP, SqualNR Cell 1 > 0 and SqualNR Cell 3 > ThreshNR Cell 3, highQ. |
| RSRQ | dB | FFS | FFS |
| Qqualmin | dB | -20 | -20 |
| Qrxlevmin | dBm | -106 | -106 |
| Noc | dBm/SCS | FFS | FFS |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | The power level values are assigned to satisfy SrxlevNR Cell 3 > Threshserving, lowP and SqualNR Cell 1 > ThreshNR Cell 1, lowQ. But SqualNR Cell 3 is larger than Threshserving, lowQ |
| RSRQ | dB | FFS | FFS |
| Qqualmin | dB | -20 | -20 |
| Qrxlevmin | dBm | -106 | -106 |
| Noc | dBm/SCS | FFS | FFS |
| T3 | threshServingLowQ | dB | 4 | 26 | The values are assigned to satisfy SqualNR Cell 3 < Threshserving, lowQ and SqualNR Cell 3 < ThreshNR Cell 3, highQ. |
| threshX-HighQ | dB | 20 | - |
| Note: The uncertain downlink signal level is specified in TS 38.508-1 [4] section FFS. | | | | | |

Table 6.1.2.22.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| 1 | The SS changes NR Cell 3 SS/PBCH EPRE level according to the row "T1" in table 6.1.2.22.3.2-1/2. | - | - | - | - |
| 2 | Wait for 34 seconds to allow UE to recognise the change. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3? | - | - | 1 | - |
| 4 | The SS changes the SSS level according to the row "T2" in table 6.1.2.22.3.2-1/2. | - | *-* | - | - |
| 5 | Wait for 8 seconds to allow UE to recognise the change. | - | *-* | - | - |
| 6 | The SS transmits a *Paging* message on NR Cell 1. | <-- | NR RRC: *Paging* | - | - |
| 6A | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1 within the next 10s? | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| 7 | The SS changes threshServingLowQ of NR Cell 3 according to the row "T3" in table 6.1.2.22.3.2-1/2. The *ValueTag* of *SIB2* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 3.  The SS changes threshX-HighQ of NR Cell 1 according to the row "T3" in table 6.1.2.22.3.2-1/2. The *ValueTag* of *SIB4* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 1.  The SS notifies the UE of change of System Information on NR Cell 3 and Cell 1 by send SM on PDCCH using P-RNTI. | - | *-* | - | - |
| 8 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | *-* | - | - |
| 9 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 1? | - | - | 2 | - |

6.1.2.22.3.3 Specific message contents

Table 6.1.2.22.3.3-1: Conditions for specific message contents in Tables below

|  |  |
| --- | --- |
| Condition | Explanation |
| NR Cell 1 | This condition applies to system information transmitted on NR Cell 1. |
| NR Cell 3 | This condition applies to system information transmitted on NR Cell 3. |

Table 6.1.2.22.3.3-2: SIB2 of NR Cell 1 and NR Cell 3 (preamble and all steps, Table 6.1.2.22.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { | 1 entry |  |  |
| threshServingLowP | 1 | 2 dB | NR Cell 3 |
| threshServingLowQ | 4 | 4 dB |  |
| cellReselectionPriority | 5 |  | NR Cell 3 |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.22.3.3-3: SIB4 of NR Cell 1 and NR Cell 3 (preamble and all steps, Table 6.1.2.22.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  | NR Cell 1 |
|  | Same downlink ARFCN as used for NR Cell 1 |  | NR Cell 3 |
| q-RxLevMin | -50 | -100 dBm |  |
| q-QualMin | -20 | -20 dB |  |
| t-ReselectionNR | 1 |  |  |
| threshX-HighP | 10 | 20 dBm | NR Cell 1 |
| threshX-Q SEQUENCE { |  |  |  |
| threshX-HighQ | 4 | 4 dB | NR Cell 1 |
| threshX-LowQ | 2 | 2 dB | NR Cell 3 |
| } |  |  |  |
| cellReselectionPriority | 5 |  | NR Cell 1 |
|  | 4 |  | NR Cell 3 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.22.3.3-4: SIB1 of NR Cell 3 (step 7, Table 6.1.2.22.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

Table 6.1.2.22.3.3-5: SI-SchedulingInfo (si-SchedulingInfo in Table 6.1.2.22.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType2 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.22.3.3-6: SIB2 of NR Cell 3 (step 7, Table 6.1.2.22.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { | 1 entry |  |  |
| threshServingLowQ | 26 | 26 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.22.3.3-7: SIB1 of NR Cell 1 (step 7, Table 6.1.2.22.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

Table 6.1.2.22.3.3-8: SI-SchedulingInfo (si-SchedulingInfo in Table 6.1.2.22.3.3-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType4 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.22.3.3-9: SIB4 of NR Cell 1 (step 7, Table 6.1.2.22.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  |  |
| threshX-Q SEQUENCE { |  |  |  |
| threshX-HighQ | 20 | 20dB |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.23 Cell reselection / MFBI

6.1.2.23.1 Test Purpose (TP)

(0)

**with** { UE is switched off }

**ensure that** {

**when** { UE is switched on a MFBI cell with the SIB1 of the first frequency band indicated in freqBandIndicator is not supported by UE and the second frequency band indicated in freqBandIndicator is supported by UE}

**then** { the UE selects the cell}

}

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { an equal priority NG-RAN Intra-frequency neighbouring cell which has been included in the frequencyBandList provided by the serving cell becomes available, and, is better ranked than the serving cell during a time interval TreselectionNR, and, more than 1 second has elapsed since the UE camped on the current serving cell }

**then** { the UE reselects the new cell}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { an equal priority NG-RAN Inter-frequency neighbouring cell which has been included in the frequencyBandList provided by the serving cell becomes available, and, is better ranked than the serving cell during a time interval TreselectionNR, and, more than 1 second has elapsed since the UE camped on the current serving cell }

**then** { the UE reselects the new cell}

(3)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { an equal priority NG-RAN Inter-band neighbouring cell which has been included in the frequencyBandList provided by the serving cell becomes available, and, is better ranked than the serving cell during a time interval TreselectionNR, and, more than 1 second has elapsed since the UE camped on the current serving cell }

**then** { the UE reselects the new cell}

6.1.2.23.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.304, clause 5.2.4.2, 5.2.4.5, 5.2.4.6 and TS 38.331, clause 5.2.2.4.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

NOTE: If *rangeToBestCell* is configured but *absThreshSS-BlocksConsolidation* is not configured on an NR frequency, the UE considers that there is one beam above the threshold for each cell on that frequency.

[TS 38.331, clause 5.2.2.4.2]

Upon receiving the *SIB1* the UE shall:

1> store the acquired *SIB1*;

…

1> if in RRC\_CONNECTED while T311 is not running:

2> disregard the *frequencyBandList*, if received, while in RRC\_CONNECTED;

2> forward the *cellIdentity* to upper layers;

2> forward the *trackingAreaCode* to upper layers;

2> apply the configuration included in the *servingCellConfigCommon*;

1> else:

2> if the UE supports one or more of the frequency bands indicated in the *frequencyBandList* for downlink, and one or more of the frequency bands indicated in the *frequencyBandList* for uplink for FDD, and they are not downlink only bands, and

2> if the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* for a supported band in the downlink and a supported band in uplink for FDD, and

2> if the UE supports the bandwidth of the initial uplink BWP and of the initial downlink BWPs indicated in the *locationAndBandwidth* fields in *uplinkConfigCommon*:

3> select the first frequency band in the *frequencyBandList* which the UE supports and for which the UE supports at least one of the *additionalSpectrumEmission* values in *nr-NS-PmaxList*, if present;

3> forward the *cellIdentity* to upper layers;

3> forward the *trackingAreaCode* to upper layers;

3> forward the PLMN identity to upper layers;

…

2> else:

3> consider the cell as barred in accordance with TS 38.304 [20]; and

3> perform barring as if intraFreqReselection is set to notAllowed;

6.1.2.23.3 Test description

6.1.2.23.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2, NR Cell 3 and NR Cell 10 are configured according to TS 38.508-1 [4] Table 4.4.2-3. NR Cell 1, NR Cell 2 and NR Cell 3 are MFBI capable cells.

- Cell 1 belongs to the frequency which overlaps between bands controlled by IXITs px\_NR\_OverlappingNotSupportedBand\_MFBI and px\_NR\_PrimaryBand.

- Cell 10 is defined by IXIT px\_NR\_SecondaryBand.

- Cell 2 belongs to the frequency which overlaps between bands controlled by IXITs px\_NR\_OverlappingNotSupportedBand\_MFBI and px\_NR\_PrimaryBand.

- Cell 3 belongs to the frequency which overlaps between bands controlled by IXITs px\_NR\_OverlappingNotSupportedBand\_MFBI and px\_NR\_PrimaryBand.

- System information combination NR-4 as defined in TS 38.508 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- UE does not support the px\_NR\_OverlappingNotSupportedBand\_MFBI band.

Preamble:

- UE is in state Switched OFF (state 0N-B) according to 38.508-1 [4].

6.1.2.23.3.2 Test procedure sequence

Table 6.1.2.23.3.2-1/2 illustrate the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration marked "T1", "T2", "T3", "T4" and "T5" are applied at the points indicated in the Main behaviour description in Table 6.1.2.23.3.2-3.

Table 6.1.2.23.3.2-1: Time instances of cell power level and parameter changes for conducted test environment

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 3 | NR Cell 10 | Remark |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | “Off” | “Off” | “Off” | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -94 | -88 | “Off” | ”Off” | The power level values are set so that RCell 1 < RCell 2. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -94 | -80 | “Off” | The power level values are set so that RCell 1 < RCell 3. |
| T4 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | -94 | -80 | The power level values are assigned to ensure the UE registered on NR Cell 10. |
| T5 | SS/PBCH  SSS EPRE | dBm/SCS | -80 | “Off” | “Off” | -94 | The power level values are set so that RCell 10 < RCell 1. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | | | |

Table 6.1.2.23.3.2-2: Time instances of cell power level and parameter changes for OTA test environment

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 3 | NR Cell 10 | Remark |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | “Off” | “Off” | “Off” | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | “Off” | ”Off” | The power level values are set so that RCell 1 < RCell 2. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -91 | -82 | “Off” | The power level values are set so that RCell 1 < RCell 3. |
| T4 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | -91 | -82 | The power level values are assigned to ensure the UE registered on NR Cell 10. |
| T5 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | “Off” | “Off” | -91 | The power level values are set so that RCell 10 < RCell 1. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.2-2. | | | | | | | |

Table 6.1.2.23.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The SS changes the SS/PBCH EPRE level according to row "T1" in table 6.1.2.23.3.2-1/2. | - | - | - | - |
| 2 | The UE is switched on. | - | - | - | - |
| 3-22a1 | Steps 1 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1. | - | - | 0 | P |
| 23 | Wait 1 second. (to ensure than 1 second has elapsed since the UE camped on the current serving cell) | - | - | - | - |
| 24 | The SS changes the SS/PBCH EPRE level according to row "T2" in table 6.1.2.23.3.2-1/2. | - | - | - | - |
| 24A | Wait for 34s for FR1 or 130s for FR2 for the UE to perform cell reselection procedure. (Note 1) |  |  |  |  |
| 25 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.4 indicate that the UE is camped on NR Cell 2? | - | - | 1 | P |
| 26 | Void |  |  |  |  |
| 27 | Void |  |  |  |  |
| 28 | Void |  |  |  |  |
| 29-48a1 | Void |  |  |  |  |
| 49 | The SS changes the SS/PBCH EPRE level according to row "T3" in table 6.1.2.23.3.2-1/2. | - | - | - | - |
| 50 | Wait for 34s for FR1 or 130s for FR2 for the UE to perform cell reselection procedure. (Note 2) | - | - | - | - |
| 51 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.4 indicate that the UE is camped on NR Cell 3? | - | - | 2 | P |
| 52 | Void |  |  |  |  |
| 53 | The SS changes the SS/PBCH EPRE level according to row "T4" in table 6.1.2.23.3.2-1/2 | - | - | - | - |
| 54 | Void |  |  |  |  |
| 55-74a1 | Void |  |  |  |  |
| 75 | Wait for 34s for FR1 or 130s for FR2 for the UE to perform cell reselection procedure. (Note 2) | - | - | - | - |
| 75A | The test result of generic test procedure in TS 38.508-1 [4] clause 4.9.4 indicates that the UE is camped on NR Cell 10. |  |  |  |  |
| 76 | The SS changes the SS/PBCH EPRE level according to row "T5" in table 6.1.2.23.3.2-1/2. | - | - | - | - |
| 76A | Wait for 34s for FR1 or 130s for FR2 for the UE to perform cell reselection procedure. (Note 2) |  |  |  |  |
| 77 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.4 indicate that the UE is camped on NR Cell 1 belonging to the MFBI band (px\_NR\_PrimaryBand)? | - | - | 3 | P |
| Note 1: The wait time for reselection to a newly detected intra frequency cell is selected to cover Tdetect,NR\_Intra (25\*1280ms=32s for FR1 and 25\*4\*1280ms=128s for FR2) + TSI-NR (11280ms= fo FR2 1.28s for FR1 and FR2) = 33.28s rounded up to 34s for FR1 and 129.28s rounded up to 130s for FR2.  Note 2: The wait time for reselection to a newly detected inter frequency cell is selected to cover Tdetect,NR\_Inter (25\*1280ms=32s for FR1 and 25\*4\*1280ms=128s for FR2) + TSI-NR (1.28s for FR1 and FR2) = 33.28s rounded up to 34s for FR1 and 129.28s rounded up to 130s for FR2. | | | | | |

6.1.2.23.3.3 Specific message contents

Table 6.1.2.23.3.3-1: Conditions for specific message contents in Table 6.1.2.23.3.3-4

|  |  |
| --- | --- |
| Condition | Explanation |
| Cell 3 | This condition applies to system information transmitted on Cell 3. |
| Cell 10 | This condition applies to system information transmitted on Cell 10. |

Table 6.1.2.23.3.3-2: SIB1 for NR Cell 1, NR Cell 2 and NR Cell 3 (preamble and all steps, Table 6.1.2.23.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1::= SEQUENCE { |  |  |  |
| servingCellConfigCommon SEQUENCE{ |  |  |  |
| downlinkConfigCommon SEQUENCE{ |  |  |  |
| frequencyInfoDL SEQUENCE { |  |  |  |
| frequencyBandlist SEQUENCE (SIZE (1.. maxNrofMultiBands)) OF NR-MultiBandInfo { | 2 entries |  |  |
| NR-MultiBandInfo[1] SEQUENCE { |  | entry 1 |  |
| freqBandIndicatorNR | An overlapping not supported frequency band MFBI under test (px\_NR\_OverlappingNotSupportedBand\_MFBI). |  |  |
| } |  |  |  |
| NR-MultiBandInfo[2] SEQUENCE { |  | entry 2 |  |
| freqBandIndicatorNR | An overlapping Band under test (px\_NR\_PrimaryBand). |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| uplinkConfigCommon SEQUENCE { |  |  |  |
| frequencyInfoUL SEQUENCE { |  |  |  |
| frequencyBandlist SEQUENCE (SIZE (1.. maxNrofMultiBands)) OF NR-MultiBandInfo { | 2 entries |  | FDD |
| NR-MultiBandInfo[1] SEQUENCE { |  | entry 1 |  |
| freqBandIndicatorNR | An overlapping not supported frequency band MFBI under test (px\_NR\_OverlappingNotSupportedBand\_MFBI). |  |  |
| } |  |  |  |
| NR-MultiBandInfo[2] SEQUENCE { |  | entry 2 |  |
| freqBandIndicatorNR | An overlapping Band under test (px\_NR\_PrimaryBand). |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| uplinkConfigCommon SEQUENCE { |  |  |  |
| frequencyInfoUL SEQUENCE { |  |  |  |
| frequencyBandlist SEQUENCE (SIZE (1.. maxNrofMultiBands)) OF NR-MultiBandInfo { | 2 entries |  | FDD |
| NR-MultiBandInfo[1] SEQUENCE { |  | entry 1 |  |
| freqBandIndicatorNR | An overlapping not supported frequency band MFBI under test (px\_NR\_OverlappingNotSupportedBand\_MFBI). |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.23.3.3-3: SIB4 for NR Cell 1 and NR Cell 2 (preamble and all steps, Table 6.1.2.23.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4::= SEQUENCE { |  |  |  |
| InterFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 10 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  |  |
| frequencyBandlist SEQUENCE (SIZE (1.. maxNrofMultiBands)) OF MultiBandInfo { | 1 entry |  |  |
| NR-MultiBandInfo[1] SEQUENCE { |  | entry 1 |  |
| freqBandIndicatorNR | An overlapping Band under test (px\_NR\_PrimaryBand). |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.23.3.3-4: SIB4 for NR Cell 3 and NR Cell 10 (preamble and all steps, Table 6.1.2.23.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4::= SEQUENCE { |  |  |  |
| InterFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 1 |  | NR Cell 10 |
|  | Same downlink ARFCN as used for NR Cell 10 |  | NR Cell 3 |
| frequencyBandList SEQUENCE (SIZE (1.. maxNrofMultiBands)) OF MultiBandInfo { | 1 entry |  |  |
| NR-MultiBandInfo[1] SEQUENCE { |  | entry 1 |  |
| freqBandIndicatorNR | An overlapping Band under test (px\_NR\_PrimaryBand) |  | NR Cell 10 |
|  | Band for interBand NR Cell 10  (px\_NR\_SecondaryBand). |  | NR Cell 3 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.1.2.24 Slice-based cell reselection / Reselection priorities provided by SIB16

6.1.2.24.1 Test Purpose (TP)

(1)

**with** { UE supporting slice-based cell reselection and in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell reselection criteria is met for two cells on different frequencies supporting different NAS-provided NSAG priorities }

**then** { UE reselects to the cell on the frequency which supports higher priority NSAG }

}

(2)

**with** { UE supporting slice-based cell reselection and in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell reselection criteria is met for two cells on different frequencies supporting same NAS-provided NSAG priority }

**then** { UE reselects to the cell on the frequency which supports the NSAG having higher nsag-CellReselectionPriority }

}

6.1.2.24.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.304, clause 5.2.4.11. Unless otherwise stated these are Rel-17 requirements.

[TS 38.304, clause 5.2.4.11]

The UE derives reselection priorities for slice-based cell reselection by using:

- NSAGs and their priorities provided by NAS,

- *sliceInfoList* and or *sliceInfoListDedicated* per frequency with *nsag-CellReselectionPriority* per NSAG, if provided in system information and/or dedicated signalling,

- *cellReselectionPriority* per frequency provided in system information and/or dedicated signalling.

The UE considers an NR frequency to support all slices of an NSAG if

- the nsag-ID and TA of the NSAG as provided by NAS are indicated for the NR frequency (see TS 38.331).

The UE considers a cell on an NR frequency to support all slices of an NSAG if

*-* the nsag-ID and TA of the NSAG as provided by NAS are indicated for the NR frequency (see TS 38.331); and

- the cell is either listed in the *sliceAllowedCellListNR* (if provided in the used slice-based cell reselection information) or the cell is not listed in the *sliceExcludedCellListNR* (if provided in the used slice-based cell reselection information); or

- Neither *sliceAllowedCellListNR* nor *sliceExcludedCellListNR* is configured in the used slice-based cell reselection information

The UE shall derive reselection priorities for slice-based cell reselection according to the following rules:

- Frequencies that support at least one prioritized NSAG received from NAS have higher reselection priority than frequencies that support none of the NSAG(s) received from NAS.

- Frequencies that support at least one NSAG provided by NAS are prioritised in the order of the NAS-provided priority for the NSAG with highest priority supported on the frequency.

- Among the frequencies (one or multiple) that support the highest prioritised NSAG(s) with the same NAS-provided priorities, the frequencies are prioritized in the order of their highest *nsag-CellReselectionPriority* given for these NSAG(s). If no nsag-CellReselectionPriority is given for a NSAG at a frequency, the lowest priority value is used (i.e, lower than any of the network configured values for these frequencies).

- Frequencies that support none of the NSAG(s) provided by NAS are prioritized in the order of their *cellReselectionPriority*;

For a UE performing slice-based cell reselection, if the highest ranked cell or best cell in a frequency fulfils the inter- frequency cell reselection criteria (see clause 5.2.4.5) based on reselection priority for the frequency and NSAG derived according to this clause or fulfils intra-frequency and equal priority inter-frequency cell reselection criteria (see clause 5.2.4.6), but this cell does not support the NSAG according to this clause,

- if this cell supports any other NSAG(s) according to this clause, the UE shall re-derive a reselection priority for the frequency by considering the NSAG(s) supported by this cell (rather than those of the corresponding NR frequency);

- Otherwise, the UE shall re-derive a reselection priority for the frequency as if none of the NSAG(s) provided by NAS is supported.

This re-derived reselection priority is used for a maximum of 300 seconds, or until new information of NSAG(s) and their priorities are received from NAS. UE shall ensure the cell reselection criteria above are fulfilled based on the newly derived priorities.

6.1.2.24.3 Test description

6.1.2.24.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- System information combination NR-30 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None

Preamble:

- The UE is in state Switched OFF (state 0N-B) according to TS 38.508-1 [4].

6.1.2.24.3.2 Test procedure sequence

Table 6.1.2.24.3.2-1 for FR1 and Table 6.1.2.24.3.2-2 for FR2 illustrate the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.1.2.24.3.2-3.

Table 6.1.2.24.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -88 | -78 | The power level values are assigned to satisfy RNR Cell 3 < RNR Cell 6. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.1.2.24.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | FFS | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -91 | FFS | The power level values are assigned to satisfy RNR Cell 3 < RNR Cell 6. |

Table 6.1.2.24.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The UE is switched on. | - | - | - | - |
| 2-13 | Steps 2 to 13 of the generic procedure for NR RRC\_IDLE specified in TS 38.508-1 subclause 4.5.2 are performed. | - | - | - | - |
| 14 | The SS transmits a REGISTRATION ACCEPT message | <-- | REGISTRATION ACCEPT | - | - |
| 15-20a1 | Steps 15 to 20a1 of the generic procedure for NR RRC\_IDLE specified in TS 38.508-1 subclause 4.5.2 are performed. | - | - | - | - |
| 21 | The SS changes NR Cell 3 and NR Cell 6 SSS levels according to the row "T1" in table 6.1.2.24.3.2-1/2. | - | - | - | - |
| 22 | Wait for 66[FR1]/258[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 23 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3? | - | - | 1 | P |
| 24 | The SS changes NR Cell 1 and NR Cell 6 SSS levels according to the row "T2" in table 6.1.2.24.3.2-1/2. | - | - | - | - |
| 25 | Wait for 34[FR1]/130[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 26 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 6? | - | - | 2 | P |
| Note: The wait time at steps 22 and 25 is Kcarrier\*Tdetect,NR\_Inter (as per TS 38.133 [30], clause 4.2.2.4) plus the time to read the system information TSI-NR. | | | | | |

6.1.2.24.3.3 Specific message contents

Table 6.1.2.24.3.3.3-1: REGISTRATION ACCEPT(step 14, Table 6.1.2.24.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 4.7.1-7 | | | |
| Information Element | | Value/remark | Comment | Condition |
| NSAG information | |  |  |  |
| NSAG information IEI | |  |  |  |
| Length of NSAG information contents | | 2 entities |  |  |
| NSAG 1 | |  |  |  |
| Length of NSAG | | 1 entity |  |  |
| NSAG identifier | | ‘00000001’B |  |  |
| S-NSSAI list of NSAG | |  |  |  |
| Length of S-NSSAI list of NSAG | |  |  |  |
| S-NSSAI value 1 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000001’B | SST value 1 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| S-NSSAI value 2 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000010’B | SST value 2 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| NSAG priority | | ‘00000011’B |  |  |
| NSAG 2 | |  |  |  |
| Length of NSAG | | 1 entity |  |  |
| NSAG identifier | | ‘00000010’B |  |  |
| S-NSSAI list of NSAG | |  |  |  |
| Length of S-NSSAI list of NSAG | |  |  |  |
| S-NSSAI value 1 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000011’B | SST value 3 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| S-NSSAI value 2 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000100’B | SST value 4 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| NSAG priority | | ‘00000010’B |  |  |

Table 6.1.2.24.3.3.3-2: *SIB16* for NR Cell 1(preamble and all steps, Table 6.1.2.24.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 1 entry |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000001’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 5 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.24.3.3.3-3: *SIB16* for NR Cell 3(preamble and all steps, Table 6.1.2.24.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 1 entry |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000010’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 4 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.24.3.3.3-4: *SIB16* for NR Cell 6(preamble and all steps, Table 6.1.2.24.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 1 entry |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000010’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 6 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.1.2.25 Slice-based cell reselection / Re-derive reselection priority for frequency

6.1.2.25.1 Test Purpose (TP)

(1)

**with** { UE supporting slice-based cell reselection and in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell on the highest priority frequency supporting NSAG is listed in the sliceExcludedCellListNR of this NSAG }

**then** { UE does not attempt to reselect to the cell listed in the sliceExcludedCellListNR }

}

(2)

**with** { UE supporting slice-based cell reselection and in NR RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell on the highest priority NR frequency supporting NSAG is listed in the sliceExcludedCellListNR }

**then** { UE re-derive a reselection priority for the frequency by considering other NSAG(s) supported by this cell }

}

6.1.2.25.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.304, clause 5.2.4.11. Unless otherwise stated these are Rel-17 requirements.

[TS 38.304, clause 5.2.4.11]

The UE derives reselection priorities for slice-based cell reselection by using:

- NAS provided NSAG information, only for NSAG(s) associated with the network slice(s) provided by NAS for cell reselection (see TS 23.501 [10], TS 24.501 [14]),

- *sliceInfoList* and/or *sliceInfoListDedicated* per frequency with *nsag-CellReselectionPriority* per NSAG, if provided in system information and/or dedicated signalling (see TS 38.331 [3]),

- *cellReselectionPriority* per frequency provided in system information and/or dedicated signalling (see TS 38.331 [3]).

The UE considers an NR frequency to support all slices of an NSAG if

- the nsag-ID and TA of the NSAG as provided by NAS are indicated for the NR frequency (see TS 38.331).

The UE considers a cell on an NR frequency to support all slices of an NSAG if

*-* the nsag-ID and TA of the NSAG as provided by NAS are indicated for the NR frequency (see TS 38.331); and

- the cell is either listed in the *sliceAllowedCellListNR* (if provided in the *sliceInfoList*) or the cell is not listed in the *sliceExcludedCellListNR* (if provided in the *sliceInfoList*); or

- Neither *sliceAllowedCellListNR* nor *sliceExcludedCellListNR* is configured in the *sliceInfoList*.

The UE shall derive reselection priorities for slice-based cell reselection according to the following rules:

- Frequencies that support at least one prioritized NSAG received from NAS have higher reselection priority than frequencies that support none of the NSAG(s) received from NAS.

- Frequencies that support at least one NSAG provided by NAS are prioritised in the order of the NAS-provided priority for the NSAG with highest priority supported on the frequency.

- Among the frequencies (one or multiple) that support the highest prioritised NSAG(s) with the same NAS-provided priorities, the frequencies are prioritized in the order of their highest *nsag-CellReselectionPriority* given for these NSAG(s). If no *nsag-CellReselectionPriority* is given for a NSAG at a frequency, the lowest priority value is used (i.e, lower than any of the network configured values for these frequencies).

- Frequencies that support none of the NSAG(s) provided by NAS are prioritized in the order of their *cellReselectionPriority*.

For a UE performing slice-based cell reselection, if the highest ranked cell or best cell in a frequency fulfils the inter- freqeuency cell reselection criteria (see clause 5.2.4.5) based on reselection priority for the frequency and NSAG derived according to this clause or fulfils intra-frequency and equal priority inter-frequency cell reselection criteria (see clause 5.2.4.6), but this cell does not support the NSAG according to this clause:

- if this cell supports any other NSAG(s) according to this clause, the UE shall re-derive a reselection priority for the frequency by considering the NSAG(s) supported by this cell (rather than those of the corresponding NR frequency);

- Otherwise, the UE shall re-derive a reselection priority for the frequency as if none of the NSAG(s) provided by NAS is supported.

This re-derived reselection priority is used for a maximum of 300 seconds, or until new network slice(s) and/or NSAG information are received from NAS. UE shall ensure the cell reselection criteria above are fulfilled based on the newly derived priorities.

6.1.2.25.3 Test description

6.1.2.25.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- System information combination NR-30 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None

Preamble:

- The UE is in state Switched OFF (state 0N-B) according to TS 38.508-1 [4].

6.1.2.25.3.2 Test procedure sequence

Table 6.1.2.25.3.2-1 for FR1 and Table 6.1.2.25.3.2-2 for FR2 illustrate the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.1.2.25.3.2-3.

Table 6.1.2.25.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | -78 | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 6. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.1.2.25.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -FFS | -FFS | -FFS | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -FFS | -FFS | -FFS | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 6. |

Table 6.1.2.25.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The UE is switched on. | - | - | - | - |
| 2-13 | Steps 2 to 13 of the generic procedure for NR RRC\_IDLE specified in TS 38.508-1 subclause 4.5.2 are performed. | - | - | - | - |
| 14 | The SS transmits a REGISTRATION ACCEPT message | <-- | REGISTRATION ACCEPT | - | - |
| 15-20a1 | Steps 15 to 20a1 of the generic procedure for NR RRC\_IDLE specified in TS 38.508-1 subclause 4.5.2 are performed. | - | - | - | - |
| 21 | The SS changes NR Cell 3 power level according to the row "T1" in table 6.1.2.25.3.2-1/2. | - | - | - | - |
| 22 | Wait for 66[FR1]/258[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 23-24 | Step 1 and 2 of the generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 3 within 60s? | - | - | 1 | F |
| 25 | The SS changes NR Cell 6 power level according to the row "T2" in table 6.1.2.25.3.2-1/2. | - | - | - | - |
| 26 | Wait for 34[FR1]/130[FR2] seconds to allow UE to recognise the change. | - | - | - | - |
| 27 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 6? | - | - | 2 | P |
| Note: The wait time at steps 22 and 25 is Kcarrier\*Tdetect,NR\_Inter (as per TS 38.133 [30], clause 4.2.2.4) plus the time to read the system information TSI-NR. | | | | | |

6.1.2.25.3.3 Specific message contents

Table 6.1.2.25.3.3.3-1: REGISTRATION ACCEPT(step 14, Table 6.1.2.25.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 4.7.1-7 | | | |
| Information Element | | Value/remark | Comment | Condition |
| NSAG information | |  |  |  |
| NSAG information IEI | |  |  |  |
| Length of NSAG information contents | | 2 entities |  |  |
| NSAG 1 | |  |  |  |
| Length of NSAG | | 1 entity |  |  |
| NSAG identifier | | ‘00000001’B |  |  |
| S-NSSAI list of NSAG | |  |  |  |
| Length of S-NSSAI list of NSAG | |  |  |  |
| S-NSSAI value 1 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000001’B | SST value 1 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| S-NSSAI value 2 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000010’B | SST value 2 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| NSAG priority | | ‘00000011’B |  |  |
| NSAG 2 | |  |  |  |
| Length of NSAG | | 1 entity |  |  |
| NSAG identifier | | ‘00000010’B |  |  |
| S-NSSAI list of NSAG | |  |  |  |
| Length of S-NSSAI list of NSAG | |  |  |  |
| S-NSSAI value 1 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000011’B | SST value 3 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| S-NSSAI value 2 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000100’B | SST value 4 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| NSAG priority | | ‘00000010’B |  |  |

Table 6.1.2.25.3.3.3-2: *SIB16* for NR Cell 1(preamble and all steps, Table 6.1.2.25.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 1 entry |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000001’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 5 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.25.3.3.3-3: *SIB16* for NR Cell 3(preamble and all steps, Table 6.1.2.25.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 2 entries |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000001’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 6 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 2 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000010’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 4 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | |  |  |  |
| sliceExcludedCellListNR-r17 SEQUENCE (SIZE (1..maxCellSlice-r17)) OF PCI-Range { | | 1 entry |  |  |
| PCI-Range[1] SEQUENCE { | |  | entry 1 |  |
| start | | PhysicalCellID of NR Cell 3 |  |  |
| range | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.25.3.3.3-4: *SIB16* for NR Cell 6(preamble and all steps, Table 6.1.2.25.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 2 entries |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000001’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 4 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 2 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000010’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 4 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | |  |  |  |
| sliceExcludedCellListNR-r17 SEQUENCE (SIZE (1..maxCellSlice-r17)) OF PCI-Range { | | 1 entry |  |  |
| PCI-Range[1] SEQUENCE { | |  | entry 1 |  |
| start | | PhysicalCellID of NR Cell 6 |  |  |
| range | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.1.2.26 Cell Selection / RedCap

6.1.2.26.1 Test Purpose (TP)

(1)

**with** { UE supporting RedCap and in NR RRC\_IDLE state }

**ensure that** {

**when** { a cell fulfils the requirements for a suitable cell except cell Barred status "true" for RedCap }

**then** { the UE considers the cell as barred and no camping on this cell can take place }

}

(2)

**with** { UE supporting RedCap and in NR RRC\_IDLE state }

**ensure that** {

**when** { a cell fulfils the requirements for a suitable cell except intraFreqReselectionRedCap in SIB1 is absent }

**then** { the UE considers the cell as barred and no camping on this cell can take place }

}

(3)

**with** { UE supporting RedCap and in NR RRC\_IDLE state }

**ensure that** {

**when** { a cell fulfils the requirements for a suitable cell except cell Barred status not "true" for RedCap }

**then** { the UE considers the cell suitable and camps on it }

}

6.1.2.26.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.304, clause 5.3.1 and TS 38.331 clause 5.2.2.4.2. Unless otherwise stated these are Rel-17 requirements.

[TS 38.331, clause 5.2.2.4.2]

Upon receiving the *SIB1* the UE shall:

1> store the acquired *SIB1*;

1> if the UE is a RedCap UE and it is in RRC\_IDLE or in RRC\_INACTIVE, or if the RedCap UE is in RRC\_CONNECTED while *T311* is running:

2> if *intraFreqReselectionRedCap* is not present in *SIB1*:

3> consider the cell as barred in accordance with TS 38.304 [20];

3> perform barring as if *intraFreqReselectionRedCap* is set to allowed;

2> else:

3> if the *cellBarredRedCap1Rx* is present in the acquired *SIB1* and is set to *barred* and the UE is equipped with 1 Rx branch; or

3> if the *cellBarredRedCap2Rx* is present in the acquired *SIB1* and is set to *barred* and the UE is equipped with 2 Rx branches; or

3> if the *halfDuplexRedCapAllowed* is not present in the acquired *SIB1* and the UE supports only half-duplex FDD operation:

4> consider the cell as barred in accordance with TS 38.304 [20];

4> perform barring based on *intraFreqReselectionRedCap* as specified in TS 38.304 [20];

[TS 38.304, clause 5.3.1]

When cell status "barred" is indicated for RedCap UEs with 1Rx/2Rx or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

- If the field *intraFreqReselectionRedCap* in *SIB1* message is set to "allowed"; or

- If the cell is to be treated as if the cell status is "barred" due to not supporting RedCap UEs:

- the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- the UE may select another cell on the same frequency if re-selection criteria are fulfilled.

- If the field *intraFreqReselectionRedCap* in *SIB1* message is set to "not allowed":

- If the cell operates in licensed spectrum, or if this cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or the selected PLMN of the UE, or if this cell belongs to the registered SNPN or the selected SNPN of the UE:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds.

- else:

- the UE may select to another cell on the same frequency if the reselection criteria are fulfilled.

- the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

[TS 38.306, clause 4.2.21.1]

RedCap UE is the UE with reduced capability:

…

- For FR 1, 1 DL MIMO layer if 1 Rx branch is supported, and 2 DL MIMO layers if 2 Rx branches are supported; for FR2, either 1 or 2 DL MIMO layers can be supported, while 2 Rx branches are always supported. For FR1 and FR2, UE features and corresponding capabilities related to more than 2 UE Rx branches or more than 2 DL MIMO layers, as well as UE features and capabilities related to more than 2 UE Tx branches or more than 2 UL MIMO layers are not supported by RedCap UEs;

6.1.2.26.3 Test description

6.1.2.26.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 11 have different tracking areas according to TS 38.508-1 [4] Table 4.4.2-3.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None

Preamble:

- The UE is in 1N-A state on NR Cell 1 using generic procedure parameter Connectivity (*NR*) and Test loop function(*Off*) according to TS 38.508-1 [4].

6.1.2.26.3.2 Test procedure sequence

Table6.1.2.26.3.2-1 for FR1 and table 6.1.2.26.3.2-2 for FR2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.1.2.26.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 11 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 |  |
| NOTE 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.1.2.26.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 11 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | "Off" |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -82 |  |
| NOTE 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2. | | | | | |

Table 6.1.2.26.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes the SIB1 of NR Cell 11 to set cell Barred status to "true". | - | - | - | - |
| 2 | Void |  |  |  |  |
| 3 | SS re-adjusts the SS/PBCH EPRE level of NR Cell 1 and NR Cell 11 according to row "T1" in table 6.1.2.26.3.2-1/2. | - | - | - | - |
| 4 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 11 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 5 | The SS changes the SIB1 of NR Cell 11 to delete the configuration of cellBarredRedCap-r17 | - | - | - | - |
| 6 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 11 after 300s from Step 3? | --> | NR RRC: *RRCSetupRequest* | 3 | P |
| 7 | Steps2-6a1 of generic test procedure in TS 38.508-1 [4] clause 4.9.5 on NR Cell 11.  NOTE: The UE performs a registration for mobility procedure and the RRC connection is released. | - | - | - | - |
| 8 | The SS changes the SIB1 of NR Cell 1 to set intraFreqReselectionRedCap to not present. | - | - | - | - |
| 9 | Wait for 2.1\* modification period to allow the new system information to take effect.(Note 1) | - | - | - | - |
| 10 | SS re-adjusts the SS/PBCH EPRE level of NR Cell 1 and NR Cell 11 according to row "T0" in table 6.1.2.26.3.2-1/2. |  |  |  |  |
| 11 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1 within the next 60 s? (Note 2) | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| Note 1: The modification period, expressed in number of radio frames = modificationPeriodCoeff \* defaultPagingCycle.  Note 2: The UE finishes in State DEREGISTRED because UE does not camp on any NR Cells after Step 11. | | | | | |

6.1.2.26.3.3 Specific message contents

Table 6.1.2.26.3.3.3-1: *SIB1* for NR Cell 11(step 1, Table 6.1.2.26.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| RedCap-ConfigCommon-r17 SEQUENCE { | |  |  |  |
| cellBarredRedCap-r17 SEQUENCE { | |  |  |  |
| cellBarredRedCap1Rx-r17 | | Not Barred |  | FR2 |
|  | | barred |  | FR1 |
| cellBarredRedCap2Rx-r17 | | Not Barred |  |  |
|  | | barred |  | FR2 or pc\_maxNumberMIMO\_LayersPDSCH\_twoLayers |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.26.3.3.3-2: *SIB1* for NR Cell 11(step 5, Table 6.1.2.26.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| RedCap-ConfigCommon-r17 SEQUENCE { | |  |  |  |
| cellBarredRedCap-r17 | | Not Present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.1.2.26.3.3.3-3: *SIB1* for NR Cell 1(step 8, Table 6.1.2.26.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| intraFreqReselectionRedCap-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.1.2.27 Cell reselection / inter-frequency / RedCap

6.1.2.27.1 Test Purpose (TP)

(1)

**with** { UE supporting RedCap and in NR RRC\_IDLE state }

**ensure that** {

**when** { serving cell broadcasts SIB4 with system information indication of frequencies which accept RedCap UEs }

**then** { UE reselects the inter-frequency neighbour cell depending on SIB4 indication }

}

6.1.2.27.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.6 and TS 38.331, clause 6.3.1 and 5.2.2.4.5. Unless otherwise stated these are Rel-17 requirements.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

NOTE: If *rangeToBestCell* is configured but *absThreshSS-BlocksConsolidation* is not configured on an NR frequency, the UE considers that there is one beam above the threshold for each cell on that frequency.

[TS 38.331, clause 6.3.1]

*redCapAccessAllowed*

Indicates whether RedCap UEs are allowed to access the frequency.

[TS 38.331, clause 5.2.2.4.5]

Upon receiving *SIB4* the UE shall:

1> if in RRC\_IDLE, or in RRC\_INACTIVE or in RRC\_CONNECTED while T311 is running:

2> for each entry in the *interFreqCarrierFreqList*:

3> if the UE is not a RedCap UE; or

3> if the UE is a RedCap UE and the *interFreqCarrierFreqList-v1700* is absent; or

3> if the UE is a RedCap UE and *redCapAccessAllowed* is present in *interFreqCarrierFreqList-v1700*:

4> select the first frequency band in the *frequencyBandList*, and *frequencyBandListSUL*, if present, which the UE supports and for which the UE supports at least one of the *additionalSpectrumEmission* values in *NR-NS-PmaxList*, if present:

6.1.2.27.3 Test description

6.1.2.27.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 23 have different tracking areas according to TS 38.508-1 [4] Table 4.4.2-3.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cells.

UE:

None.

Preamble:

- The UE is in NR RRC Idle mode (state 1N-A) on NR Cell 1(according to 38.508-1 [4] Table 4.4A.2-1.

6.1.2.27.3.2 Test procedure sequence

Table 6.1.2.27.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configuration marked "T1" is applied at the points indicated in the Main behaviour description in Table 6.1.2.27.3.2-3.

Table 6.1.2.27.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 23 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 23. |

Table 6.1.2.27.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 23 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 23. |

Table 6.1.2.27.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.1.2.27.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the UE send an RRCSetupRequest on NR Cell 23 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 3 | The SS changes SIB 4 of NR Cell 1 according to Table 6.1.2.27.3.3-1. The *ValueTag* of *SIB4* in the SI-SchedulingInfo of *SIB1* is increased on NR Cell 1. | - | - | - | - |
| 4 | The SS transmits a Short message on PDCCH  using P-RNTI indicating a  *systemInfoModification*. | <-- | NR RRC: *Paging* | - | - |
| 5 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 indicate that the UE is camped on NR Cell 23? | - | *-* | 1 | - |

6.1.2.27.3.3 Specific message contents

Table 6.1.2.27.3.3-1: *SIB4* for NR Cell 1 (step 3, Table 6.1.2.27.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| interFreqCarrierFreqList-v1700 SEQUENCE { |  |  |  |
| redCapAccessAllowed-r17 | true |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.27.3.3-2: SIB1 of NR Cell 1 (step 3, Table 6.1.2.27.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

Table 6.1.2.27.3.3-3: SI-SchedulingInfo (si-SchedulingInfo in Table 6.1.2.27.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| Type | sibType4 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.1.2.27.3.3-4: *SIB4* for NR Cell 1 (preamble, Table 6.1.2.27.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| interFreqCarrierFreqList-v1700 SEQUENCE { |  |  |  |
| redCapAccessAllowed-r17 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

## 6.2 Multi-mode environment

### 6.2.1 Inter-RAT PLMN selection

#### 6.2.1.1 Inter-RAT PLMN Selection / Selection of correct RAT for OPLMN / Automatic mode

6.2.1.1.1 Test Purpose (TP)

(1)

**with** { UE pre-set in Automatic network selection mode }

**ensure that** {

**when** { UE is switched on and there are suitable NR and E-UTRAN cells some on the OPLMN list and some not on the OPLMN list, none of them being part of the RPLMN }

**then** { UE selects the highest priority OPLMN and RAT combination, attaches on the selected cell.}

}

(2)

**with** { UE in Automatic network selection mode }

**ensure that** {

**when** { UE returns to coverage and there are suitable NR and E-UTRAN cells some on the OPLMN list and some not on the OPLMN list , none of them being part of the RPLMN }

**then** { UE selects the highest priority OPLMN and RAT combination, attaches on the selected cell**.** }

}

6.2.1.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clauses 4.4.3.1 and 4.4.3.1.1. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.1]

If successful registration is achieved, the MS indicates the selected PLMN.

...

NOTE 3: If successful registration is achieved, then the current serving PLMN becomes the registered PLMN and the MS does not store the previous registered PLMN for later use.

[TS 23.122, clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

6.2.1.1.3 Test description

6.2.1.1.3.1 Pre-test conditions

System Simulator

- 3 NR cells as specified in TS 38.508-1 [4] table 4.4.2-3. System information combination NR-1 as defined in Ts 38.508-1 [4] sub-clause 4.4.3.1.2 is applied to all the NR cells.

- 1 cell belongs to E-UTRA. System information combination 1 as defined in TS 36.508 [7] clause 4.4.3.1 is used.

- PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.2.1.1.3.1-1: Cell PLMN identities

|  |  |
| --- | --- |
| Cell | PLMN name |
| NR Cell 1 | PLMN2 |
| NR Cell 12 | PLMN13 |
| NR Cell 13 | PLMN14 |
| E-UTRA Cell 1 | PLMN13 |

UE

- The UE is in Automatic PLMN selection mode.

- The HPLMN is PLMN1.

- USIM configuration 12 as specified in tables 6.4.1-12 in TS 38.508-1 [4] will be used.

Preamble

- The UE is in state Switched OFF (state 0-A) according to TS 38.508-1 [4].

6.2.1.1.3.2 Test procedure sequence

Table 6.2.1.1.3.2-1 and table 6.2.1.1.3.2-2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.2.1.1.3.2-1: Cell configuration changes over time for conducted test environment

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 13 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | -88 |  | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz |  |  |  | -85 |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | -88 |  | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz |  |  |  | -85 |  |

Table 6.2.1.1.3.2-2: Cell configuration changes over time for OTA test environment

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 13 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | "Off" | -82 |  | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz | - | - | - | -85 |  |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | - | -91+ Delta(NRf3) | - |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -82 | -82 |  | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz | - | - | - | -85 |  |
|  | Qrxlevmin | dBm | - | -91+ Delta(NRf2) | -91+ Delta(NRf1) | - |  |

Table 6.2.1.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| 1 | The UE is switched on. | - | - | - | - |
| 2 | Check: Does the UE send *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 3-20a1 | Steps 3-20a1 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-2 are performed on NR Cell 1. | - | - | - | - |
| 21 | The SS adjusts cell levels according to row T1 of table 6.2.1.1.3.2-1. | - | - | - | - |
| 22-28a1 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | *-* | 2 | P |

6.2.1.1.3.3 Specific message contents

None.

#### 6.2.1.2 Inter-RAT PLMN Selection / Selection of correct RAT for UPLMN / Automatic mode

6.2.1.2.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode **and** UPLMN and OPLMN cells available on NR and E-UTRAN}

**ensure that** {

**when** { UE is switched on}

**then** { UE selects the highest priority UPLMN and RAT combination **and** UE attempts to register on the selected cell }

}

(2)

**with** { UE in Automatic network selection mode **and** UPLMN and OPLMN cells available on NR and E-UTRAN}

**ensure that** {

**when** { UE returns to coverage}

**then** { UE selects the highest priority VPLMN and RAT combination **and** UE attempts to attach on the selected cell }

}

6.2.1.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clauses 4.4.3.1 and 4.4.3.1.1. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.1]

If successful registration is achieved, the MS indicates the selected PLMN.

...

NOTE 3: If successful registration is achieved, then the current serving PLMN becomes the registered PLMN and the MS does not store the previous registered PLMN for later use.

[TS 23.122, clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

6.2.1.2.3 Test description

6.2.1.2.3.1 Pre-test conditions

System Simulator

- NR Cell 1 and NR Cell 12 as specified in TS 38.508-1 [4] table 4.4.2-3 are configured as shown in Table 6.2.1.2.3.2-1. System information combination NR-1 as defined in Ts 38.508-1 [4] sub-clause 4.4.3.1.2 is applied to all the NR cells.

- E-UTRA Cell 1 belongs to E-UTRA (defined in TS 36.508 [7]). System information combination 1 as defined in TS 36.508 [7] clause 4.4.3.1 is used.

- PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.2.1.2.3.1-1: Cell PLMN identities

|  |  |
| --- | --- |
| Cell | PLMN name |
| NR Cell 1 | PLMN2 |
| NR Cell 12 | PLMN13 |
| E-UTRA Cell 1 | PLMN13 |

UE

- The UE is in Automatic PLMN selection mode.

- The HPLMN is PLMN1.

- USIM configuration 7 as specified in tables 6.4.1-7 in TS 38.508-1 [4] will be used.

Preamble

- The UE is in state Switched OFF (state 0-A) according to TS 38.508-1 [4].

6.2.1.2.3.2 Test procedure sequence

Table 6.2.1.2.3.2-1 and table 6.2.1.2.3.2-2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.2.1.2.3.2-1: Cell configuration changes over time for conducted test environment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | - |  |
| RS EPRE | dBm/15kHz |  |  | -85 |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | - | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz |  |  | -85 |  |

Table 6.2.1.2.3.2-2: Cell configuration changes over time for OTA test environment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | - |  |
| RS EPRE | dBm/15kHz | - | - | -85 |  |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | -91+ Delta(NRf2) | - |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | "Off" | - | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz | - | - | -85 |  |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | - | - |  |

Table 6.2.1.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| 1 | The UE is switched on. | - | - | - | - |
| 2 | Check: Does the UE send *RRCSetupRequest* on NR Cell 12? | --> | *RRCSetupRequest* | 1 | P |
| 3-20a1 | Steps 3-20a1 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-2 are performed on NR Cell 12. | - | - | - | - |
| 21 | The SS adjusts cell levels according to row T1 of table 6.2.1.2.3.2-1/2. | - | - | - | - |
| 22 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1 with condition '*connected without release*'? | - | - | 2 | P |
| 23 | At the end of this test procedure sequence, the UE is in end state E-UTRA connected  (E2\_T3440) according to TS 36.508 [7]. | - | - | - | - |

6.2.1.2.3.3 Specific message contents

None.

#### 6.2.1.3 Inter-RAT PLMN Selection / Selection of correct PLMN and RAT in shared network environment / Automatic mode

6.2.1.3.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode and shared OPLMN cells available on NR and E-UTRAN }

**ensure that** {

**when** { UE is switched on }

**then** { UE selects the highest priority OPLMN and RAT combination and UE attempts to register on the selected cell and PLMN }

}

(2)

**with** { UE in Automatic network selection mode and shared OPLMN cells available on NR and E-UTRAN }

**ensure that** {

**when** { UE returns to coverage }

**then** { UE selects the highest priority OPLMN and RAT combination and UE attempts to attach on the selected cell and PLMN }

}

6.2.1.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clauses 4.4.3, 4.4.3.1 and 4.4.3.1.1. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3]

When the MS reselects to a cell in a shared network, and the cell is a suitable cell for multiple PLMN identities received on the BCCH or on the EC-BCCH the AS indicates these multiple PLMN identities to the NAS according to 3GPP TS 44.018 [34], 3GPP TS 44.060 [39], 3GPP TS 25.304 [32] and 3GPP TS 36.304 [43]. The MS shall choose one of these PLMNs. If the registered PLMN is available among these PLMNs, the MS shall not choose a different PLMN.

[TS 23.122, clause 4.4.3.1]

If successful registration is achieved, the MS indicates the selected PLMN.

...

NOTE 3: If successful registration is achieved, then the current serving PLMN becomes the registered PLMN and the MS does not store the previous registered PLMN for later use.

[TS 23.122, clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

6.2.1.3.3 Test description

6.2.1.3.3.1 Pre-test conditions

System Simulator

- 2 NR cells as specified in TS 38.508-1 [4] table 4.4.2-3 are configured as shown in Table 6.2.1.3.3.2-1. System information combination NR-1 as defined in Ts 38.508-1 [4] sub-clause 4.4.3.1.2 is applied to all the NR cells.

- 1 cell belongs to E-UTRA. System information combination 1 as defined in TS 36.508 [7] clause 4.4.3.1 is used.

- PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.2.1.3.3.1-1: Cell PLMN identities

|  |  |
| --- | --- |
| Cell | PLMN name |
| NR Cell 1 | PLMN16 |
| PLMN15 |
| NR Cell 12 | PLMN16 |
| PLMN17 |
| E-UTRA Cell 1 | PLMN17 |
| PLMN16 |

UE

- The UE is in Automatic PLMN selection mode.

- The HPLMN is PLMN1.

- USIM configuration 8 as specified in tables 6.4.1-8 in TS 38.508-1 [4] will be used.

Preamble

- The UE is in state Switched OFF (state 0-A) according to TS 38.508-1 [4].

6.2.1.3.3.2 Test procedure sequence

Table 6.2.1.3.3.2-1 and table 6.2.1.3.3.2-2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.2.1.3.3.2-1: Cell configuration changes over time for conducted test environment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 |  |  |
| RS EPRE | dBm/15kHz |  |  | -85 |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 |  | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz |  |  | -85 |  |

Table 6.2.1.3.3.2-2: Cell configuration changes over time for OTA test environment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 |  |  |
| RS EPRE | dBm/15kHz | - | - | -85 |  |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | -91+ Delta(NRf2) | - |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -82 | - | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz | - | - | -85 |  |
|  | Qrxlevmin | dBm | - | -91+ Delta(NRf2) | - |  |

Table 6.2.1.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| 1 | The UE is switched on. | - | - | - | - |
| 2 | Check: Does the UE send *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 3-20a1 | Steps 3-20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1. | - | - | - | - |
| 21 | The SS adjusts cell levels according to row T1 of table 6.2.1.3.3.2-1/2. | - | - | - | - |
| 22 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1 with condition '*connected without release*'? | - | *-* | 2 | P |
| 23 | At the end of this test procedure sequence, the UE is in end state E-UTRA connected  (E2\_T3440) according to TS 36.508 [7]. | - | *-* | - | - |

6.2.1.3.3.3 Specific message contents

Table 6.2.1.3.3.3-1: SIB1 for NR Cell 1 (all steps, Table 6.2.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4] Table 4.6.1-28 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| CellAccessRelatedInfo SEQUENCE { |  |  |  |
| PLMN-IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 1 entry |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { | 2 entries |  |  |
| PLMN-Identity[1] SEQUENCE { |  | entry 1 |  |
| mcc | PLMN16 MCC |  |  |
| mnc | PLMN16 MNC |  |  |
| } |  |  |  |
| PLMN-Identity[2] SEQUENCE { |  | entry 2 |  |
| mcc | PLMN15 MCC |  |  |
| mnc | PLMN15 MNC |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.1.3.3.3-2: SIB1 for NR Cell 12 (all steps, Table 6.2.1.3.3.2-)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4] Table 4.6.1-28 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| CellAccessRelatedInfo SEQUENCE { |  |  |  |
| PLMN-IdentityInfoList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-IdentityInfo { | 1 entry |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| plmn-IdentityList SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity { | 2 entries |  |  |
| PLMN-Identity[1] SEQUENCE { |  | entry 1 |  |
| mcc | PLMN16 MCC |  |  |
| mnc | PLMN16 MNC |  |  |
| } |  |  |  |
| PLMN-Identity[2] SEQUENCE { |  | entry 2 |  |
| mcc | PLMN17 MCC |  |  |
| mnc | PLMN17 MNC |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.1.3.3.3-3: SystemInformationBlockType1 for E-UTRAN Cell 1 (all steps, Table 6.2.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 36.508[7] Table 4.4.3.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| plmn-IdentityList SEQUENCE (SIZE (1..6)) OF PLMN-IdentityInfo { | 2 entries |  |  |
| PLMN-IdentityInfo[1] SEQUENCE { |  | entry 1 |  |
| plmn-Identity | PLMN17 |  |  |
| } |  |  |  |
| PLMN-IdentityInfo[2] SEQUENCE { |  | entry 2 |  |
| plmn-Identity | PLMN16 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.1.3.3.3-4: *RRCSetupComplete* (Step 6, Table 6.2.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4] Table 4.6.1-22 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCSetupComplete::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcSetupComplete SEQUENCE { | |  |  |  |
| selectedPLMN-Identity | | 2 | PLMN15 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.2.1.3.3.3-5: *RRCConnectionSetupComplete* (Step 22, Table 6.2.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.331 [11] clause 6.2.2 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCConnectionSetupComplete ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| c1 CHOICE { | |  |  |  |
| rrcConnectionSetupComplete-r8 SEQUENCE { | |  |  |  |
| selectedPLMN-Identity | | 1 | PLMN17 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.2.1.4 Inter-RAT PLMN Selection / Selection of correct RAT from the OPLMN list / Manual mode

6.2.1.4.1 Test Purpose (TP)

(1)

**with** { UE in Manual network selection mode **and** OPLMN cells available on NR and E-UTRA}

**ensure that** {

**when** { the USER selects an OPLMN}

**then** { UE selects the highest priority RAT for the OPLMN and UE attempts to attach on the selected cell and when successfully registered indicates the PLMN to the user }

}

(2)

**with** { UE in Manual network selection mode and OPLMN cells available on NR and E-UTRA}

**ensure that** {

**when** { the USER selects an OPLMN and RAT combination}

**then** {UE attempts to attach on the selected OPLMN and RAT combination and when successfully registered indicates the PLMN to the user }

}

6.2.1.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clauses 4.4.3.1.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.1.2]

The MS indicates whether there are any PLMNs, which are available using all supported access technologies. This includes PLMNs in the "forbidden PLMNs" list, "forbidden PLMNs for GPRS service" list and PLMNs which only offer services not supported by the MS. An MS which supports GSM COMPACT shall also indicate GSM COMPACT PLMNs (which use PBCCH).

If displayed, PLMNs meeting the criteria above are presented in the following order:

i)- either the HPLMN (if the EHPLMN list is not present or is empty) or, if one or more of the EHPLMNs are available then based on an optional data field on the SIM either only the highest priority available EHPLMN is to be presented to the user or all available EHPLMNs are presented to the user in priority order. If the data field is not present on the SIM, then only the highest priority available EHPLMN is presented;

ii)- PLMN/access technology combinations contained in the " User Controlled PLMN Selector with Access Technology " data file in the SIM (in priority order);

iii)- PLMN/access technology combinations contained in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv)- other PLMN/access technology combinations with received high quality signal in random order;

v)- other PLMN/access technology combinations in order of decreasing signal quality.

…

The user may select his desired PLMN and the MS then initiates registration on this PLMN using the access technology chosen by the user for that PLMN or using the highest priority available access technology for that PLMN, if the associated access technologies have a priority order. (This may take place at any time during the presentation of PLMNs). For such a registration, the MS shall ignore the contents of the "forbidden location areas for roaming", "forbidden tracking areas for roaming", "5GS forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service", "5GS forbidden tracking areas for regional provision of service", "forbidden PLMNs for GPRS service" and "forbidden PLMNs" lists.

NOTE 1: It is an MS implementation option whether to indicate access technologies to the user. If the MS does display access technologies, then the access technology selected by the user is only used for initial registration on the selected PLMN. If the MS does not display access technologies, then the access technology chosen for a particular PLMN should be the highest priority available access technology for that PLMN, if the associated access technologies have a priority order, and is only used for initial registration.

6.2.1.4.3 Test description

6.2.1.4.3.1 Pre-test conditions

System Simulator

- 3 cells are used:

- NR Cell 1 and NR Cell 12 as specified in TS 38.508-1 [4] table 4.4.2-3 are configured as shown in Table 6.2.1.2.3.2-1. System information combination NR-1 as defined in Ts 38.508-1 [4] sub-clause 4.4.3.1.2 is applied to all the NR cells.

- E-UTRA Cell 1 belongs to E-UTRA (defined in TS 36.508 [7]). System information combination 1 as defined in TS 36.508 [7] clause 4.4.3.1 is used.

- PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.2.1.4.3.1-1: Cell PLMN identities

|  |  |
| --- | --- |
| Cell | PLMN name |
| NR Cell 1 | PLMN2 |
| NR Cell 12 | PLMN13 |
| E-UTRA Cell 1 | PLMN2 |

UE

- The HPLMN is PLMN1.

- USIM configuration 13 as specified in table 6.4.1-13 in TS 38.508-1 [4] will be used.

Preamble

- The UE is attached to PLMN1 and the UE is set to Manual PLMN selection mode before it is in state Switched OFF (state 0N-B) according to TS 38.508-1 [4].

6.2.1.4.3.2 Test procedure sequence

Table 6.2.1.4.3.2-1 and table 6.2.1.4.3.2-2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble.Configurations marked "T1" and "T2" are applied at the points indicated in the Main behaviour description in Table 6.2.1.4.3.2-3.

Table 6.2.1.4.3.2-1: Cell configuration changes over time for conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | E-UTRA Cell 1 |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 |  |
| RS EPRE | dBm/15kHz |  |  | -85 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | OFF | OFF |  |
|  | RS EPRE | dBm/15kHz |  |  | -85 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | OFF |  |
|  | RS EPRE | dBm/15kHz |  |  | OFF |

Table 6.2.1.4.3.2-2: Cell configuration changes over time for OTA test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | E-UTRA Cell 1 |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | - |
| RS EPRE | dBm/15kHz | - | - | -85 |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | -91+ Delta(NRf2) | - |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | OFF | OFF |  |
|  | RS EPRE | dBm/15kHz |  |  | -85 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | OFF |  |
|  | RS EPRE | dBm/15kHz |  |  | OFF |

Table 6.2.1.4.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| 1 | The UE is switched on. | - | - | - | - |
| 2 | Make the UE display the list of available PLMNs. | - | *-* | - | - |
| - | EXCEPTION: Steps 2a1 to 2b5 describe behaviour that depends on UE capabilities; the "lower case letter" identifies a step sequence that takes place if the condition is met. | - | - | - | - |
| 2a1 | IF pc\_Available\_PLMNs\_AcT\_Ind[29] (Support of Access Technology Indication in available PLMNs list) THEN PLMN2 (E-UTRAN) is selected | - | - | - | - |
| 2a2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] table 4.5.2.2-5 is performed and the UE is camped on E-UTRA Cell 1? | - | *-* | 2 |  |
| 2a3 | Check: Is PLMN2 indicated as registered PLMN by the UE? | - | - | 2 | P |
| 2a4 | The SS adjusts the NR Cell power levels according to row "T1" in table 6.2.1.4.3.2-1/2. |  |  |  |  |
| 2a5 | Set the UE in Automatic PLMN selection mode. |  |  |  |  |
| 2b1 | ELSE (No Access Technology shown to the User)  PLMN2 is selected |  |  |  |  |
| 2b2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] table 4.5.2.2-2 is performed and the UE is camped on NR Cell 1? | - |  | 1 |  |
| 2b3 | Check: Is PLMN2 indicated as registered PLMN by the UE? | - | - | 1 | P |
| 2b4 | The SS adjusts the E-UTRA and NR Cell power levels according to row "T2" in table 6.2.1.4.3.2-1/2. |  |  |  |  |
| 2b5 | Set the UE in Automatic PLMN selection mode. |  |  |  |  |
| 3 | Wait for 300s to allow the UE to switch to automatic PLMN selection mode. | - | - | - | - |

6.2.1.4.3.3 Specific message contents

None.

#### 6.2.1.5 Inter-RAT Background HPLMN Search / Search for correct RAT for HPLMN / Automatic Mode

6.2.1.5.1 Test Purpose (TP)

**with** { UE in Automatic network selection mode is camped on a E-UTRAN VPLMN cell and HPLMN cell available on NR}

**ensure that** {

**when** { higher priority PLMN search timer T expires }

**then** { UE detects NR cell and camps on the NR cell }

}

6.2.1.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clauses 4.4.3.3.1. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.3.1]

If the MS is in a VPLMN, the MS shall periodically attempt to obtain service on its HPLMN (if the EHPLMN list is not present or is empty) or one of its EHPLMNs (if the EHPLMN list is present) or a higher priority PLMN/access technology combinations listed in "user controlled PLMN selector" or "operator controlled PLMN selector" by scanning in accordance with the requirements that are applicable to i), ii) and iii) as defined in the Automatic Network Selection Mode in subclause 4.4.3.1.1. In the case that the mobile has a stored "Equivalent PLMNs" list the mobile shall only select a PLMN if it is of a higher priority than those of the same country as the current serving PLMN which are stored in the "Equivalent PLMNs" list. For this purpose, a value of timer T may be stored in the SIM. The interpretation of the stored value depends on the radio capabilities supported by the MS:

- For an MS that does not support any of the following: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 6 minutes to 8 hours in 6 minute steps or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 60 minutes is used for T.

- For an MS that only supports any of the following or a combination of: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 2 hours to 240 hours, using 2 hour steps from 2 hours to 80 hours and 4 hour steps from 84 hours to 240 hours, or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 72 hours is used.

- For an MS that supports both:

a) any of the following or a combination of: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]); and

b) any access technology other than the following: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]),

then T is interpreted depending on the access technology in use as specified below:

1) if the MS is using any of the following at the time of starting timer T: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 2 hours to 240 hours, using 2 hour steps from 2 hours to 80 hours and 4 hour steps from 84 hours to 240 hours, or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 72 hours is used; and

2) if the MS is not using any of the following at the time of starting timer T: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 6 minutes to 8 hours in 6 minute steps or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 60 minutes is used for T.

If the MS is configured with the MinimumPeriodicSearchTimer as specified in 3GPP TS 24.368 [50] or 3GPP TS 31.102 [40], the MS shall not use a value for T that is less than the MinimumPeriodicSearchTimer. If the value stored in the SIM, or the default value for T (when no value is stored in the SIM), is less than the MinimumPeriodicSearchTimer, then T shall be set to the MinimumPeriodicSearchTimer.

The MS does not stop timer T, as described in 3GPP TS 24.008 [23] and 3GPP TS 24.301 [23A], when it activates power saving mode (PSM) (see 3GPP TS 23.682 [27A]).

The MS can be configured for Fast First Higher Priority PLMN search as specified in 3GPP TS 31.102 [40] or 3GPP TS 24.368 [50]. Fast First Higher Priority PLMN search is enabled if the corresponding configuration parameter is present and set to enabled. Otherwise, Fast First Higher Priority PLMN search is disabled.

The attempts to access the HPLMN or an EHPLMN or higher priority PLMN shall be as specified below:

a) The periodic attempts shall only be performed in automatic mode when the MS is roaming, and not while the MS is attached for emergency bearer services, is registered for emergency services, has a PDU session for emergency services or has a PDN connection for emergency bearer services;

b) The MS shall make the first attempt after a period of at least 2 minutes and at most T minutes:

- only after switch on if Fast First Higher Priority PLMN search is disabled; or

- after switch on or upon selecting a VPLMN if Fast First Higher Priority PLMN search is enabled.

c) The MS shall make the following attempts if the MS is on the VPLMN at time T after the last attempt;

d) Periodic attempts shall only be performed by the MS while in idle mode;

d1) periodic attempts may be postponed while the MS is in power saving mode (PSM) (see 3GPP TS 23.682 [27A]).

e) If the HPLMN (if the EHPLMN list is not present or is empty) or a EHPLMN (if the list is present) or a higher priority PLMN is not found, the MS shall remain on the VPLMN.

f) In steps i), ii) and iii) of subclause 4.4.3.1.1 the MS shall limit its attempts to access higher priority PLMN/access technology combinations to PLMN/access technology combinations of the same country as the current serving VPLMN, as defined in Annex B.

g) Only the priority levels of Equivalent PLMNs of the same country as the current serving VPLMN, as defined in Annex B, shall be taken into account to compare with the priority level of a selected PLMN.

h) If the PLMN of the highest priority PLMN/access technology combination available is the current VPLMN, or one of the PLMNs in the "Equivalent PLMNs" list, the MS shall remain on the current PLMN/access technology combination.

6.2.1.5.3 Test description

6.2.1.5.3.1 Pre-test conditions

System Simulator

- E-UTRA Cell 1 as specified in TS 36.508 [7]. System information combination 1 as defined in TS 36.508 [7] clause 4.4.3.1 is used.

- NR Cell 1 as specified in TS 38.508-1 [4] table 4.4.2-3. System information combination NR-1 as defined in TS 38.508-1 [4] sub-clause 4.4.3.1.2 is applied to the NR cell.

- PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.2.1.5.3.1-1: Cell PLMN identities

|  |  |
| --- | --- |
| Cell | PLMN name |
| NR Cell 1 | PLMN1 |
| E-UTRA Cell 1 | PLMN15 |

UE

- USIM configuration 9 as specified in table 6.4.1-9 in TS 38.508-1 [4] will be used.

Preamble

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameter Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

- the UE is switched-off.

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 0N-B, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.5.2-1. 5G-GUTI and ngKSI are assigned and security context established.

6.2.1.5.3.2 Test procedure sequence

Table 6.2.1.3.3.2-1and table 6.2.1.3.3.2-2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1" is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.2.1.5.3.2-1: Cell configuration changes over time for conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" |  | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz |  | -85 |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 |  |  |
| RS EPRE | dBm/15kHz |  | -85 |  |

Table 6.2.1.5.3.2-2: Cell configuration changes over time for OTA test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | E-UTRA Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" |  | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| RS EPRE | dBm/15kHz | - | -85 |  |
|  | Qrxlevmin | dBm | - | - |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -82 |  |  |
| RS EPRE | dBm/15kHz | - | -85 |  |
|  | Qrxlevmin | dBm | -91+ Delta(NRf1) | - |  |

Table 6.2.1.5.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| 1 | Power on the UE. | - | - | - | - |
| 2 | Void | - | - | - | - |
| 3-12b8 | Steps 1-10b8 of the registration procedure described in TS 38.508-1 [4] table 4.5.2.2-1 take place on E-UTRAN Cell 1. | - | - | - | - |
| 13-18 | Void | - | - | - | - |
| 18A | SS starts timer of tmin = 2 minutes and tmax =6 minutes \*(1+10% tolerance) (Note 1) | - | - | - | - |
| 19 | The SS adjusts cell levels according to row T1 of table 6.2.1.5.3.2-1. | - | - | - | - |
| 20 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1 after tmin but before tmax expires?  (Note 1) | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 20A-20B | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 2) |  |  |  |  |
| - | EXCEPTION: Steps 21a1 to 21b10a1 describe behaviours which depend on procedure parameters; the "lower case letter" identifies a step sequence that take place if a procedure parameter has a particular value. | - | - | - | - |
| 21a1-21a16a1 | IF 5GS registration type is set as Initial Registration in step 20B, THEN steps 5 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1. | - | - | - | - |
| 21b1-21b8 | ELSE IF 5GS registration type is set as Mobility Registration in step 20B, THEN steps 4 to 11 of the tracking area update procedure described in TS 38.508-1 [4] table 4.9.9.2.2-1 are performed without connection release on NR Cell 1. | - | - | - | - |
| 21b9a1-21b10a1 | Steps 19a1-20a1 of the procedure described in TS 38.508-1c [4] table 4.5.2.2-2 are performed with connection release on NR Cell 1. |  |  |  |  |
| 22-27a1 | Void | - | - | - | - |
| Note 1: Timers tmin and tmax in step 12b are derived from the high priority PLMN search timer T defined by EFHPPLMN. The timer tmax shall be set to 396s (6 minutes \*(1+10% tolerance)), where the high priority PLMN search timer T is defined in EFHPPLMN.  Note 2: The 5GS registration type shall be only set as Mobility Registration for R16 UEs according to TS 24.501 [22] subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to R15 UEs. | | | | | |

6.2.1.5.3.3 Specific message contents

Table 6.2.1.5.3.3-1: REGISTRATION ACCEPT (Step 21b7 of Table 6.2.1.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6. | | | |
| Information Element | Value/remark | Comment | Condition |
| PDU session status | 0X 00 00 |  |  |

### 6.2.2 Inter-RAT Cell Selection

#### 6.2.2.1 Inter-RAT cell selection / From NR RRC\_IDLE to EUTRA\_Idle / Serving cell becomes non-suitable

6.2.2.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes non-suitable and there is a suitable E-UTRA neighbour cell }

**then** { UE selects the suitable E-UTRA neighbour cell }

}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes barred and there is a suitable E-UTRA neighbour cell }

**then** { UE selects the suitable E-UTRA neighbour cell }

}

6.2.2.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.1, 5.2.3.1, 5.2.3.2 and TS 36.304, clause 5.2.1, 5.2.3.1, 5.2.3.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.1]

UE shall perform measurements for cell selection and reselection purposes as specified in TS 38.133 [8].

When evaluating Srxlev and Squal of non-serving cells for reselection evaluation purposes, the UE shall use parameters provided by the serving cell and for the final check on cell selection criterion, the UE shall use parameters provided by the target cell for cell reselection.

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on RRC\_IDLE or RRC\_INACTIVE state measurements and cell selection criteria.

In order to expedite the cell selection process, stored information for several RATs, if available, may be used by the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT. Details on performance requirements for cell reselection can be found in TS 38.133 [8].

The NAS is informed if the cell selection and reselection result in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, monitor control channel(s) of that cell so that the UE can:

- receive system information from the PLMN or SNPN; and

- receive registration area information from the PLMN or SNPN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN or SNPN; and

- initiate transfer to Connected mode.

For cell selection in multi-beam operations, measurement quantity of a cell is up to UE implementation.

For cell reselection in multi-beam operations, including inter-RAT reselection from E-UTRA to NR, the measurement quantity of this cell is derived amongst the beams corresponding to the same cell based on SS/PBCH block as follows:

- if *nrofSS-BlocksToAverage* (*maxRS-IndexCellQual* in E-UTRA) is not configured in *SIB2/SIB4* (*SIB24* in E-UTRA); or

- if *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA)is not configured in *SIB2/SIB4* (*SIB24* in E-UTRA); or

- if the highest beam measurement quantity value is below or equal to *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA):

- derive a cell measurement quantity as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [11].

- else:

- derive a cell measurement quantity as the linear average of the power values of up to *nrofSS-BlocksToAverage* (*maxRS-IndexCellQual* in E-UTRA) of highest beam measurement quantity values above *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA).

[TS 38.304, clause 5.2.3.1]

Cell selection is performed by one of the following two procedures:

a) Initial cell selection (no prior knowledge of which RF channels are NR frequencies):

1. The UE shall scan all RF channels in the NR bands according to its capabilities to find a suitable cell.

2. On each frequency, the UE need only search for the strongest cell, except for operation with shared spectrum channel access where the UE may search for the next strongest cell(s).

3. Once a suitable cell is found, this cell shall be selected.

b) Cell selection by leveraging stored information:

1. This procedure requires stored information of frequencies and optionally also information on cell parameters from previously received measurement control information elements or from previously detected cells.

2. Once the UE has found a suitable cell, the UE shall select it.

3. If no suitable cell is found, the initial cell selection procedure in a) shall be started.

NOTE: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

|  |
| --- |
| Srxlev > 0 AND Squal > 0 |

where:

|  |
| --- |
| Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp  Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *q-RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9]. |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9]. |
| Pcompensation | For FR1, if the UE supports the additionalPmax in the NR-NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)*  For FR2, Pcompensation is set to 0. |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. If UE supports SUL frequency for this cell, PEMAX1 and PEMAX2 are obtained from the *p-Max* for SUL in *SIB1* and *NR-NS-PmaxList* for SUL respectively in *SIB1, SIB2* and *SIB4* as specified in TS 38.331 [3], else PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NR-NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* for normal UL as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101-1 [15]. |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

[TS 36.304, clause 5.2.1]

UE shall perform measurements for cell selection and reselection purposes as specified in TS 36.133 [10].

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on idle mode measurements and cell selection criteria.

In order to speed up the cell selection process, stored information for several RATs may be available in the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT, or if the current and selected cell are both E-UTRA cells, a change of the CN type. Details on performance requirements for cell reselection can be found in TS 36.133 [10].

The NAS is informed if the cell selection and reselection results in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, tune to that cell's control channel(s) so that the UE can:

- Receive system information from the PLMN; and

- receive registration area information from the PLMN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN; and

- initiate transfer to connected mode.

[TS 36.304, clause 5.2.3.1]

The UE shall use one of the following two cell selection procedures:

a) Initial Cell Selection

This procedure requires no prior knowledge of which RF channels are E-UTRA or NB-IoT carriers. The UE shall scan all RF channels in the E-UTRA bands according to its capabilities to find a suitable cell. On each carrier frequency, the UE need only search for the strongest cell. Once a suitable cell is found this cell shall be selected.

b) Stored Information Cell Selection

This procedure requires stored information of carrier frequencies and optionally also information on cell parameters, from previously received measurement control information elements or from previously detected cells. Once the UE has found a suitable cell the UE shall select it. If no suitable cell is found the Initial Cell Selection procedure shall be started.

NOTE 1: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

NOTE 2: If BL UE, UE in enhanced coverage or NB-IoT UE has been provisioned with EARFCN, the UE may use this information during Initial Cell Selection and Stored Information Cell Selection to find a suitable cell.

[TS 36.304, clause 5.2.3.2]

For NB-IoT the cell selection criterion is defined in clause 5.2.3.2a.

The cell selection criterion S in normal coverage is fulfilled when:

|  |
| --- |
| Srxlev > 0 AND Squal > 0 |

where:

|  |
| --- |
| Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset) – Pcompensation - Qoffsettemp  Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 36.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm) |
| Qqualmin | Minimum required quality level in the cell (dB) |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5] |
| Pcompensation | If the UE supports the *additionalPmax* in the *NS-PmaxList*, if present, in SIB1, SIB3 and SIB5:  max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);  else:  if PPowerClass is 14 dBm:  max(PEMAX1 –(PPowerClass – Poffset), 0) (dB);  else:  max(PEMAX1 –PPowerClass, 0) (dB) |
| PEMAX1, PEMAX2 | Maximum TX power level an UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 36.101 [33]. PEMAX1 and PEMAX2 are obtained from the *p-Max* and the *NS-PmaxList* respectively in SIB1, SIB3 and SIB5 as specified in TS 36.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 36.101 [33] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5]. During this periodic search for higher priority PLMN the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

If cell selection criterion S in normal coverage is not fulfilled for a cell, UE shall consider itself to be in enhanced coverage if the cell selection criterion S for enhanced coverage is fulfilled, where:

|  |  |
| --- | --- |
| Qrxlevmin | UE applies coverage specific value Qrxlevmin\_CE (dBm) |
| Qqualmin | UE applies coverage specific value Qqualmin\_CE (dB) |

If cell selection criteria S in normal coverage is fulfilled for a cell, UE [may] consider itself to be in enhanced coverage if *SystemInformationBlockType1* cannot be acquired but UE is able to acquire *MasterInformationBlock, SystemInformationBlockType1-BR* and *SystemInformationBlockType2*.

If cell selection criterion S in normal coverage is not fulfilled for a cell and UE does not consider itself in enhanced coverage based on coverage specific values Qrxlevmin\_CE and Qqualmin\_CE, UE shall consider itself to be in enhanced coverage if UE supports CE Mode B and CE mode B is not restricted by upper layers and the cell selection criterion S for enhanced coverage is fulfilled, where:

|  |  |
| --- | --- |
| Qrxlevmin | UE applies coverage specific value Qrxlevmin\_CE1 (dBm) |
| Qqualmin | UE applies coverage specific value Qqualmin\_CE1 (dB) |

For the UE in enhanced coverage, coverage specific values Qrxlevmin\_CE and Qqualmin\_CE (orQrxlevmin\_CE1 and Qqualmin\_CE1)are only applied for the suitability check in enhanced coverage (i.e. not used for measurement and reselection thresholds).

6.2.2.1.3 Test description

6.2.2.1.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1, NR Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 31 as defined in TS 36.508-1 [7] clause 4.4.3.1 is used in E-UTRA Cell.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

- the UE is switched-off.

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

6.2.2.1.3.2 Test procedure sequence

Table 6.2.2.1.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.2.1.3.2-3.

Table 6.2.2.1.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **E-UTRA**  **Cell 1** | NR  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | Off | - | The power level values are assigned to ensure UE registered on NR cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -85 |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level value is such to satisfy SrxlevNR cell 1 < 0 and ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -115 |
| T2 | Cell-specific RS EPRE | dBm/15kHz | Off | - | The power level values are assigned to ensure UE registered on NR cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -85 |  |
| T3 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -85 |
| Note1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.2.2.1.3.2-2: Void

Table 6.2.2.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the E-UTRA and NR Cells power levels according to row "T1" in table 6.2.2.1.3.2-1. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRA Cell 1? | - | - | 1 | P |
| 3 | The SS adjusts the E-UTRA and NR Cells power levels according to row "T2" in table 6.2.2.1.3.2-1. | - | - | - | - |
| 4 | The test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1. (NOTE 1) | - | - | - | - |
| 5 | The SS changes SIB1 of NR Cell 1 according to table 6.2.2.1.3.3-3 and notifies the UE of change of System Information on NR Cell 1 by sending Short Message on PDCCH using P-RNTI. | <-- | PDCCH (DCI 1\_0): Short Message | - | - |
| 6 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | *-* | - | - |
| 7 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T3" in table 6.2.2.1.3.2-1. | - | - | - | - |
| 8 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRA Cell 1? | - | - | 2 | P |
| Note 1: This is the first time in this test case that the UE moves from S1 to N1. | | | | | |

6.2.2.1.3.3 Specific message contents

Table 6.2.2.1.3.3-1: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.1.3.3-2: *SystemInformationBlockType24* of EUTRA Cell 1 (preamble and all steps, Table 6.2.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.1.3.3-3: *SIB1* for NR Cell 1 (step 5, Table 6.2.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true | The UE shall treat this cell as if cell status is "barred" |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.1.3.3-4: REGISTRATION REQUEST (step 4, Table 6.2.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-1. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.2.2.1.3.3-5 |  |

Table 6.2.2.1.3.3-5: TRACKING AREA UPDATE REQUEST (Table 6.2.2.1.3.3-4)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-2 with condition Mapped EPS security context. |

#### 6.2.2.2 Inter-RAT cell selection / From E-UTRA\_Idle to NR RRC\_IDLE / Serving cell becomes non-suitable

6.2.2.2.1 Test Purpose (TP)

(1)

**with** { UE in E-UTRA RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes non-suitable and there is a suitable NR neighbour cell }

**then** { UE selects the suitable NR neighbour cell }

}

(2)

**with** { UE in E-UTRA RRC\_IDLE state }

**ensure that** {

**when** { the serving cell becomes barred and there is a suitable NR neighbour cell }

**then** { UE selects the suitable NR neighbour cell }

}

6.2.2.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.1, 5.2.3.1, 5.2.3.2 and TS 36.304, clause 5.2.1, 5.2.3.1, 5.2.3.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.1]

UE shall perform measurements for cell selection and reselection purposes as specified in TS 38.133 [8].

When evaluating Srxlev and Squal of non-serving cells for reselection evaluation purposes, the UE shall use parameters provided by the serving cell and for the final check on cell selection criterion, the UE shall use parameters provided by the target cell for cell reselection.

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on RRC\_IDLE or RRC\_INACTIVE state measurements and cell selection criteria.

In order to expedite the cell selection process, stored information for several RATs, if available, may be used by the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT. Details on performance requirements for cell reselection can be found in TS 38.133 [8].

The NAS is informed if the cell selection and reselection result in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, monitor control channel(s) of that cell so that the UE can:

- receive system information from the PLMN or SNPN; and

- receive registration area information from the PLMN or SNPN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN or SNPN; and

- initiate transfer to Connected mode.

For cell selection in multi-beam operations, measurement quantity of a cell is up to UE implementation.

For cell reselection in multi-beam operations, including inter-RAT reselection from E-UTRA to NR, the measurement quantity of this cell is derived amongst the beams corresponding to the same cell based on SS/PBCH block as follows:

- if *nrofSS-BlocksToAverage* (*maxRS-IndexCellQual* in E-UTRA) is not configured in *SIB2/SIB4* (*SIB24* in E-UTRA); or

- if *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA)is not configured in *SIB2/SIB4* (*SIB24* in E-UTRA); or

- if the highest beam measurement quantity value is below or equal to *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA):

- derive a cell measurement quantity as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [11].

- else:

- derive a cell measurement quantity as the linear average of the power values of up to *nrofSS-BlocksToAverage* (*maxRS-IndexCellQual* in E-UTRA) of highest beam measurement quantity values above *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA).

[TS 38.304, clause 5.2.3.1]

Cell selection is performed by one of the following two procedures:

a) Initial cell selection (no prior knowledge of which RF channels are NR frequencies):

1. The UE shall scan all RF channels in the NR bands according to its capabilities to find a suitable cell.

2. On each frequency, the UE need only search for the strongest cell, except for operation with shared spectrum channel access where the UE may search for the next strongest cell(s).

3. Once a suitable cell is found, this cell shall be selected.

b) Cell selection by leveraging stored information:

1. This procedure requires stored information of frequencies and optionally also information on cell parameters from previously received measurement control information elements or from previously detected cells.

2. Once the UE has found a suitable cell, the UE shall select it.

3. If no suitable cell is found, the initial cell selection procedure in a) shall be started.

NOTE: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

Srxlev > 0 AND Squal > 0

where:

Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp

Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *q-RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9]. |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9]. |
| Pcompensation | For FR1, if the UE supports the additionalPmax in the NR-NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)*  For FR2, Pcompensation is set to 0. |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. If UE supports SUL frequency for this cell, PEMAX1 and PEMAX2 are obtained from the *p-Max* for SUL in *SIB1* and *NR-NS-PmaxList* for SUL respectively in *SIB1, SIB2* and *SIB4* as specified in TS 38.331 [3], else PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NR-NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* for normal UL as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101-1 [15]. |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

[TS 36.304, clause 5.2.1]

UE shall perform measurements for cell selection and reselection purposes as specified in TS 36.133 [10].

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on idle mode measurements and cell selection criteria.

In order to speed up the cell selection process, stored information for several RATs may be available in the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT, or if the current and selected cell are both E-UTRA cells, a change of the CN type. Details on performance requirements for cell reselection can be found in TS 36.133 [10].

The NAS is informed if the cell selection and reselection results in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, tune to that cell's control channel(s) so that the UE can:

- Receive system information from the PLMN; and

- receive registration area information from the PLMN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN; and

- initiate transfer to connected mode.

[TS 36.304, clause 5.2.3.1]

The UE shall use one of the following two cell selection procedures:

a) Initial Cell Selection

This procedure requires no prior knowledge of which RF channels are E-UTRA or NB-IoT carriers. The UE shall scan all RF channels in the E-UTRA bands according to its capabilities to find a suitable cell. On each carrier frequency, the UE need only search for the strongest cell. Once a suitable cell is found this cell shall be selected.

b) Stored Information Cell Selection

This procedure requires stored information of carrier frequencies and optionally also information on cell parameters, from previously received measurement control information elements or from previously detected cells. Once the UE has found a suitable cell the UE shall select it. If no suitable cell is found the Initial Cell Selection procedure shall be started.

NOTE 1: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

NOTE 2: If BL UE, UE in enhanced coverage or NB-IoT UE has been provisioned with EARFCN, the UE may use this information during Initial Cell Selection and Stored Information Cell Selection to find a suitable cell.

[TS 36.304, clause 5.2.3.2]

For NB-IoT the cell selection criterion is defined in clause 5.2.3.2a.

The cell selection criterion S in normal coverage is fulfilled when:

Srxlev > 0 AND Squal > 0

where:

Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset) – Pcompensation - Qoffsettemp

Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 36.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm) |
| Qqualmin | Minimum required quality level in the cell (dB) |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5] |
| Pcompensation | If the UE supports the *additionalPmax* in the *NS-PmaxList*, if present, in SIB1, SIB3 and SIB5:  max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);  else:  if PPowerClass is 14 dBm:  max(PEMAX1 –(PPowerClass – Poffset), 0) (dB);  else:  max(PEMAX1 –PPowerClass, 0) (dB) |
| PEMAX1, PEMAX2 | Maximum TX power level an UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 36.101 [33]. PEMAX1 and PEMAX2 are obtained from the *p-Max* and the *NS-PmaxList* respectively in SIB1, SIB3 and SIB5 as specified in TS 36.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 36.101 [33] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5]. During this periodic search for higher priority PLMN the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

If cell selection criterion S in normal coverage is not fulfilled for a cell, UE shall consider itself to be in enhanced coverage if the cell selection criterion S for enhanced coverage is fulfilled, where:

|  |  |
| --- | --- |
| Qrxlevmin | UE applies coverage specific value Qrxlevmin\_CE (dBm) |
| Qqualmin | UE applies coverage specific value Qqualmin\_CE (dB) |

If cell selection criteria S in normal coverage is fulfilled for a cell, UE [may] consider itself to be in enhanced coverage if *SystemInformationBlockType1* cannot be acquired but UE is able to acquire *MasterInformationBlock, SystemInformationBlockType1-BR* and *SystemInformationBlockType2*.

If cell selection criterion S in normal coverage is not fulfilled for a cell and UE does not consider itself in enhanced coverage based on coverage specific values Qrxlevmin\_CE and Qqualmin\_CE, UE shall consider itself to be in enhanced coverage if UE supports CE Mode B and CE mode B is not restricted by upper layers and the cell selection criterion S for enhanced coverage is fulfilled, where:

|  |  |
| --- | --- |
| Qrxlevmin | UE applies coverage specific value Qrxlevmin\_CE1 (dBm) |
| Qqualmin | UE applies coverage specific value Qqualmin\_CE1 (dB) |

For the UE in enhanced coverage, coverage specific values Qrxlevmin\_CE and Qqualmin\_CE (orQrxlevmin\_CE1 and Qqualmin\_CE1)are only applied for the suitability check in enhanced coverage (i.e. not used for measurement and reselection thresholds).

6.2.2.2.3 Test description

6.2.2.2.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1, NR Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 31 as defined in TS 36.508-1 [7] clause 4.4.3.1 is used in E-UTRA Cell.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.2-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

- The UE is switched-off

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.2-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (*E*-UTRA/EPC) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

6.2.2.2.3.2 Test procedure sequence

Table 6.2.2.2.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.2.2.3.2-3.

Table 6.2.2.2.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **E-UTRA**  **Cell 1** | NR  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | Off |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -115 | - | The power level value is such to satisfy SrxlevE-UTRA cell 1 < 0 and ensure UE registered on NR cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -85 |
| T2 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | Off |  |
| T3 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on NR cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -85 |
| Note1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.2.2.2.3.2-2: Void

Table 6.2.2.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the E-UTRA and NR Cells power levels according to row "T1" in table 6.2.2.2.3.2-1. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1?. (NOTE 1) | - | - | 1 | P |
| 3 | The SS adjusts the E-UTRA and NR Cells power levels according to row "T2" in table 6.2.2.2.3.2-1. | - | - | - | - |
| 4 | The test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRA Cell 1. | - | - | - | - |
| 5 | The SS changes *SystemInformationBlockType1* of E-UTRA Cell 1 according to table 6.2.2.2.3.3-3 and notifies the UE of change of System Information on E-UTRA Cell 1. | <-- | *Paging* | - | - |
| 6 | The SS adjusts the E-UTRA and NR Cells power levels according to row "T3" in table 6.2.2.2.3.2-1. | - | - | - | - |
| 7 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1? | - | - | 2 | P |
| Note 1: This is the first time in this test case that the UE moves from S1 to N1. | | | | | |

6.2.2.2.3.3 Specific message contents

Table 6.2.2.2.3.3-1: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { |  |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.2.3.3-2: *SystemInformationBlockType24* of EUTRA Cell 1 (preamble and all steps, Table 6.2.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.2.3.3-3: *SystemInformationBlockType1* for E-UTRA Cell 1 (step 5, Table 6.2.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508-1 [7], Table 4.4.3.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellBarred | barred |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.2.3.3-4: REGISTRATION REQUEST (step 4, Table 6.2.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-1. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.2.2.2.3.3-5 |  |

Table 6.2.2.2.3.3-5: TRACKING AREA UPDATE REQUEST (Table 6.2.2.2.3.3-4)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-2 with condition Mapped EPS security context. |

### 6.2.3 Inter-RAT Cell Reselection

#### 6.2.3.1 Inter-RAT cell reselection / From E-UTRA\_IDLE to NR RRC\_IDLE (lower priority & higher priority, Srxlev based)

6.2.3.1.1 Test Purpose (TP)`

(1)

**with** { UE in E-UTRA RRC\_Idle state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority inter-RAT NR cell }

**then** { UE reselects the cell which belongs to the lower priority inter-RAT NR cell }

}

(2)

**with** { UE in E-UTRA RRC\_Idle state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority inter-RAT NR cell }

**then** { UE reselects the cell which belongs to the higher priority inter-RAT NR cell }

}

6.2.3.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 36.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 36.304, clause 5.2.4.1]

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCConnectionReject* unless specified otherwise. When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority.

NOTE 1: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 36.133 [10] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection.

NOTE 7: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

[TS 36.304, clause 5.2.4.2]

For NB-IoT measurement rules for cell re-selection is defined in sub-clause 5.2.4.2.a.

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for E-UTRAN inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For an E-UTRAN inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current E-UTRA frequency the UE shall perform measurements of higher priority E-UTRAN inter-frequency or inter-RAT frequencies according to TS 36.133 [10].

- For an E-UTRAN inter-frequency with an equal or lower reselection priority than the reselection priority of the current E-UTRA frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current E-UTRAN frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo*.

- Otherwise,the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3*, the UE may further limit the needed measurements, as specified in sub-clause 5.2.4.12.

[TS 36.304, clause 5.2.4.5]

For NB-IoT inter-frequency cell reselection shall be based on ranking as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT; or

- A cell of a higher priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority E-UTRAN frequency shall be based on ranking for Intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT; or

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/ frequency shall take precedence over a lower priority RAT/ frequency, if multiple cells of different priorities fulfil the cell reselection criteria.

The UE shall not perform cell reselection to NR or UTRAN FDD cells for which the cell selection criterion S is not fulfilled.

For cdma2000 RATs, Srxlev is equal to -FLOOR(-2 x 10 x log10 Ec/Io) in units of 0.5 dB, as defined in [18], with Ec/Io referring to the value measured from the evaluated cell.

For cdma2000 RATs, ThreshX, HighP and ThreshX, LowP are equal to -1 times the values signalled for the corresponding parameters in the system information.

In all the above criteria the value of TreselectionRAT is scaled when the UE is in the medium or high mobility state as defined in subclause 5.2.4.3.1. If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an E-UTRAN frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

Cell reselection to another RAT, for which Squal based cell reselection parameters are broadcast in system information, shall be performed based on the Squal criteria if the UE supports Squal (RSRQ) based cell reselection to E-UTRAN from all the other RATs provided by system information which UE supports. Otherwise, cell reselection to another RAT shall be performed based on Srxlev criteria.

Cell reselection to NR, for which a cell reselection parameter, *q-RxLevMinSUL* is broadcast in system information and the UE supports SUL, shall be performed based on Srxlev criteria taking the parameter into account.

6.2.3.1.3 Test description

6.2.3.1.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1, NR Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 31 as defined in TS 36.508-1 [7] clause 4.4.3.1 is used in E-UTRA Cell.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

- the UE is switched-off

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

6.2.3.1.3.2 Test procedure sequence

Table 6.2.3.1.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.3.1.3.2-3.

Table 6.2.3.1.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **E-UTRA**  **Cell 1** | NR  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | Off |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -95 | - | The power level values are assigned to satisfy both SrxlevNR Cell 1 > Threshx, low and SrxlevE-UTRA Cell 1 < Threshserving, low |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -80 |
| T2 | Cell-specific RS EPRE | dBm/15kHz | -80 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -95 | , SrxlevE-UTRA Cell 1 > Threshx, high |
| T3 | Cell-specific RS EPRE | dBm/15kHz | -95 | - | The Priority and power level values are assigned to satisfy SrxlevNR Cell 1 > Threshx, high |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -80 |
| Note1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.2.3.1.3.2-2: Void

Table 6.2.3.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the E-UTRAN and NR Cell power levels according to row "T1" in table 6.2.3.1.3.2-1. | - | - | - | - |
| 2 | Wait for 1 second to allow UE to recognise the change. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1? | - | - | 1 | P |
| 4 | Void. | - | - | - | - |
| 5 | The SS adjusts the E-UTRAN and NR Cell power levels according to row "T2" in table 6.2.3.1.3.2-1. | - | - | - | - |
| 6 | Wait for 1 second to allow UE to recognise the change. | - | - | - | - |
| 7 | The test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRAN Cell 1. | - | - | - | - |
| 7A | The SS changes *Priority* of NR cell 1 in *SystemInformationBlockType24*. And the *systemInfoValueTag* in the *SystemInformationBlockType1* of E-UTRA Cell 1 is increased. | - | *-* | - | - |
| 8 | The SS notifies the UE of change of System Information on E-UTRAN Cell 1. | <-- | *Paging* | - | - |
| 9 | Void | - | *-* | - | - |
| 10 | Wait for 6 s for UE to receive system information. | - | - | - | - |
| 11 | The SS re-adjusts the E-UTRAN and NR Cell levels according to row "T3" in table 6.2.3.1.3.2-1. | - | - | - | - |
| 12 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1? | - | *-* | 2 | P |
| 13 | Void. | - | - | - | - |

6.2.3.1.3.3 Specific message contents

Table 6.2.3.1.3.3-1: *SystemInformationBlockType3* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLow | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.1.3.3-2: *SystemInformationBlockType24* of EUTRA Cell 1 (preamble, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Downlink NR ARFCN of SSB for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| threshX-High-r15 | 20 | 40 dB |  |
| threshX-Low-r15 | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 |  |  |
| } |  |  |  |

Table 6.2.3.1.3.3-3: *SIB2* of NR Cell 1(preamble and all steps, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 10 | 20 dB |  |
| cellReselectionPriority | 3 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.1.3.3-4: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| cellReselectionPriority | 5 |  |  |
| threshX-High | 10 | 20 dB |  |
| threshX-Low | 20 | 40 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 |  |  |
| } |  |  |  |

Table 6.2.3.1.3.3-5: *Paging* (step 8, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.6.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| Paging ::= SEQUENCE { |  |  |  |
| systemInfoModification | True |  |  |
| } |  |  |  |

Table 6.2.3.1.3.3-6: *SystemInformationBlockType1* of EUTRA Cell 1 (step 7A, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| systemInfoValueTag | 1 | Previous value is 0 |  |
| } |  |  |  |

Table 6.2.3.1.3.3-7: *SystemInformationBlockType24* of EUTRA Cell 1 (step 7A, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 5 |  |  |
| threshX-High-r15 | 10 | 20 dB |  |
| threshX-Low-r15 | 20 | 40 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.1.3.3-8: TRACKING AREA UPDATE REQUEST (Step 7, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.7.2.3-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS update type |  |  |  |
| EPS update type Value | '010'B | Combined TA/LA updating | combined\_TA\_LA |
| '000'B | TA updating | TA\_only |
| NOTE: The message shall be integrity protected using the 5GS security context available in the UE. | | | |

|  |  |
| --- | --- |
| Condition | Explanation |
| TA\_only | This condition applies if the UE is configured to initiate EPS attach or if explicitly specified. |
| combined\_TA\_LA | This condition applies if the UE is configured to initiate combined EPS/IMSI attach or if explicitly specified. |

Table 6.2.3.1.3.3-9: REGISTRATION REQUEST (Step 12, Table 6.2.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.2.3.1.3.3-10 |  |

Table 6.2.3.1.3.3-10: TRACKING AREA UPDATE REQUEST (Table 6.2.3.1.3.3-9)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-2 with condition Mapped EPS security context |

#### 6.2.3.2 Inter-RAT cell reselection / From E-UTRA\_IDLE to NR RRC\_IDLE (lower priority & higher priority, Squal based)

6.2.3.2.1 Test Purpose (TP)

(1)

**with** { UE in E-UTRA RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority inter-RAT NR cell}

**then** { UE reselects the cell which belongs to the lower priority inter-RAT NR cell }

}

(2)

**with** { UE in E-UTRA RRC\_IDLE state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority inter-RAT NR cell}

**then** { UE reselects the cell which belongs to the higher priority inter-RAT NR cell }

}

6.2.3.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 36.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 36.304, clause 5.2.4.1]

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCConnectionReject* unless specified otherwise. When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority.

NOTE 1: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 36.133 [10] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection.

NOTE 7: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

[TS 36.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 36.304, clause 5.2.4.5]

For NB-IoT inter-frequency cell reselection shall be based on ranking as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT; or

- A cell of a higher priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority E-UTRAN frequency shall be based on ranking for Intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT; or

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/ frequency shall take precedence over a lower priority RAT/ frequency, if multiple cells of different priorities fulfil the cell reselection criteria.

The UE shall not perform cell reselection to NR or UTRAN FDD cells for which the cell selection criterion S is not fulfilled.

For cdma2000 RATs, Srxlev is equal to -FLOOR(-2 x 10 x log10 Ec/Io) in units of 0.5 dB, as defined in [18], with Ec/Io referring to the value measured from the evaluated cell.

For cdma2000 RATs, ThreshX, HighP and ThreshX, LowP are equal to -1 times the values signalled for the corresponding parameters in the system information.

In all the above criteria the value of TreselectionRAT is scaled when the UE is in the medium or high mobility state as defined in subclause 5.2.4.3.1. If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an E-UTRAN frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

Cell reselection to another RAT, for which Squal based cell reselection parameters are broadcast in system information, shall be performed based on the Squal criteria if the UE supports Squal (RSRQ) based cell reselection to E-UTRAN from all the other RATs provided by system information which UE supports. Otherwise, cell reselection to another RAT shall be performed based on Srxlev criteria.

Cell reselection to NR, for which a cell reselection parameter, *q-RxLevMinSUL* is broadcast in system information and the UE supports SUL, shall be performed based on Srxlev criteria taking the parameter into account.

6.2.3.2.3 Test description

6.2.3.2.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1 and NR Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 31 as defined in TS 36.508 [7] clause 4.4.3.1, and message contents defined in clause 4.4.3.3 with QBASED condition is used in E-UTRA cell.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3, and message contents defined in clause 4.6.1 and clause 4.6.2 with QBASED condition is used in NR Cell.

UE:

None.

Preamble:

-

With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

The UE is switched-off.

With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (E-UTRA/EPC) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G-GUTI and eKSI are assigned and security context established.

6.2.3.2.3.2 Test procedure sequence

Table 6.2.3.2.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configurations marked "T1","T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.3.2.3.2-3.

Table 6.2.3.2.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell and NR Cell in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | E-UTRA Cell 1 | NR Cell 1 | Remark |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -95 | - | The power level values are assignen to ensure UE reselected to NR Cell 1: both Squal ServingCell, E-UTRA Cell1 < ThreshServing, LowQ and SqualnonServingCell, NR Cell1 > ThreshNR Cell1,LowQ |
| SS/PBCH SSS EPRE | dBm/SCS | - | -80 |
| RSRQ | dB | -11.46 | -11.17 |
| Qqualmin | dB | -20 | -25 |
| NocE-UTRA | dBm/15kHz | -95 | - |
| NocNR | dBm/SCS | - | -90 |
| T2 | Cell-specific RS EPRE | dBm/15kHz | -80 | - | The power level values are assignen to ensure UE reselected back to E-UTRA Cell 1: Squal nonServingCell, E-UTRA Cell1 > ThreshE-UTRA Cell1, HighQ |
| SS/PBCH SSS EPRE | dBm/SCS | - | -95 |
| RSRQ | dB | -3.76 | -16.98 |
| Qqualmin | dB | -20 | -25 |
| NocE-UTRA | dBm/15kHz | -95 | - |
| NocNR | dBm/SCS | - | -90 |
| T3 | Cell-specific RS EPRE | dBm/15kHz | -95 | - | The power level values are assignen to ensure UE reselected to NR Cell 1: Squal nonServingCell, NR Cell1 > Thresh NR Cell1, HighQ |
| SS/PBCH SSS EPRE | dBm/SCS | - | -80 |
| RSRQ | dB | -11.46 | -11.17 |
| Qqualmin | dB | -20 | -25 |
| NocE-UTRA | dBm/15kHz | -95 | - |
| NocNR | dBm/SCS | - | -90 |

Table 6.2.3.2.3.2-2: Void

Table 6.2.3.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes Cell-specific RS EPRE level for E-UTRA Cell 1 and SS/PBCH SSS EPRE level for NR Cell 1 according to row "T1" in table 6.2.3.2.3.2-1. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1?  NOTE: This is the first time in this test case that the UE moves from S1 to N1. |  |  | 1 | - |
| 3 | The SS transmits an *RRCRelease* message on NR Cell 1. | <-- | NR RRC: *RRCRelease* |  |  |
| 4 | The SS changes Cell-specific RS EPRE level for E-UTRA Cell 1 and SS/PBCH SSS EPRE level for NR Cell 1 according to row "T2" in table 6.2.3.2.3.2-1. | - | - | - | - |
| 5 | The UE selects E-UTRAN Cell 1 and performs the generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2 from steps 1-6. | - | - | - | - |
| 6 | The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC\_IDLE on E-UTRAN Cell 1. | <-- | E-UTRA RRC: *RRCConnectionRelease* | - | - |
| 7 | The SS changes the NR cell priority broadcast in system information on E-UTRAN Cell 1. | - | - | - | - |
| 8 | Notify UE change of System Information on E-UTRAN Cell 1. | <-- | E-UTRA RRC: *Paging* |  |  |
| 9 | Wait for 6 s for UE to receive system information. | - | - | - | - |
| 10 | The SS changes Cell-specific RS EPRE level for E-UTRA Cell 1 and SS/PBCH SSS EPRE level for NR Cell 1 according to row "T3" in table 6.2.3.2.3.2-1. | - | - | - | - |
| 11 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1? | - | - | 2 | - |
| 12 | Void. | - | - | - | - |

6.2.3.2.3.3 Specific message contents

Table 6.2.3.2.3.3-1: *SystemInformationBlockType1* for E-UTRA Cell 1 (preamble and all steps, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508-1 [7], Table 4.4.3.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| cellSelectionInfo-v920 SEQUENCE { |  |  |  |
| q-QualMin-r9 | -20 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-2:S*ystemInformationBlockType3* for E-UTRA Cell 1 (preamble and all steps, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| lateNonCriticalExtension { |  |  |  |
| q-QualMin-r9 | -20 |  |  |
| threshServingLowQ-r9 | 12 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-3:*SystemInformationBlockType24* for E-UTRA Cell 1 (preamble, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Downlink NR ARFCN of SSB for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| threshX-Q-r15 SEQUENCE { |  |  |  |
| threshX-HighQ-r15 | 20 |  |  |
| threshX-LowQ-r15 | 5 |  |  |
| } |  |  |  |
| q-QualMin-r15 | -25 |  |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-4:*SIB1* for NR Cell 1 (preamble and all steps, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfo SEQUENCE { |  |  |  |
| q-QualMin | -25 | -25dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-5:*SIB2* for NR Cell 1 (preamble and all steps, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowQ | 26 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-6:*SIB5* for NR Cell 1 (preamble and all steps, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| cellReselectionPriority | 5 |  |  |
| threshX-Q SEQUENCE { |  |  |  |
| threshX-HighQ | 12 |  |  |
| threshX-LowQ | 5 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-7:*SystemInformationBlockType24* for E-UTRA Cell 1 (step 7, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Downlink NR ARFCN of SSB for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 5 |  |  |
| threshX-Q-r15 SEQUENCE { |  |  |  |
| threshX-HighQ-r15 | 5 |  |  |
| threshX-LowQ-r15 | 20 |  |  |
| } |  |  |  |
| q-QualMin-r15 | -25 |  |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-8: *Paging* for E-UTRA Cell 1 (step 8, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.6.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| Paging ::= SEQUENCE { |  |  |  |
| pagingRecordList | Not present |  |  |
| systemInfoModification | True |  |  |
| etws-PrimaryNotificationIndication | Not present |  |  |
| nonCriticalExtension | Not present |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-9: *SystemInformationBlockType1* for E-UTRA Cell 1 (step 9, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508-1 [7], Table 4.4.3.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| systemInfoValueTag | 1 |  |  |
| } |  |  |  |

Table 6.2.3.2.3.3-10: REGISTRATION REQUEST (Step 11, Table 6.2.3.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.2.3.2.3.3-11 |  |

Table 6.2.3.2.3.3-11: TRACKING AREA UPDATE REQUEST (Table 6.2.3.2.3.3-10)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-2 with condition Mapped EPS security context |

#### 6.2.3.3 Inter-RAT cell reselection / From NR RRC\_IDLE to E-UTRA\_IDLE (lower priority & higher priority, Srxlev based)

6.2.3.3.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_Idle state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority E-UTRA frequency }

**then** { UE reselects to the E-UTRA cell }

}

(2)

**with** { UE in NR RRC\_Idle state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the neighour cell which belongs to the lower priority E-UTRA frequency }

**then** { UE reselects to the E-UTRA cell }

}

6.2.3.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.1]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

6.2.3.3.3 Test description

6.2.3.3.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, E-UTRA Cell 1 is different priority inter-RAT Cell.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

- System information combination 31 as defined in TS 36.508-1 [18] clause 4.4.3.1 is used in E-UTRA Cell.

UE:

None.

Preamble:

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

- the UE is switched-off.

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

6.2.3.3.3.2 Test procedure sequence

Table 6.2.3.3.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.3.3.3.2-3.

Table 6.2.3.3.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | NR  **Cell 1** | **E-UTRA**  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | - | -Off | The power level values are assigned to ensure UE registered on NR Cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | -88 | - |
| T1 | Cell-specific RS EPRE | dBm/15kHz | - | -75 | The power level values are assigned to satisfy SrxlevE-UTRA Cell 1> Threshx, high |
| SS/PBCH  SSS EPRE | dBm/SCS | -95 | - |
| T2 | Cell-specific RS EPRE | dBm/15kHz | - | -95 | The power level values are assigned to ensure UE reselected back to NR Cell 1: both SrxlevE-UTRA Cell 1 < Threshserving, low and SrxlevNR Cell 1 > Threshx, low. |
| SS/PBCH  SSS EPRE | dBm/SCS | -78 | - |
| T3 | Cell-specific RS EPRE | dBm/15kHz | - | -75 | The power level values are assigned to satisfy both SrxlevNR Cell 1 < Threshserving, low and SrxlevE-UTRA Cell 1 > Threshx, low. |
| SS/PBCH  SSS EPRE | dBm/SCS | -95 | - |

Table 6.2.3.3.3.2-2: Void

Table 6.2.3.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T1" in table 6.2.3.3.3.2-1. | - | - | - | - |
| 2 | Void | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | - | 1 | - |
| 4 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T2" in table 6.2.3.3.3.2-1. | - | - | - | - |
| 5 | Void | - | - | - | - |
| 6 | Generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 take place and UE is camped on NR Cell 1. | - | - | - | - |
| 7 | The SS transmits RRCRelease message on NR Cell 1. | <-- | NR:*RRCRelease* | - | - |
| 7A | The SS changes *Priority* of E-UTRA cell 1 in the *SIB5* of NR Cell 1, The *ValueTag* of *SIB5* in the *SIB1* is increased on NR Cell 1. | - | *-* | - | - |
| 8 | The SS notifies the UE of change of System Information on NR Cell 1 by send Short Message on PDCCH using P-RNTI. | <-- | NR: *ShortMessage* | - | - |
| 9 | Void | - | *-* | - | - |
| 10 | Wait for 2.1\* modification period to allow the new system information to take effect. | - | *-* | - | - |
| 11 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T3" in table 6.2.3.3.3.2-1. | - | - | - | - |
| 12 | Void | - | - | - | - |
| 13 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | *-* | 2 | - |

6.2.3.3.3.3 Specific message contents

Table 6.2.3.3.3.3-1: *SIB2* of NR Cell 1(preamble and all steps, Table 6.2.3.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.3.3.3-2: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.3.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| cellReselectionPriority | 5 |  |  |
| threshX-High | 10 | 20 dB |  |
| threshX-Low | 20 | 40 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.3.3.3-3: *SystemInformationBlockType3* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLow | 10 | 20 dB |  |
| } |  |  |  |

Table 6.2.3.3.3.3-4: *SystemInformationBlockType24* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| threshX-High-r15 | 20 | 40 dB |  |
| threshX-Low-r15 | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.3.3.3-5: *SIB5* of NR Cell 1(Step 7A, Table 6.2.3.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| cellReselectionPriority | 3 |  |  |
| threshX-High | 20 | 40 dB |  |
| threshX-Low | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.3.3.3-6: SIB1 of NR Cell 1 (step 7A, Table 6.2.3.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.128 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

Table 6.2.3.3.3.3-7: SI-SchedulingInfo (si-SchedulingInfo in Table 6.2.3.3.3.3-6)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType5 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.3.3.3-8: TRACKING AREA UPDATE REQUEST (Step 3, Table 6.2.3.3.3.2-3)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.7.2.3-1 with condition First-N1-to-S1 = TRUE |

Table 6.2.3.3.3.3-9: TRACKING AREA UPDATE REQUEST (Step 13, Table 6.2.3.3.3.2-3)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.7.2.3-1 with condition First-N1-to-S1 = FALSE |

Table 6.2.3.3.3.3-10: REGISTRATION REQUEST (Step 6, Table 6.2.3.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.2.3.3.3.3-11 |  |

Table 6.2.3.3.3.3-11: TRACKING AREA UPDATE REQUEST (Table 6.2.3.3.3.3-10)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [2], Table 4.7.2-27. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS update type |  |  |  |
| EPS update type Value | '000'B | TA updating |  |
| "Active" flag | '0'B | No bearer establishment requested |  |
| NAS key set identifier |  |  |  |
| NAS key set identifier | the eKSI value for the current mapped EPS security context |  |  |
| TSC | '1'B | mapped security context |  |

#### 6.2.3.4 Inter-RAT cell reselection / From NR RRC\_IDLE to E-UTRA\_IDLE (lower priority & higher priority, Squal based)

6.2.3.4.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_Idle state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority inter-RAT E-UTRA cell }

**then** { UE reselects the cell which belongs to the lower priority inter-RAT E-UTRA cell }

}

(2)

**with** { UE in NR RRC\_Idle state }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority inter-RAT E-UTRA cell }

**then** { UE reselects the cell which belongs to the higher priority inter-RAT E-UTRA cell }

}

6.2.3.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.1]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

6.2.3.4.3 Test description

6.2.3.4.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and E-UTRA Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination NR-6 as defined in TS 38.508-1 [7] clause 4.4.3.1, and message contents defined in clause 4.6.1 and clause 4.6.2 with QBASED condition is used in NR cell.

- System information combination 31 as defined in TS 36.508 [7] clause 4.4.3.1, and message contents defined in clause 4.4.3.3 with QBASED condition is used in E-UTRA cell.

UE:

None.

Preamble:

With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (E-UTRA/EPC) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G-GUTI and eKSI are assigned and security context established.

The UE is switched-off.

With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

6.2.3.4.3.2 Test procedure sequence

Table 6.2.3.4.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Configurations marked "T1","T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.3.4.3.2-3.

Table 6.2.3.4.3.2-1: Time instances of cell power level and parameter changes for NR Cell in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | E-UTRA Cell 1 | Remark |
| T1 | Cell-specific RS EPRE | dBm/15kHz | - | -80 | The power level values are assigned to ensure UE reselected to E-UTRA Cell 1: both Squal ServingCell, NR Cell1 < ThreshServing, LowQ and SqualnonServingCell, E-UTRA Cell1 > ThreshX, LowQ |
| SS/PBCH SSS EPRE | dBm/SCS | -95 | - |
| RSRQ | dB | -21.20 | -3.76 |
| Qqualmin | dB | -25 | -20 |
| NocE-UTRA | dBm/15kHz | - | -95 |
| NocNR | dBm/SCS | -85 | - |
| T2 | Cell-specific RS EPRE | dBm/15kHz | - | -95 | The power level values are assigned to ensure UE reselected back to NR Cell 1: Squal nonServingCell, NR Cell1 > ThreshX, HighQ |
| SS/PBCH SSS EPRE | dBm/SCS | -77 | - |
| RSRQ | dB | -11.40 | -11.46 |
| Qqualmin | dB | -25 | -20 |
| NocE-UTRA | dBm/15kHz | - | -95 |
| NocNR | dBm/SCS | -85 | - |
| T3 | Cell-specific RS EPRE | dBm/15kHz | - | -80 | The power level values are assigned to ensure UE reselected to E-UTRA Cell 1: Squal nonServingCell, E-UTRA Cell1 > ThreshX, HighQ |
| SS/PBCH SSS EPRE | dBm/SCS | -95 | - |
| RSRQ | dB | -21.20 | -3.76 |
| Qqualmin | dB | -25 | -20 |
| NocE-UTRA | dBm/15kHz | - | -95 |
| NocNR | dBm/SCS | -85 | - |

Table 6.2.3.4.3.2-2: Void

Table 6.2.3.4.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes SS/PBCH SSS EPRE level for NR Cell 1 and Cell-specific RS EPRE level for E-UTRA Cell 1 according to row "T1" in table 6.2.3.4.3.2-1. | - | - | - | - |
| 2 | Check: Does the test result of test steps 1 to 6 of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRA Cell 1? | - | - | 1 | - |
| 3 | The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC\_IDLE on E-UTRAN Cell 1. | <-- | E-UTRA RRC: *RRCConnectionRelease* | - | - |
| 4 | The SS changes SS/PBCH SSS EPRE level for NR Cell 1 and Cell-specific RS EPRE level for E-UTRA Cell 1 according to row "T2" in table 6.2.3.4.3.2-1. | - | - | - | - |
| 5 | The UE selects NR Cell 1 and performs the generic test procedure in TS 38.508-1 Table 4.9.9.2.2-1 with condition '*connected without release*'. | - | - | - | - |
| 6 | The SS transmits an *RRCRelease* message on NR Cell 1. | <-- | NR RRC: *RRCRelease* | - | - |
| 7 | The SS changes the E-UTRA cell priority broadcast in system information on NR Cell 1. | - | - | - | - |
| 8 | Notify UE change of System Information on NR Cell 1. | <-- | NR RRC: *ShortMessage* | - | - |
| 9 | Wait for 6 s for UE to receive system information. | - | - | - | - |
| 10 | The SS changes SS/PBCH SSS EPRE level for NR Cell 1 and Cell-specific RS EPRE level for E-UTRA Cell 1 according to row "T3" in table 6.2.3.4.3.2-1. | - | - | - | - |
| 11 | Check: Does the test result of test steps 1 to 6 of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRA Cell 1? | - | - | 2 | - |
| 12 | The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC\_IDLE on E-UTRAN Cell 1. | <-- | E-UTRA RRC: *RRCConnectionRelease* | - | - |

6.2.3.4.3.3 Specific message contents

Table 6.2.3.4.3.3-1: *SIB1* for NR Cell 1 (preamble and all steps, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfo SEQUENCE { |  |  |  |
| q-QualMin | -25 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-2: *SIB2* for NR Cell 1 (preamble and all steps, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowQ | 9 |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-3: *SIB5* NR Cell 1 (preamble, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink E-UTRA ARFCN for E-UTRA Cell 1 |  |  |
| threshX-Q SEQUENCE { |  |  |  |
| threshX-HighQ | 20 |  |  |
| threshX-LowQ | 10 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-4: *SystemInformationBlockType1* for E-UTRA Cell 1 (preamble and all steps, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508-1 [7], Table 4.4.3.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| cellSelectionInfo-v920 SEQUENCE { |  |  |  |
| q-QualMin-r9 | -20 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-5: S*ystemInformationBlockType3* for E-UTRA Cell 1 preamble and all steps, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| lateNonCriticalExtension { |  |  |  |
| q-QualMin-r9 | -20 |  |  |
| threshServingLowQ-r9 | 26 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-6: *SystemInformationBlockType24* for E-UTRA Cell 1 (preamble and all steps, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Downlink NR ARFCN of SSB for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 5 |  |  |
| threshX-Q-r15 SEQUENCE { |  |  |  |
| threshX-HighQ-r15 | 10 |  |  |
| threshX-LowQ-r15 | 20 |  |  |
| } |  |  |  |
| q-QualMin-r15 | -25 |  |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-7: *SIB5* NR Cell 1 (step 7, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink E-UTRA ARFCN for E-UTRA Cell 1 |  |  |
| cellReselectionPriority | 5 |  |  |
| q-QualMin | -20 |  |  |
| threshX-Q SEQUENCE { |  |  |  |
| threshX-HighQ | 12 |  |  |
| threshX-LowQ | 20 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-8: *SIB1* of NR Cell 1 (step 9, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellSelectionInfo SEQUENCE { |  |  |  |
| q-QualMin | -25 |  |  |
| } |  |  |  |
| si-SchedulingInfo | SI-SchedulingInfo |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-9: SI-SchedulingInfo (si-SchedulingInfo in Table 6.2.3.4.3.3-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-173 | | | |
| Information Element | Value/remark | Comment | Condition |
| SI-SchedulingInfo ::= SEQUENCE { |  |  |  |
| schedulingInfoList SEQUENCE (SIZE(1..maxSI-Message)) OF SchedulingInfo { | 1 entry |  |  |
| SchedulingInfo[1] SEQUENCE { |  | entry 1 |  |
| sib-MappingInfo SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo { | 1 entry |  |  |
| SIB-TypeInfo[1] SEQUENCE { |  | entry 1 |  |
| type | sibType5 |  |  |
| valueTag | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.4.3.3-10: REGISTRATION REQUEST (Step 5, Table 6.2.3.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.2.3.4.3.3-11 |  |

Table 6.2.3.4.3.3-11: TRACKING AREA UPDATE REQUEST (Table 6.2.3.4.3.3-10)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-2 with condition Mapped EPS security context |

#### 6.2.3.5 Inter-RAT cell reselection / From NR RRC\_IDLE to E-UTRA\_IDLE according to RAT priority provided by dedicated signalling (RRCRelease)

6.2.3.5.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state having received an RRCRelease message including cellReselectionPriorities }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority RAT }

**then** { UE reselects the cell which belongs to the higher priority RAT }

}

}

(2)

**with** { UE in NR RRC\_IDLE state having received an RRCRelease message including a cellReselectionPriorities }

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority RAT }

**then** { UE reselects the cell which belongs to the lower priority RAT }

}

}

(3)

**with** { UE in NR RRC\_IDLE state having received an RRCRelease message including a cellReselectionPriorities }

**ensure that** {

**when** { T320 expires }

**then** { UE reselects a cell by applying the cellReselectionPriority broadcast in the system information }

}

}

(4)

**with** { UE in NR RRC\_IDLE state and reselection priorities have been provided in dedicated signalling }

**ensure that** {

**when** { T320 has not expired }

**then** { The UE shall ignore all the priorities provided in system information, and not perform cell reselection evaluation for NR frequencies and E-UTRA frequencies for which the UE doesn’t have a priority provided }

}

}

6.2.3.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304: clause 5.2.4.1 and 5.2.4.5, 3GPP TS 38.331:clause 5.3.8.3 and 5.3.8.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.331, clause 5.3.8.3]

The UE shall:

1> delay the following actions defined in this sub-clause 60 ms from the moment the *RRCRelease* message was received or optionally when lower layers indicate that the receipt of the *RRCRelease* message has been successfully acknowledged, whichever is earlier;

1> stop timer T380, if running;

1> stop timer T320, if running;

1> if T390 is running:

2> stop timer T390 for all access categories;

2> perform the actions as specified in 5.3.14.4;

1> if theAS security is not activated, perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with the release cause 'other' upon which the procedure ends;

1> if the *RRCRelease* message includes *redirectedCarrierInfo* indicating redirection to *eutra*:

2> if *cnType* is included:

3> after the cell selection, indicate the available CN Type(s) and the received *cnType* to upper layers;

NOTE: Handling the case if the E-UTRA cell selected after the redirection does not support the core network type specified by the *cnType,* is up to UE implementation.

1> if the *RRCRelease* message includes the *cellReselectionPriorities*:

2> store the cell reselection priority information provided by the *cellReselectionPriorities*;

2> if the *t320* is included:

3> start timer T320, with the timer value set according to the value of *t320*;

1> else:

2> apply the cell reselection priority information broadcast in the system information;

1> if *deprioritisationReq* is included:

2> start or restart timer T325 with the timer value set to the *deprioritisationTimer* signalled;

2> store the *deprioritisationReq* until T325 expiry;

1> if the *RRCRelease* includes *suspendConfig*:

2> apply the received *suspendConfig*;

2> reset MAC and release the default MAC Cell Group configuration, if any;

2> re-establish RLC entities for SRB1;

2> if the *RRCRelease* message with *suspendConfig* was received in response to an *RRCResumeRequest* or an *RRCResumeRequest1*:

3> stop the timer T319 if running;

3> in the stored UE Inactive AS context:

4> replace the KgNB and KRRCint keys with the current KgNB and KRRCint keys;

4> replace the C-RNTI with the temporary C-RNTI in the cell the UE has received the *RRCRelease* message;

4> replace the *cellIdentity* with the *cellIdentity* of the cell the UE has received the *RRCRelease* message;

4> replace the physical cell identitywith the physical cell identity of the cell the UE has received the *RRCRelease* message;

4> replace the *suspendConfig* with the current *suspendConfig*;

2> else:

3> store in the UE Inactive AS Context the configured *suspendConfig*, the current KgNB and KRRCint keys, the ROHC state, the C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, and all other parameters configured except with *ReconfigurationWithSync*;

2> suspend all SRB(s) and DRB(s), except SRB0;

2> indicate PDCP suspend to lower layers of all DRBs;

2> if the *t380* is included:

3> start timer T380, with the timer value set to *t380*;

2> if the *RRCRelease* message is including the *waitTime*:

3> start timer T302 with the value set to the *waitTime*;

3> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2';

2> indicate the suspension of the RRC connection to upper layers;

2> enter RRC\_INACTIVE and perform cell selection as specified in TS 38.304 [20];

1> else

2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with the release cause 'other'.

[TS 38.331, clause 5.3.8.4]

The UE shall:

1> if T320 expires:

2> if stored, discard the cell reselection priority information provided by the *cellReselectionPriorities* or inherited from another RAT;

2> apply the cell reselection priority information broadcast in the system information.

6.2.3.5.3 Test description

6.2.3.5.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, E-UTRA Cell 1 is inter-RAT cell.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

- System information combination 31 as defined in TS 36.508-1 [18] clause 4.4.3.1 is used in E-UTRA Cell.

UE:

None.

Preamble:

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (E-UTRA/EPC) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

- the UE is switched-off.

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 3N-A, RRC\_CONNECTED Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.4.2-3. 5G-GUTI and ngKSI are assigned and security context established.

6.2.3.5.3.2 Test procedure sequence

Table 6.2.3.5.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and so on are applied at the points indicated in the Main behaviour description in Table 6.1.3.5.3.2-3.

Table 6.2.3.5.3.2-1: Time instances of cell power level and parameter changes for E-UTRA cell 1 and NR cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | NR  **Cell 1** | **E-UTRA**  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | - | OFF | The power level values are assigned to satisfy Srxlev NR Cell 1 > 0 and SrxlevE-UTRA Cell 1 < 0. And UE camping on NR Cell 1 is guaranteed. |
| SS/PBCH  SSS EPRE | dBm/SCS | -88 | - |
| T1 | Cell-specific RS EPRE | dBm/15kHz | - | -70 | The power level values are assigned to satisfy SrxlevE-UTRA cell 1 > Threshx,high. |
| SS/PBCH  SSS EPRE | dBm/SCS | -90 | - |
| T2 | Cell-specific RS EPRE | dBm/15kHz | - | -104 | The power level values are such that camping on NR Cell 1 is guaranteed. |
| SS/PBCH  SSS EPRE | dBm/SCS | -78 | - |
| T3 | Cell-specific RS EPRE | dBm/15kHz | - | -88 | The power level values are assigned to satisfy both SrxlevNR Cell 1 < Threshserving, low and SrxlevE-UTRA Cell 1 > Threshx, low. |
| SS/PBCH  SSS EPRE | dBm/SCS | -104 | - |
| T4 | Cell-specific RS EPRE | dBm/15kHz | - | -104 | The power level values are such that camping on NR Cell 1 is guaranteed. |
| SS/PBCH  SSS EPRE | dBm/SCS | -78 | - |
| T5 | Cell-specific RS EPRE | dBm/15kHz | - | -70 | The power level values are assigned to satisfy SrxlevNR cell 1 > Threshserving, low and SrxlevE-UTRA cell 1 > Threshx,high. |
| SS/PBCH  SSS EPRE | dBm/SCS | -90 | - |

Table 6.2.3.5.3.2-2: Void

Table 6.2.3.5.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits RRCRelease message including cellReselectionPriorities on NR Cell 1. | - | NR:*RRCRelease* | - | - |
| 2 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T1" in table 6.2.3.5.3.2-1. | - | - | - | - |
| 3 | Check: Does the UE transmit an RRC CONNECTION REQUEST on E-UTRA Cell 1 within the next 30 Seconds? | - | - | 4 | F |
| 4 | The test steps 1 to 8 of generic test procedure in TS 38.508-1 [4] Table 4.5.4.2-3 are performed on NR Cell 1. | - | - | - | - |
| 5 | The SS transmits RRCRelease message including cellReselectionPriorities on NR Cell 1. | <-- | NR:*RRCRelease* | - | - |
| 6 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | - | 1 | - |
| 7 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T2" in table 6.2.3.5.3.2-1. | - | *-* | - | - |
| 8 | Generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 take place and the UE is camped on NR Cell 1. | - | - | - | - |
| 9 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T3" in table 6.2.3.5.3.2-1. | - | *-* | - | - |
| 10 | The SS transmits RRCRelease message including cellReselectionPriorities on NR Cell 1. | <-- | NR:*RRCRelease* | - | - |
| 11 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | - | 2 | - |
| 12 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T4" in table 6.2.3.5.3.2-1. | - | *-* | - | - |
| 13 | Generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 take place and the UE is camped on NR Cell 1. | - | - | - | - |
| 14 | The SS transmits RRCRelease message including cellReselectionPriorities on NR Cell 1. | <-- | NR:*RRCRelease* | - | - |
| 15 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T5" in table 6.2.3.5.3.2-1. | - | - | - | - |
| 16 | Wait for 5 minutes from step 17 to ensure that T320 expires. | - | - | - | - |
| 17 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | - | 3 | - |

6.2.3.5.3.3 Specific message contents

Table 6.2.3.5.3.3-1: *SIB2* of NR Cell 1(preamble and all steps, Table 6.2.3.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 5 | 10dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.5.3.3-2: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.3.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EARFCN as E-UTRA Cell 1 used |  |  |
| cellReselectionPriority | 5 |  |  |
| threshX-High | 13 | 26 dB |  |
| threshX-Low | 5 | 10 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.5.3.3-3: *SystemInformationBlockType3* for EUTRA Cell 1 (preamble and all steps, Table 6.2.3.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLow | 5 | 10dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.5.3.3-4: *SystemInformationBlockType24* for EUTRA Cell 1 (preamble and all steps, Table 6.2.3.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| threshX-High-r15 | 20 | 40dB |  |
| threshX-Low-r15 | 10 | 20dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.5.3.3-5 *RRCRelease* (step1, Table 6.2.3.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCRelease ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcRelease SEQUENCE { |  |  |  |
| cellReselection Priorities SEQUENCE { |  |  |  |
| freqPriorityListEUTRA | Not present |  | Step1 |
| freqPriorityListEUTRA SEQUENCE (SIZE (1..maxFreq)) OF FreqPriorityEUTRA { | 1 entry |  |  |
| FreqPriorityListEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink ARFCN of E-UTRA Cell 1 |  |  |
| cellReselectionPriority | 5 |  | Step5 |
|  | 3 |  | Step10 |
|  | 3 |  | Step14 |
| } |  |  |  |
| } |  |  |  |
| freqPriorityListNR SEQUENCE (SIZE (1..maxFreq)) OF FreqPriorityNR { | 1 entry |  |  |
| FreqPriorityNR[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink SSB ARFCN of NR Cell 1 |  |  |
| cellReselectionPriority | 4 |  | Step1 |
|  | 4 |  | Step5 |
|  | 4 |  | Step10 |
|  | 4 |  | Step14 |
| } |  |  |  |
| } |  |  |  |
| t320 | Not present |  | Step1 |
|  | Not present |  | Step5 |
|  | Not present |  | Step10 |
|  | min5 | 5 minutes | Step14 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.5.3.3-6: REGISTRATION REQUEST (Step 8 and Step13, Table 6.2.3.5.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.2.3.5.3.3-7 |  |

Table 6.2.3.5.3.3-7: TRACKING AREA UPDATE REQUEST (Table 6.2.3.5.3.3-6)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-2 with condition Mapped EPS security context |

#### 6.2.3.6 Inter-RAT cell reselection / From E-UTRA\_IDLE to NR RRC\_IDLE according to RAT priority provided by dedicated signalling (RRConnRelease)

6.2.3.6.1 Test Purpose (TP)

(1)

**with** { UE in E-UTRA RRC\_Idle state having received *RRCConnectionRelease* including *IdleModeMobilityControlInfo* containing *cellReselectionPriority* for NR cell}

**ensure that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority inter-RAT NR cell based on the configured RAT priority provided by dedicated signaling}

**then** { UE reselects the cell which belongs to the lower priority inter-RAT NR cell}

}

(2)

**with** { UE in NR RRC\_IDLE state having inherit RAT priority provided by dedicated signaling with the remaining validity time}

**ensure that** {

**when** { UE discard the inherit RAT priority upon connection establishment}

**then** { UE reselects a cell by applying the cellReselectionPriority broadcast in the system information}

6.2.3.6.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 36.304, clause 5.2.4.1, and 3GPP TS 38.304, clause 5.2.4.1. Unless otherwise stated these are Rel-15 requirements.

[TS 36.304, clause 5.2.4.1]

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCConnectionReject* unless specified otherwise. When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority.

NOTE 1: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 36.133 [10] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection.

NOTE 7: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

6.2.3.6.3 Test description

6.2.3.6.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1, NR Cell 1 is different priority inter-RAT NR cell.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 31 as defined in TS 36.508-1 [7] clause 4.4.3.1 is used in E-UTRA Cell.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

- the UE is switched-off.

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_CONNECTED using generic procedure parameters Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4. 4G GUTI and eKSI are assigned and security context established.

6.2.3.6.3.2 Test procedure sequence

Table 6.2.3.6.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.3.6.3.2-3.

Table 6.2.3.6.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **E-UTRA**  **Cell 1** | NR  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | Off |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -95 | - | The power level values are assigned to satisfy both SrxlevE-UTRA Cell 1 < Threshserving, low and SrxlevNR Cell 1 > Threshx, low. |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -80 |
| T2 | Cell-specific RS EPRE | dBm/15kHz | -80 | - | The power level values are assigned to satisfy both SrxlevNR Cell 1 < Threshserving, low and SrxlevE-UTRA Cell 1 > Threshx, low |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -95 |

Table 6.2.3.6.3.2-2: Void

Table 6.2.3.6.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmmits *RRCConnectionRelease* message with dedicated priority information and validtity timer to the UE on E-UTRA cell 1. | <-- | E-UTRA: *RRCConnectionRelease* | - | - |
| 2 | The SS adjusts the E-UTRAN and NR Cell power levels according to row "T1" in table 6.2.3.6.3.2-1. | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1?  NOTE: This is the first time in this test case that the UE moves from S1 to N1. | - | *-* | 1 | - |
| 4 | Void. | - | *-* | - | - |
| 5 | The SS adjusts the E-UTRAN and NR Cell power levels according to row "T2" in table 6.2.3.6.3.2-1. | - | - | - | - |
| 6 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | - | 2 | - |

6.2.3.6.3.3 Specific message contents

Table 6.2.3.6.3.3-1: *SystemInformationBlockType3* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLow | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.6.3.3-2: *SystemInformationBlockType24* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 5 |  |  |
| threshX-High-r15 | 20 | 40 dB |  |
| threshX-Low-r15 | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.6.3.3-3: *SIB2* of NR Cell 1(preamble and all steps, Table 6.2.3.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.6.3.3-4: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.3.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| threshX-High | 20 | 40 dB |  |
| threshX-Low | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.6.3.3-5: *RRCConnectionRelease* message for EUTRA Cell 1 (step 1 of Table 6.2.3.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.6.1-15 | | | |
| Information Element | Value/Remark | Comment | Condition |
| RRCConnectionRelease ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE { |  |  |  |
| rrcConnectionRelease-r8 SEQUENCE { |  |  |  |
| IdleModeMobilityControlInfo SEQUENCE { |  |  |  |
| freqPriorityListEUTRA SEQUENCE (SIZE (1.. maxFreq)) OF FreqPriorityEUTRA { | 1 entry |  |  |
| freqPriorityListEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | DownLink ARFCN-Value of E-UTRA cell 1 |  |  |
|  | maxEARFCN |  | Band > 64 |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| t320 | Not present |  |  |
| freqPriorityListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF FreqPriorityNR-r15 { | 1 entry |  |  |
| FreqPriorityNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same Downlink SSB ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| } |  |  |  |
| } |  |  |  |
| nonCriticalExtension |  |  | Band > 64 |
| nonCriticalExtension |  |  |  |
| idleModeMobilityControlInfo-v9e0 SEQUENCE { |  |  |  |
| freqPriorityListEUTRA-v9e0 SEQUENCE (SIZE (1..maxFreq)) OF SEQUENCE { |  |  |  |
| carrierFreq-v9e0[1] | DownLink ARFCN-Value of E-UTRA cell 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.2.3.7 Inter-RAT cell reselection / From NR RRC\_IDLE to E-UTRA RRC\_IDLE, Snonintrasearch

6.2.3.7.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state, and the UE is not in high mobility state }

**ensure that** {

**when** { *Snonintrasearch* is non-zero in system information }

**then** { UE perform measurement and reselects to cell which belongs to the high priority E-UTRA cell even if Srxlev>Snonintrasearch }

}

6.2.3.7.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell

[TS 38.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

6.2.3.7.3 Test description

6.2.3.7.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, E-UTRA Cell 1 is higher priority inter-RAT cell.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

- System information combination 31 as defined in TS 36.508-1 [7] clause 4.4.3.1 is used in E-UTRA Cell.

UE:

None.

Preamble:

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

- the UE is switched-off.

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

6.2.3.7.3.2 Test procedure sequence

Table 6.2.3.7.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1"is applied at the points indicated in the Main behaviour description in Table 6.2.3.7.3.2-3.

Table 6.2.3.7.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR**  **Cell 1** | **E-UTRA**  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | - | Off | The power level values are assigned to ensure UE registered on NR Cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | -88 | - |
| T1 | Cell-specific RS EPRE | dBm/15kHz | - | -75 | The power level values are assigned to satisfy Srxlev NR Cell 1 >Snonintrasearch and SrxlevE-UTRA Cell 1> Threshx, high. |
| SS/PBCH  SSS EPRE | dBm/SCS | -90 | - |

Table 6.2.3.7.3.2-2: Void

Table 6.2.3.7.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the NR and E-UTRAN Cell power levels according to row "T1" in table 6.2.3.7.3.2-1. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 is performed and the UE is camped on E-UTRAN Cell 1? | - | - | 1 | - |

6.2.3.7.3.3 Specific message contents

Table 6.2.3.7.3.3-1: SIB2 of NR Cell 1 (preabmle and all steps, Table 6.2.3.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| s-NonIntraSearchP | 3 | 6 dB |  |
| threshServingLowP | 3 | 6 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.7.3.3-2: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.3.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| cellReselectionPriority | 5 |  |  |
| threshX-High | 10 | 20 dB |  |
| threshX-Low | 20 | 40 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.7.3.3-3: *SystemInformationBlockType3* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLow | 3 | 6 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.7.3.3-4: *SystemInformationBlockType24* for EUTRA Cell 1 (preamble and all steps, Table 6.2.3.7.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| threshX-High-r15 | 15 | 30 dB |  |
| threshX-Low-r15 | 15 | 30 dB |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 | 7 Seconds |  |
| } |  |  |  |

#### 6.2.3.8 Inter-RAT cell reselection / From E-UTRA RRC\_IDLE to NR RRC\_IDLE, Snonintrasearch

6.2.3.8.1 Test Purpose (TP)

(1)

**with** { UE in E-UTRA RRC\_Idle state, and the UE is not in high mobility state }

**ensure that** {

**when** { *Snonintrasearch* is non-zero in system information }

**then** { UE perform measurement and reselects to cell which belongs to the high priority NR cell even if Srxlev>Snonintrasearch }

}

6.2.3.8.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 36.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 36.304, clause 5.2.4.1]

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCConnectionReject* unless specified otherwise. When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority.

NOTE 1: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 36.133 [10] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection.

NOTE 7: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

[TS 36.304, clause 5.2.4.2]

For NB-IoT measurement rules for cell re-selection is defined in sub-clause 5.2.4.2.a.

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for E-UTRAN inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For an E-UTRAN inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current E-UTRA frequency the UE shall perform measurements of higher priority E-UTRAN inter-frequency or inter-RAT frequencies according to TS 36.133 [10].

- For an E-UTRAN inter-frequency with an equal or lower reselection priority than the reselection priority of the current E-UTRA frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current E-UTRAN frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo*.

- Otherwise,the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3*, the UE may further limit the needed measurements, as specified in sub-clause 5.2.4.12.

[TS 36.304, clause 5.2.4.5]

For NB-IoT inter-frequency cell reselection shall be based on ranking as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT; or

- A cell of a higher priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority E-UTRAN frequency shall be based on ranking for Intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT; or

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/ frequency shall take precedence over a lower priority RAT/ frequency, if multiple cells of different priorities fulfil the cell reselection criteria.

The UE shall not perform cell reselection to NR or UTRAN FDD cells for which the cell selection criterion S is not fulfilled.

For cdma2000 RATs, Srxlev is equal to -FLOOR(-2 x 10 x log10 Ec/Io) in units of 0.5 dB, as defined in [18], with Ec/Io referring to the value measured from the evaluated cell.

For cdma2000 RATs, ThreshX, HighP and ThreshX, LowP are equal to -1 times the values signalled for the corresponding parameters in the system information.

In all the above criteria the value of TreselectionRAT is scaled when the UE is in the medium or high mobility state as defined in subclause 5.2.4.3.1. If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an E-UTRAN frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

Cell reselection to another RAT, for which Squal based cell reselection parameters are broadcast in system information, shall be performed based on the Squal criteria if the UE supports Squal (RSRQ) based cell reselection to E-UTRAN from all the other RATs provided by system information which UE supports. Otherwise, cell reselection to another RAT shall be performed based on Srxlev criteria.

Cell reselection to NR, for which a cell reselection parameter, *q-RxLevMinSUL* is broadcast in system information and the UE supports SUL, shall be performed based on Srxlev criteria taking the parameter into account.

6.2.3.8.3 Test description

6.2.3.8.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1, NR Cell 1 is higher priority inter-RAT NR cell.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 31 as defined in TS 36.508-1 [7] clause 4.4.3.1 is used in E-UTRA Cell.

- System information combination NR-6 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

- the UE is switched-off.

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (E-UTRA/EPC) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established.

6.2.3.8.3.2 Test procedure sequence

Table 6.2.3.8.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1"is applied at the points indicated in the Main behaviour description in Table 6.2.3.8.3.2-3.

Table 6.2.3.8.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell and NR Cell in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **E-UTRA**  **Cell 1** | **NR**  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA Cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | Off |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -90 | - | The power level values are assigned to satisfy Srxlev E-UTRA Cell 1 >Snonintrasearch and and SrxlevNR Cell 1> Threshx, high. |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -80 |

Table 6.2.3.8.3.2-2: Void

Table 6.2.3.8.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the E-UTRAN and NR Cell power levels according to row "T1" in table 6.2.3.8.3.2-1. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1?  NOTE: This is the first time in this test case that the UE moves from S1 to N1. | - | - | 1 | - |
| 3 | Void. | - | - | - | - |

6.2.3.8.3.3 Specific message contents

Table 6.2.3.8.3.3-1: *SystemInformationBlockType3* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.8.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| s-NonIntraSearch | 3 | 6 dB |  |
| threshServingLow | 3 | 6 dB |  |
| } |  |  |  |

Table 6.2.3.8.3.3-2: *SystemInformationBlockType24* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.8.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink SSB ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 5 |  |  |
| threshX-High-r15 | 10 | 20 dB |  |
| threshX-Low-r15 | 20 | 40 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionNR-r15 | 7 | 7 Seconds |  |
| } |  |  |  |

Table 6.2.3.8.3.3-3: SIB2 of NR Cell 1 (preabmle and all steps, Table 6.2.3.8.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 3 | 6 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.8.3.3-4: *SIB5* of NR Cell 1(preamble and all steps, Table 6.2.3.8.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508 [6], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 1 entry |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Downlink EUTRA ARFCN as E-UTRA Cell 1 used |  |  |
| cellReselectionPriority | 3 |  |  |
| threshX-High | 15 | 30 dB |  |
| threshX-Low | 15 | 30 dB |  |
| } |  |  |  |
| } |  |  |  |
| t-ReselectionEUTRA | 7 | 7 Seconds |  |
| } |  |  |  |

#### 6.2.3.9 Void

#### 6.2.3.10 Inter-RAT cell reselection / From E-UTRA\_IDLE to NR RRC\_IDLE / schedulingInfoList-v12j0

6.2.3.10.1 Test Purpose (TP)

(1)

**with** { the UE is in E-UTRA IDLE state and *SystemInformationBlockType24* scheduled by optional extended field *schedulingInfoList-v12j0* in *SystemInformationBlockType1* is broadcasted }

**ensure that** {

**when** { UE detects the cell re-selection criteria is met for a lower priority NR cell }

**then** { UE reselects to the NR cell }

}

6.2.3.10.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 36.331, clause 5.2.3 and 5.2.3a and TS 36.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 36.331, clause 5.2.3]

When acquiring an SI message, the UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*, *schedulingInfoListExt* (if present) or if the concerned SI message is configured in the *pos-schedulingInfoList* and *si-posOffset* is not configured;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list of SI messages configured by *schedulingInfoList*, *schedulingInfoListExt* (if present) and *posSchedulingInfoList* in *SystemInformationBlockType1*;

3> determine the integer value *x* = (*n* – 1)\**w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10), where *T* is the *si-Periodicity* of the concerned SI message;

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *si-posOffset* is configured determine the start of the SI-window for the concerned SI message as follows:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* and *schedulingInfoListExt* (if present) in *SystemInformationBlockType1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SystemInformationBlockType1*;

3> determine the integer value *x* = *m*\**w +* (*n* – 1)\**w*, where *w* is the *si-WindowLength*

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10) + 8, where *T* is the *si-posPeriodicity* of the concerned SI message;

NOTE: E-UTRAN should configure an SI-window of 1 ms only if all SIs are scheduled before subframe #5 in radio frames for which SFN mod 2 = 0.

1> receive DL-SCH using the SI-RNTI from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength*, or until the SI message was received, excluding the following subframes:

2> subframe #5 in radio frames for which SFN mod 2 = 0;

2> any MBSFN subframes;

2> any uplink subframes in TDD;

1> if the SI message was not received by the end of the SI-window, repeat reception at the next SI-window occasion for the concerned SI message;

[TS 36.331, clause 5.2.3a]

When acquiring an SI message, the BL UE or UE in CE or NB-IoT UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*, *schedulingInfoListExt* (if present) or if the concerned SI message is configured in the *pos-schedulingInfoList* and *si-posOffset* is not configured;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list of SI messages configured by *schedulingInfoList*, *schedulingInfoListExt* (if present) in *SystemInformationBlockType1-BR* (or *SystemInformationBlockType1-NB* in NB-IoT) and *posSchedulingInfoList* in *SystemInformationBlockType1-BR*;

3> determine the integer value *x* = (*n* – 1)\**w*, where *w* is the *si-WindowLength-BR* (or *si-WindowLength* in NB-IoT);

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *si-posOffset* is configured determine the start of the SI-window for the concerned SI message as follows:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* and *schedulingInfoListExt* (if present) in *SystemInformationBlockType1-BR*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SystemInformationBlockType1-BR*;

3> determine the integer value *x* = *m*\**w +* (*n* – 1)\**w*, where *w* is the *si-WindowLength-BR*;

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10) + 8, where *T* is the *si-posPeriodicity* of the concerned SI message;

2> if the UE is a NB-IoT UE:

3> the SI-window starts at the subframe #0 in the radio frame for which (H-SFN \* 1024 + SFN) mod *T* = FLOOR(*x*/10) + Offset, where *T* is the *si-Periodicity* of the concerned SI message and, Offset is the offset of the start of the SI-Window (*si-RadioFrameOffset*);

2> else:

3> the SI-window starts at the subframe #0 in the radio frame for which SFN mod *T* = FLOOR(*x*/10), where *T* is the *si-Periodicity* of the concerned SI message;

1> if the UE is a NB-IoT UE:

2> receive and accumulate SI message transmissions on DL-SCH from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength,* starting from the radio frames as provided in *si-RepetitionPattern* and in subframes as provided in *downlinkBitmap*, or until successful decoding of the accumulated SI message transmissions excluding the subframes used for transmission of NPSS, NSSS, *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* and *SystemInformationBlockType1-NB*. If there are not enough subframes for one SI message transmission in the radio frames as provided in *si-RepetitionPattern*, the UE shall continue to receive the SI message transmission in the radio frames following the radio frame indicated in *si-RepetitionPattern*;

1> else:

2> receive and accumulate SI message transmissions on DL-SCH on narrowband provided by *si-Narrowband*, from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength-BR,* only in radio frames as provided in *si-RepetitionPattern* and subframes as provided in *fdd-DownlinkOrTddSubframeBitmapBR* in *bandwidthReducedAccessRelatedInfo*, or until successful decoding of the accumulated SI message transmissions;

1> if the SI message was not possible to decode from the accumulated SI message transmissions by the end of the SI-window, continue reception and accumulation of SI message transmissions on DL-SCH in the next SI-window occasion for the concerned SI message;

[TS 36.304, clause 5.2.4.1]

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCConnectionReject* unless specified otherwise. When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority.

NOTE 1: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it cannot receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it cannot receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 36.133 [10] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection.

NOTE 7: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

[TS 36.304, clause 5.2.4.2]

For NB-IoT measurement rules for cell re-selection is defined in sub-clause 5.2.4.2.a.

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for E-UTRAN inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For an E-UTRAN inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current E-UTRA frequency the UE shall perform measurements of higher priority E-UTRAN inter-frequency or inter-RAT frequencies according to TS 36.133 [10].

- For an E-UTRAN inter-frequency with an equal or lower reselection priority than the reselection priority of the current E-UTRA frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current E-UTRAN frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo*.

- Otherwise,the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3*, the UE may further limit the needed measurements, as specified in sub-clause 5.2.4.12.

[TS 36.304, clause 5.2.4.5]

For NB-IoT inter-frequency cell reselection shall be based on ranking as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT; or

- A cell of a higher priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority E-UTRAN frequency shall be based on ranking for Intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT; or

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/ frequency shall take precedence over a lower priority RAT/ frequency, if multiple cells of different priorities fulfil the cell reselection criteria.

The UE shall not perform cell reselection to NR or UTRAN FDD cells for which the cell selection criterion S is not fulfilled.

For cdma2000 RATs, Srxlev is equal to -FLOOR(-2 x 10 x log10 Ec/Io) in units of 0.5 dB, as defined in [18], with Ec/Io referring to the value measured from the evaluated cell.

For cdma2000 RATs, ThreshX, HighP and ThreshX, LowP are equal to -1 times the values signalled for the corresponding parameters in the system information.

In all the above criteria the value of TreselectionRAT is scaled when the UE is in the medium or high mobility state as defined in subclause 5.2.4.3.1. If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an E-UTRAN frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

Cell reselection to another RAT, for which Squal based cell reselection parameters are broadcast in system information, shall be performed based on the Squal criteria if the UE supports Squal (RSRQ) based cell reselection to E-UTRAN from all the other RATs provided by system information which UE supports. Otherwise, cell reselection to another RAT shall be performed based on Srxlev criteria.

Cell reselection to NR, for which a cell reselection parameter, *q-RxLevMinSUL* is broadcast in system information and the UE supports SUL, shall be performed based on Srxlev criteria taking the parameter into account.

6.2.3.10.3 Test description

6.2.3.10.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1, NR Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 1 as defined in TS 36.508 [7] clause 4.4.3.1 is used in E-UTRA Cell 1. *SystemInformationBlockType1* is broadcasted with extended fields as specified in Table 6.2.3.10.3.3-1. And *SystemInformationBlockType24* is broadcasted according to scheduling information specified in Table 6.2.3.10.3.3-1.

- System information combination NR-1 defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell 1.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_CONNECTED 1N-A, Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

- The UE is switched-off

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5. 4. 4G GUTI and eKSI are assigned and security context established.

6.2.3.10.3.2 Test procedure sequence

Table 6.2.3.10.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.3.10.3.2-3.

Table 6.2.3.10.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **E-UTRA**  **Cell 1** | NR  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | Off |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -95 | - | The power level values are assigned to satisfy both SrxlevNR Cell 1 > Threshx, low and SrxlevE-UTRA Cell 1 < Threshserving, low |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -80 |
| Note1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.2.3.10.3.2-2: Void

Table 6.2.3.10.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the E-UTRAN and NR Cell power levels according to row "T1" in table 6.2.3.10.3.2-1. | - | - | - | - |
| 1A | Wait for 1s (Note 2). | - | - | - | - |
| 1B | The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to E-UTRA RRC\_IDLE. | <-- | RRC: *RRCConnectionRelease* | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1 within 34s for FR1? (Note 1) | - | - | 1 | P |
| Note 1: The wait time for reselection to an newly detected Inter-RAT NR cell is selected to cover Tdetect,NR (32s for FR1) + TSI-NR (1280 ms system information block type scheduling) = 33.28s rounded up to 34s for FR1 .  Note 2: The wait time 1 sec is added to allow the NR cell to be setup before RRC is released on E-UTRAN. This will avoid the UE to miss the Tdetect,NR window if the NR cell is not up. | | | | | |

6.2.3.10.3.3 Specific message contents

Table 6.2.3.10.3.3-1: *SystemInformationBlockType1* for cell 1 (preamble and all steps, Table 6.2.3.11.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| lateNonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| schedulingInfoList-v12j0 SEQUENCE (SIZE (1..maxSI-Message)) OF SEQUENCE { | 2 entries | It includes the same number of entries, and listed in the same order, as in *schedulingInfoList* (without suffix). |  |
| SchedulingInfo-v12j0[1] SEQUENCE { |  | entry 1 |  |
| SIB-MappingInfo-v12j0 | Not present |  |  |
| } |  |  |  |
| SchedulingInfo-v12j0[2] SEQUENCE { |  | entry 2 |  |
| SIB-MappingInfo-v12j0 SEQUENCE (SIZE (1..maxSIB-1)) OF SIB-Type-v12j0 { | 1 entry |  |  |
| SIB-Type-v12j0[1] | sibType24-v1530 | entry 2, SIB24 is mapped into the SI message scheduled via the second entry of *schedulingInfoList* (without suffix) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.10.3.3-2: *SystemInformationBlockType3* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.10.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLow | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.10.3.3-3: *SystemInformationBlockType24* of EUTRA Cell 1 (preamble and all steps, Table 6.2.3.10.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Downlink NR ARFCN of SSB for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| threshX-Low-r15 | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.2.3.11 Inter-RAT cell reselection / From E-UTRA\_IDLE to NR RRC\_IDLE / schedulingInfoListExt-r12

6.2.3.11.1 Test Purpose (TP)

(1)

**with** { the UE is in E-UTRA IDLE state and *SystemInformationBlockType24* scheduled by optional extended field *schedulingInfoListExt-r12* in *SystemInformationBlockType1* is broadcasted }

**ensure that** {

**when** { UE detects the cell re-selection criteria is met for a lower priority NR cell }

**then** { UE reselects to the NR cell }

}

6.2.3.11.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 36.331, clause 5.2.3 and 5.2.3a and TS 36.304, clause 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 36.331, clause 5.2.3]

When acquiring an SI message, the UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*, *schedulingInfoListExt* (if present) or if the concerned SI message is configured in the *pos-schedulingInfoList* and *si-posOffset* is not configured;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list of SI messages configured by *schedulingInfoList*, *schedulingInfoListExt* (if present) and *posSchedulingInfoList* in *SystemInformationBlockType1*;

3> determine the integer value *x* = (*n* – 1)\**w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10), where *T* is the *si-Periodicity* of the concerned SI message;

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *si-posOffset* is configured determine the start of the SI-window for the concerned SI message as follows:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* and *schedulingInfoListExt* (if present) in *SystemInformationBlockType1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SystemInformationBlockType1*;

3> determine the integer value *x* = *m*\**w +* (*n* – 1)\**w*, where *w* is the *si-WindowLength*

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10) + 8, where *T* is the *si-posPeriodicity* of the concerned SI message;

NOTE: E-UTRAN should configure an SI-window of 1 ms only if all SIs are scheduled before subframe #5 in radio frames for which SFN mod 2 = 0.

1> receive DL-SCH using the SI-RNTI from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength*, or until the SI message was received, excluding the following subframes:

2> subframe #5 in radio frames for which SFN mod 2 = 0;

2> any MBSFN subframes;

2> any uplink subframes in TDD;

1> if the SI message was not received by the end of the SI-window, repeat reception at the next SI-window occasion for the concerned SI message;

[TS 36.331, clause 5.2.3a]

When acquiring an SI message, the BL UE or UE in CE or NB-IoT UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*, *schedulingInfoListExt* (if present) or if the concerned SI message is configured in the *pos-schedulingInfoList* and *si-posOffset* is not configured;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list of SI messages configured by *schedulingInfoList*, *schedulingInfoListExt* (if present) in *SystemInformationBlockType1-BR* (or *SystemInformationBlockType1-NB* in NB-IoT) and *posSchedulingInfoList* in *SystemInformationBlockType1-BR*;

3> determine the integer value *x* = (*n* – 1)\**w*, where *w* is the *si-WindowLength-BR* (or *si-WindowLength* in NB-IoT);

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *si-posOffset* is configured determine the start of the SI-window for the concerned SI message as follows:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* and *schedulingInfoListExt* (if present) in *SystemInformationBlockType1-BR*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SystemInformationBlockType1-BR*;

3> determine the integer value *x* = *m*\**w +* (*n* – 1)\**w*, where *w* is the *si-WindowLength-BR*;

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10) + 8, where *T* is the *si-posPeriodicity* of the concerned SI message;

2> if the UE is a NB-IoT UE:

3> the SI-window starts at the subframe #0 in the radio frame for which (H-SFN \* 1024 + SFN) mod *T* = FLOOR(*x*/10) + Offset, where *T* is the *si-Periodicity* of the concerned SI message and, Offset is the offset of the start of the SI-Window (*si-RadioFrameOffset*);

2> else:

3> the SI-window starts at the subframe #0 in the radio frame for which SFN mod *T* = FLOOR(*x*/10), where *T* is the *si-Periodicity* of the concerned SI message;

1> if the UE is a NB-IoT UE:

2> receive and accumulate SI message transmissions on DL-SCH from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength,* starting from the radio frames as provided in *si-RepetitionPattern* and in subframes as provided in *downlinkBitmap*, or until successful decoding of the accumulated SI message transmissions excluding the subframes used for transmission of NPSS, NSSS, *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* and *SystemInformationBlockType1-NB*. If there are not enough subframes for one SI message transmission in the radio frames as provided in *si-RepetitionPattern*, the UE shall continue to receive the SI message transmission in the radio frames following the radio frame indicated in *si-RepetitionPattern*;

1> else:

2> receive and accumulate SI message transmissions on DL-SCH on narrowband provided by *si-Narrowband*, from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength-BR,* only in radio frames as provided in *si-RepetitionPattern* and subframes as provided in *fdd-DownlinkOrTddSubframeBitmapBR* in *bandwidthReducedAccessRelatedInfo*, or until successful decoding of the accumulated SI message transmissions;

1> if the SI message was not possible to decode from the accumulated SI message transmissions by the end of the SI-window, continue reception and accumulation of SI message transmissions on DL-SCH in the next SI-window occasion for the concerned SI message;

[TS 36.304, clause 5.2.4.1]

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCConnectionReject* unless specified otherwise. When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority.

NOTE 1: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it cannot receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it cannot receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 36.133 [10] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection.

NOTE 7: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

[TS 36.304, clause 5.2.4.2]

For NB-IoT measurement rules for cell re-selection is defined in sub-clause 5.2.4.2.a.

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for E-UTRAN inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For an E-UTRAN inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current E-UTRA frequency the UE shall perform measurements of higher priority E-UTRAN inter-frequency or inter-RAT frequencies according to TS 36.133 [10].

- For an E-UTRAN inter-frequency with an equal or lower reselection priority than the reselection priority of the current E-UTRA frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current E-UTRAN frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo*.

- Otherwise,the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3*, the UE may further limit the needed measurements, as specified in sub-clause 5.2.4.12.

[TS 36.304, clause 5.2.4.5]

For NB-IoT inter-frequency cell reselection shall be based on ranking as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT; or

- A cell of a higher priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority E-UTRAN frequency shall be based on ranking for Intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT; or

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/ frequency shall take precedence over a lower priority RAT/ frequency, if multiple cells of different priorities fulfil the cell reselection criteria.

The UE shall not perform cell reselection to NR or UTRAN FDD cells for which the cell selection criterion S is not fulfilled.

For cdma2000 RATs, Srxlev is equal to -FLOOR(-2 x 10 x log10 Ec/Io) in units of 0.5 dB, as defined in [18], with Ec/Io referring to the value measured from the evaluated cell.

For cdma2000 RATs, ThreshX, HighP and ThreshX, LowP are equal to -1 times the values signalled for the corresponding parameters in the system information.

In all the above criteria the value of TreselectionRAT is scaled when the UE is in the medium or high mobility state as defined in subclause 5.2.4.3.1. If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an E-UTRAN frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

Cell reselection to another RAT, for which Squal based cell reselection parameters are broadcast in system information, shall be performed based on the Squal criteria if the UE supports Squal (RSRQ) based cell reselection to E-UTRAN from all the other RATs provided by system information which UE supports. Otherwise, cell reselection to another RAT shall be performed based on Srxlev criteria.

Cell reselection to NR, for which a cell reselection parameter, *q-RxLevMinSUL* is broadcast in system information and the UE supports SUL, shall be performed based on Srxlev criteria taking the parameter into account.

6.2.3.11.3 Test description

6.2.3.11.3.1 Pre-test conditions

System Simulator:

- E-UTRA Cell 1, NR Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination 1 as defined in TS 36.508 [7] clause 4.4.3.1 is used in E-UTRA Cell 1. *SystemInformationBlockType1* is broadcasted with extended fields as specified in Table 6.2.3.11.3.3-1. And *SystemInformationBlockType24* is broadcasted according to scheduling information specified in Table 6.2.3.11.3.3-1.

- System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR Cell 1.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_CONNECTED 1N-A, Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.2.2-2. 5G-GUTI and ngKSI are assigned and security context established.

- the UE is switched-off

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (*E-UTRA/EPC*) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4. 4G GUTI and eKSI are assigned and security context established.

6.2.3.11.3.2 Test procedure sequence

Table 6.2.3.11.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cell at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. Row marked "T0" denotes the conditions in the preamble. Configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.2.3.11.3.2-3.

Table 6.2.3.11.3.2-1: Time instances of cell power level and parameter changes for E-UTRA Cell 1 and NR Cell 1 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **E-UTRA**  **Cell 1** | NR  **Cell 1** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/15kHz | -85 | - | The power level values are assigned to ensure UE registered on E-UTRA cell 1 |
| SS/PBCH  SSS EPRE | dBm/SCS | - | Off |
| T1 | Cell-specific RS EPRE | dBm/15kHz | -95 | - | The power level values are assigned to satisfy both SrxlevNR Cell 1 > Threshx, low and SrxlevE-UTRA Cell 1 < Threshserving, low |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -80 |
| Note1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.2.3.11.3.2-2: Void

Table 6.2.3.11.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the E-UTRAN and NR Cell power levels according to row "T1" in table 6.2.3.11.3.2-1. | - | - | - | - |
| 1A | Wait for 1s (Note 2). | - | - | - | - |
| 1B | The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to E-UTRA RRC\_IDLE. | <-- | RRC: *RRCConnectionRelease* | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 indicate that the UE is camped on NR Cell 1 within 34s for FR1? (Note 1) | - | - | 1 | P |
| Note 1: The wait time for reselection to an newly detected Inter-RAT NR cell is selected to cover Tdetect,NR (32s for FR1) + TSI-NR (1280 ms system information block type scheduling) = 33.28s rounded up to 34s for FR1.  Note 2: The wait time 1 sec is added to allow the NR cell to be setup before RRC is released on E-UTRAN. This will avoid the UE to miss the Tdetect,NR window if the NR cell is not up. | | | | | |

6.2.3.11.3.3 Specific message contents

Table 6.2.3.11.3.3-1: *SystemInformationBlockType1* for E-UTRA Cell 1 (Preamble and all steps)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType1 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| lateNonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| schedulingInfoListExt-r12 SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfoExt-r12 { | 1 entry |  |  |
| SchedulingInfoExt-r12[1] SEQUENCE { |  | entry 1 |  |
| si-Periodicity-r12 | rf64 |  |  |
| SIB-MappingInfo-v12j0 SEQUENCE (SIZE (1..maxSIB-1)) OF SIB-Type-v12j0 { | 1 entry |  |  |
| SIB-Type-v12j0[1] | sibType24-v1530 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.11.3.3-2: *SystemInformationBlockType3* of E-UTRA Cell 1 (preamble and all steps , Table 6.2.3.11.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.4.3.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SystemInformationBlockType3 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLow | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.3.11.3.3-3: *SystemInformationBlockType24* of E-UTRA Cell 1 (preamble and all steps, Table 6.2.3.11.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 36.508 [7], Table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Downlink NR ARFCN of SSB for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 3 |  |  |
| threshX-Low-r15 | 10 | 20 dB |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

## 6.3 5GS Steering of Roaming

### 6.3.1 Steering of Roaming

#### 6.3.1.1 Steering of UE in roaming during registration/security check successful using List Type 1

6.3.1.1.1 Test Purpose (TP)

(1)

**with** {UE being in automatic PLMN selection mode, current VPLMN not part of “PLMNs where registration was aborted due to SOR” List and not part of "User Controlled PLMN Selector with Access Technology" list and UE's USIM configured with indication that the UE is to receive Steering of Roaming information due to initial registration in a VPLMN}

**ensure that** {

**when** {SOR Transparent container indicates ACK has been requested & List Type indicates PLMN ID and Access technology list in REGISTRATION ACCEPT and security check is successful}

**then** {UE sends ACK in REGISTRATION COMPLETE, waits for network release of the NAS signalling connection and selects higher priority PLMN}

}

6.3.1.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.2]

6) The VPLMN AMF to the UE: The VPLMN AMF shall transparently send the received steering of roaming information to the UE in the REGISTRATION ACCEPT message;

7) If the steering of roaming information is received and the security check is successful, then:

a) if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]):

- if the UDM has not requested an acknowledgement from the UE the UE shall send the REGISTRATION COMPLETE message;

- the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41].

NOTE 1: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

- if the UDM has not requested an acknowledgement from the UE and the ME receives a USAT REFRESH command qualifier (3GPP TS 31.111 [41]) of type "Steering of Roaming" it shall perform items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6 and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

b) if the steering of roaming information contains the list of preferred PLMN/access technology combinations, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations. Additionally, if the UDM has not requested an acknowledgement from the UE and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container and then either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 and 10;

8) If:

a) the UE's USIM is configured with indication that the UE is to receive the steering of roaming information due to initial registration in a VPLMN, but neither the list of preferred PLMN/access technology combinations nor the secured packet nor the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' is received in the REGISTRATION ACCEPT message, when the UE performs initial registration in a VPLMN or if the steering of roaming information is received but the security check is not successful; and

b) the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR", not part of "User Controlled PLMN Selector with Access Technology" list, the UE is not in manual mode of operation and the PDU session for emergency services is not pending to be activated;

then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container, release the current N1 NAS signalling connection locally, store the PLMN identity in the list of "PLMNs where registration was aborted due to SOR" and attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, and skip steps 9 to 12;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

9) The UE to the VPLMN AMF: If the UDM has requested an acknowledgement from the UE:

the UE verified that the steering of roaming information has been provided by the HPLMN in step 7, the UE sends the REGISTRATION COMPLETE message to the serving AMF with an SOR transparent container including the UE acknowledgement; and

if the steering of roaming information contained a secured packet and the security check was successful, then when the UE receives the USAT REFRESH command qualifier of type "Steering of Roaming", it performs items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6.

10) The AMF to the UDM: If an SOR transparent container is received in the REGISTRATION COMPLETE message, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge the successful security check of the received steering of roaming information in step 4, the UDM verifies that the acknowledgement is provided by the UE as specified in 3GPP TS 33.501 [66];

11) If the UE has a list of available PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired after the release of the N1 NAS signalling connection. If the N1 NAS signaling connection is not released after implementation dependent time, the UE may locally release the N1 signaling connection except when the UE is registered for emergency services or the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]); and

12) The UE deletes the list of "PLMNs where registration was aborted due to SOR".

The list of "PLMNs where registration was aborted due to SOR" is deleted when the UE is switched off or the USIM is removed.

6.3.1.1.3 Test Description

6.3.1.1.3.1 Pre-test conditions

System Simulator:

Three inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.1.3.1-1.

The PLMNs are identified in the test by the identifiers in Table 6.3.1.1.3.1-1. The MCC and MNC values corresponding to the PLMN identifier shall understood as those specified in TS 36.523-1 [42], Table 6.0.1-1.

Table 6.3.1.1.3.1–1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |
| NR Cell 13 | PLMN14 |

NR Cell 11 is set to ''ServingCell”;

NR Cell 12 is set to ''Serving Cell'';

NR Cell 13 is set to “Serving Cell'';

System Information Combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-10 in TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.1.4 Test procedure sequence

Table 6.3.1.1.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE | - |  | - | - |
| 2-14 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed on NR Cell 13 | - | - | - | - |
| 15 | The SS transmits an *DLInformationTransfer* message and an REGISTRATION ACCEPT message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception | <-- | NR RRC: *DLInformationTransfer*  5G MM: REGISTRATION ACCEPT | - | - |
| 16 | SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) |  |  |  |  |
| 17 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message carrying acknowledgement of successful reception of the steering of roaming information | --> | NR RRC: *ULInformationTransfer*  5G MM: REGISTRATION COMPLETE | 1 | P |
| - | EXCEPTION: Step 18a1 is performed in pc\_noOf\_PDUsSameConnection > 0. | - | - | - | - |
| 18a1 | The generic procedure for UE-requested PDU session establishment, specified in subclause 4.5A.2, takes place performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsSameConnection. | - | - | - | - |
| 18a2-18a5a1 | Void. | - | - | - | - |
| 18A | The SS transmits an *RRCRelease* message. | <-= | NR RRC: *RRCRelease* |  |  |
| - | EXCEPTION: Step 18Ba1 is performed if pc\_noOf\_PDUsNewConnection > 0 and the UE starts PDU session establishment automatically | - | - | - | - |
| 18Ba1 | The generic procedure for UE-requested PDU session establishment, specified in subclause 4.5.2.2-4, takes place from step 2 to 9a1 performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsNewConnection on NR Cell 13 and then release the RRC Connection. | - | - | - | - |
| 19 | Check: Does the UE transmits an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 20-21 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 4) | - | - | - | - |
| - | EXCEPTION: Steps 22a1 to 22b5a1 describe behaviours which depend on procedure parameters; the "lower case letter" identifies a step sequence that take place if a procedure parameter has a particular value. | - | - | - | - |
| 22a1-22a16a1 | IF 5GS registration type is set as Initial Registration in step 21, THEN steps 5 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 11. | - | - | - | - |
| 22b1-22b2 | Void | - | - | - | - |
| 22b3-22b5a1 | ELSE IF 5GS registration type is set as Mobility Registration in step 21, THEN steps 4 to 6a1 of the generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 11. | - | - | - | - |
| Note 1: Timer tmax in step 16 and 19 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12).Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 5min is added to allow time for the UE to find the proper PLMN  Note 4: The 5GS registration type shall be only set as Mobility Registration for R16 UEs according to TS 24.501 [22] subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to R15 UEs. | | | | | |

6.3.1.1.5 Specific message contents

Table 6.3.1.1.5-1: REGISTRATION ACCEPT for NR Cell 13 (step 15, Table 6.3.1.1.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 1 | Acknowledgement requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |

Table 6.3.1.1.5-2: Void

Table 6.3.1.1.5-3: REGISTRATION COMPLETE for NR Cell 13 (step 17, Table 6.3.1.1.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |
| SOR data type | 1 | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |

Table 6.3.1.1.5-4: Void

Table 6.3.1.1.5-5: REGISTRATION ACCEPT for NR Cell 11 (step 22a10, Table 6.3.1.1.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 1 | Acknowledgement requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |

Table 6.3.1.1.5-6: REGISTRATION COMPLETE for NR Cell 11 (step 22a11, Table 6.3.1.1.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |
| SOR data type | 1 | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |

#### 6.3.1.2 Steering of UE in roaming during registration/security check successful but SOR Transparent container indicates ACK has been NOT been requested

6.3.1.2.1 Test Purpose (TP)

(1)

**with** {UE being in automatic PLMN selection mode, current VPLMN not part of “PLMNs where registration was aborted due to SOR” List and not part of "User Controlled PLMN Selector with Access Technology" list and UE's USIM configured with indication that the UE is to receive Steering of Roaming information due to initial registration in a VPLMN}

**ensure that** {

**when** {SOR Transparent container indicates ACK has NOT been requested & List Type indicates PLMN ID and Access technology list in REGISTRATION ACCEPT and security check is successful and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN}

**then** {the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container and then either  releases N1 NAS Signaling connection locally and then attempt to obtain service on a higher priority PLMN or optionally wait for network release of the NAS signalling connection and then selects higher priority PLMN}

}

6.3.1.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.2, TS 24.501 clause 4.4.4.2 and 5.5.1.2.4. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.2]

6) The VPLMN AMF to the UE: The VPLMN AMF shall transparently send the received steering of roaming information to the UE in the REGISTRATION ACCEPT message;

7) If the steering of roaming information is received and the security check is successful, then:

a) if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]):

- if the UDM has not requested an acknowledgement from the UE the UE shall send the REGISTRATION COMPLETE message;

- the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41].

NOTE 1: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

- if the UDM has not requested an acknowledgement from the UE and the ME receives a USAT REFRESH command qualifier (3GPP TS 31.111 [41]) of type "Steering of Roaming" it shall perform items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6 and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

b) if the steering of roaming information contains the list of preferred PLMN/access technology combinations, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations. Additionally, if the UDM has not requested an acknowledgement from the UE and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container and then either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 and 10;

8) If:

a) the UE's USIM is configured with indication that the UE is to receive the steering of roaming information due to initial registration in a VPLMN, but neither the list of preferred PLMN/access technology combinations nor the secured packet nor the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' is received in the REGISTRATION ACCEPT message, when the UE performs initial registration in a VPLMN or if the steering of roaming information is received but the security check is not successful; and

b) the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR", not part of "User Controlled PLMN Selector with Access Technology" list, the UE is not in manual mode of operation and the PDU session for emergency services is not pending to be activated;

then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container, release the current N1 NAS signalling connection locally, store the PLMN identity in the list of "PLMNs where registration was aborted due to SOR" and attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, and skip steps 9 to 12;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

9) The UE to the VPLMN AMF: If the UDM has requested an acknowledgement from the UE:

the UE verified that the steering of roaming information has been provided by the HPLMN in step 7, the UE sends the REGISTRATION COMPLETE message to the serving AMF with an SOR transparent container including the UE acknowledgement; and

if the steering of roaming information contained a secured packet and the security check was successful, then when the UE receives the USAT REFRESH command qualifier of type "Steering of Roaming", it performs items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6.

10) The AMF to the UDM: If an SOR transparent container is received in the REGISTRATION COMPLETE message, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge the successful security check of the received steering of roaming information in step 4, the UDM verifies that the acknowledgement is provided by the UE as specified in 3GPP TS 33.501 [66];

11) If the UE has a list of available PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired after the release of the N1 NAS signalling connection. If the N1 NAS signaling connection is not released after implementation dependent time, the UE may locally release the N1 signaling connection except when the UE is registered for emergency services or the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]); and

12) The UE deletes the list of "PLMNs where registration was aborted due to SOR".

The list of "PLMNs where registration was aborted due to SOR" is deleted when the UE is switched off or the USIM is removed.

[TS 24.501 clause 4.4.4.2]

…

The network can provide the SOR transparent container IE during the registration procedure to the UE in the REGISTRATION ACCEPT message. The SOR transparent container IE is integrity protected by the HPLMN as specified in 3GPP TS 33.501 [24].

…

[TS 24.501 clause 5.5.1.2.4]

…

If the REGISTRATION ACCEPT message includes the SOR transparent container IE and the SOR transparent container IE successfully passes the integrity check (see 3GPP TS 33.501 [24]):

a) the UE shall proceed with the behaviour as specified in 3GPP TS 23.122 [5] annex C; and

b) if the registration procedure is performed over 3GPP access and the UE attempts obtaining service on another PLMNs as specified in 3GPP TS 23.122 [5] annex C, then the UE may locally release the established N1 NAS signalling connection after sending a REGISTRATION COMPLETE message. Otherwise the UE shall send a REGISTRATION COMPLETE message and not release the current N1 NAS signalling connection locally. If an acknowledgement is requested in the SOR transparent container IE of the REGISTRATION ACCEPT message, the UE acknowledgement is included in the SOR transparent container IE of the REGISTRATION COMPLETE message.

If the SOR transparent container IE successfully passes the integrity check (see 3GPP TS 33.501 [24]), indicates list of preferred PLMN/access technology combinations is provided and the list type indicates:

a) "PLMN ID and access technology list", then the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME and shall proceed with the behaviour as specified in 3GPP TS 23.122 [5] annex C; or

b) "secured packet", then the ME shall behave as if a SMS is received with protocol identifier set to SIM data download, data coding scheme set to class 2 message and SMS payload as secured packet contents of SOR transparent container IE. The SMS payload is forwarded to UICC as specified in 3GPP TS 23.040 [4A] and the ME shall proceed with the behaviour as specified in 3GPP TS 23.122 [5] annex C.

…

6.3.1.2.3 Test Description

6.3.1.2.3.1 Pre-test conditions

System Simulator:

- Three inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.2.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.2.3.1-1. The MCC and MNC values corresponding to the PLMN identifier shall understood as those specified in TS 36.523-1 [42], Table 6.0.1-1.

Table 6.3.1.2.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |
| NR Cell 13 | PLMN14 |

NR Cell 11 is set to ''ServingCell”;

NR Cell 12 is set to ''Serving Cell'';

NR Cell 13 is set to “Serving Cell'';

System Information Combination NR-1 as defined in TS38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-10 in TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.2.4 Test procedure sequence

Table 6.3.1.2.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE. | - |  | - | - |
| 2-14 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed on NR Cell 13. | - | - | - | - |
| 15 | The SS transmits an *DLInformationTransfer* message and a REGISTRATION ACCEPT message containing steering of roaming information indicating that acknowledgment is not requested from the UE for successful reception. | <-- | NR RRC: *DLInformationTransfer*  5G MM: REGISTRATION ACCEPT | - | - |
| 16 | The SS also starts timer of tmax = (6 minutes + cell selection time) (Note 1, 2 and 3) | - | - | - | - |
| 17 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message without Steering of Roaming Transparent container. | --> | NR RRC: *ULInformationTransfer*  5G MM: REGISTRATION COMPLETE | -1 | - |
| - | EXCEPTION: Steps 18a1-18a5 are performed IF pc\_SOR\_ACKNotReqLocalRel is False, ELSE step 18b1 is performed. | - | - | - | - |
| - | EXCEPTION: Step 18a1a1 is performed in pc\_noOf\_PDUsSameConnection > 0. | - | - | - | - |
| 18a1a1 | The generic procedure for UE-requested PDU session establishment, specified in subclause 4.5A.2, takes place performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsSameConnection. | - | - | - | - |
| 18a2 | The SS transmits an *RRCRelease* message. | <-= | NR RRC: *RRCRelease* | - | - |
| - | EXCEPTION: Step 18a2a1 is performed if pc\_noOf\_PDUsNewConnection > 0 and the UE starts PDU session establishment automatically | - | - | - | - |
| 18a3a1 | The generic procedure for UE-requested PDU session establishment, specified in subclause 4.5.2.2-4, takes place from step 2 to 9a1 performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsNewConnection and then release the RRC Connection. | - | - | - | - |
| 18a4-18a5a1 | Void | - | - | - | - |
| 18b1 | The SS locally releases the RRC connection. | - | - | - | - |
| 19 | Void | - | - | - | - |
| 20 | Check: Does the UE transmits an *RRCSetupRequest* message on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 21 | The SS transmits an *RRCSetup* message on NR Cell 11. | <-- | NR RRC: *RRCSetup* | - | - |
| 22 | The UE transmits an *RRCSetupComplete* message and a REGISTRATION REQUEST message on NR Cell 11.  (Note 4) | --> | NR RRC: *RRCSetupComplete*  5GMM: REGISTRATION REQUEST | - | - |
| - | EXCEPTION: Steps 23a1 to 23b5a1 describe behaviours which depend on procedure parameters; the "lower case letter" identifies a step sequence that take place if a procedure parameter has a particular value | - | - | - | - |
| 23a1-23a15a1 | IF 5GS registration type is set as Initial Registration in step 22, THEN steps 5 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 11. | - | - | - | - |
| 23b1-23b2 | Void | - | - | - | - |
| 23b3-23b5a1 | ELSE IF 5GS registration type is set as Mobility Registration in step 22, THEN steps 4 to 6a1 of the generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 11. | - | - | - | - |
| 24-26 | Void | - | - | - | - |
| Note 1: Timer tmax in step 16 and 20 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used, where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 5min is added to allow time for the UE to find the proper PLMN  Note 4: The 5GS registration type shall be only set as Mobility Registration for Rel-16 UEs according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to Rel-15 UEs. | | | | | |

6.3.1.2.5 Specific message contents

Table 6.3.1.2.5-1: REGISTRATION ACCEPT for NR Cell 12 (step 15, Table 6.3.1.2.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 0 | Acknowledgement is NOT requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |
| PLMN ID 2 | PLMN13 |  |  |
| Access Technology Identifier 2 | NG-RAN |  |  |
| PLMN ID 3 | PLMN14 |  |  |
| Access Technology Identifier 3 | NG-RAN |  |  |

Table 6.3.1.2.5-2: Void

Table 6.3.1.2.5-3: REGISTRATION COMPLETE for NR Cell 13 (step 17, Table 6.3.1.2.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present | The SOR transparent container should not be present when ACK is not requested by UDM. |  |

Table 6.3.1.2.5-4: REGISTRATION ACCEPT for NR Cell 11 (step 23a10, Table 6.3.1.2.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 0 | Acknowledgement is NOT requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |
| PLMN ID 2 | PLMN13 |  |  |
| Access Technology Identifier 2 | NG-RAN |  |  |
| PLMN ID 3 | PLMN14 |  |  |
| Access Technology Identifier 3 | NG-RAN |  |  |

#### 6.3.1.3 Steering of UE in roaming during registration/security check unsuccessful/Automatic mode

6.3.1.3.1 Test Purpose (TP)

(1)

**with** {UE being in automatic PLMN selection mode **and** current VPLMN not part of “PLMNs where registration was aborted due to SOR” List and not part of "User Controlled PLMN Selector with Access Technology" list **and** UE's USIM configured with indication that the UE is to receive Steering of Roaming information due to initial registration in a VPLMN}

**ensure that** {

**when** {Security check on the steering of roaming information SOR Transparent container is unsuccessful}

**then** {UE sends REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container **and** releases the current N1 NAS signalling connection locally and attempts to obtain service on a higher priority PLMN}

}

6.3.1.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.2]

8) If:

a) the UE's USIM is configured with indication that the UE is to receive the steering of roaming information due to initial registration in a VPLMN, but neither the list of preferred PLMN/access technology combinations nor the secured packet nor the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' is received in the REGISTRATION ACCEPT message, when the UE performs initial registration in a VPLMN or if the steering of roaming information is received but the security check is not successful; and

b) the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR", not part of "User Controlled PLMN Selector with Access Technology" list, the UE is not in manual mode of operation and the PDU session for emergency services is not pending to be activated;

then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container, release the current N1 NAS signalling connection locally, store the PLMN identity in the list of "PLMNs where registration was aborted due to SOR" and attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, and skip steps 9 to 12;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

6.3.1.3.3 Test Description

6.3.1.3.3.1 Pre-test conditions

System Simulator:

- Three inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.3.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.3.3.1-1. The MCC and MNC values corresponding to the PLMN identifier shall understood as those specified in TS 36.523-1 [42], Table 6.0.1-1.

Table 6.3.1.3.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |
| NR Cell 13 | PLMN14 |

NR Cell 11 is set to ''Serving Cell'';

NR Cell 12 is set to ''Serving Cell'';

NR Cell 13 is set to “Serving Cell'';

System Information Combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-10 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.3.4 Test procedure sequence

Table 6.3.1.3.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE | - | - | - | - |
| 2-14 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 13 | - | - | - | - |
| 15 | The SS transmits a *DLInformationTransfer* message and a REGISTRATION ACCEPT message containing steering of roaming information, includes unmatched SOR-MAC-IAUSF that will result in unsuccessful security check while on UE reception | <-- | NR RRC: *DLInformationTransfer*  5G MM: REGISTRATION ACCEPT | - | - |
| 16 | SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 17 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message without including an SOR transparent container | --> | NR RRC: *ULInformationTransfer*  5G MM: REGISTRATION COMPLETE | 1 | P |
| 18-21a1 | Void | - | - | - | - |
| 22 | The SS locally releases the RRC connection. | - | - | - | - |
| 23 | Check: Does the UE transmits an *RRCSetupRequest* message on NR Cell 12 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 24 | The SS transmits an *RRCSetup* message on NR Cell 12. | <-- | NR RRC: *RRCSetup* | - | - |
| 25 | The UE transmits an *RRCSetupComplete* message and a REGISTRATION REQUEST message on NR Cell 12.  (Note 4) | --> | NR RRC: *RRCSetupComplete*  5GMM: REGISTRATION REQUEST | - | - |
| 25A – 25F | Steps 4 to 9 of the generic test procedure in TS 38.508-1 [4] Table 4.9.8.2.2-1 are performed. | - | - | - | - |
| 26 – 28a1 | Void | - | - | - | - |
| Note 1: Timer tmax in step 16 is derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 5min is added to allow time for the UE to find the proper PLMN  Note 4: The 5GS registration type shall be only set as Mobility Registration for Rel-16 UEs according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to Rel-15 UEs. | | | | | |

6.3.1.3.5 Specific message contents

Table 6.3.1.3.5-1: REGISTRATION ACCEPT for NR Cell 13 (step 15, Table 6.3.1.3.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to mismatch the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 1 | Acknowledgement requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |

Table 6.3.1.3.5-2: Void

Table 6.3.1.3.5-3: REGISTRATION COMPLETE for NR Cell 13 (step 17, Table 6.3.1.3.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present | The SOR transparent container is not included in REGISTRATION COMPLETE message |  |

Table 6.3.1.3.5-4: Void

Table 6.3.1.3.5-5: Void

Table 6.3.1.3.5-6: REGISTRATION REJECT (step 25E, Table 6.3.1.3.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-9 | | | |
| Information Element | | Value/remark | Comment | Condition |
| 5GMM cause | | ‘00010110’B | Cause #22 (Congestion) |  |
| T3346 Value | | ‘00100001’B | 1 minute |  |

#### 6.3.1.4 Steering of UE in roaming during registration/security check unsuccessful/Manual mode

6.3.1.4.1 Test Purpose (TP)

(1)

**with** {UE being in manual PLMN selection mode **and** current VPLMN not part of “PLMNs where registration was aborted due to SOR” List and not part of "User Controlled PLMN Selector with Access Technology" list **and** UE's USIM configured with indication that the UE is to receive Steering of Roaming information due to initial registration in a VPLMN}

**ensure that** {

**when** {Security check on the steering of roaming information SOR Transparent container is unsuccessful}

**then** {UE sends REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container **and** stays on this VPLMN}

}

6.3.1.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.2]

6) The VPLMN AMF to the UE: The VPLMN AMF shall transparently send the received steering of roaming information to the UE in the REGISTRATION ACCEPT message;

7) If the steering of roaming information is received and the security check is successful, then:

a) if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]):

- if the UDM has not requested an acknowledgement from the UE the UE shall send the REGISTRATION COMPLETE message;

- the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41];

NOTE 1: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

- if the UDM has not requested an acknowledgement from the UE and the ME receives a USAT REFRESH command qualifier (3GPP TS 31.111 [41]) of type "Steering of Roaming" it shall perform items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6 and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

b) if the steering of roaming information contains the list of preferred PLMN/access technology combinations, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations. Additionally, if the UDM has not requested an acknowledgement from the UE and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container and then either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

8) If:

a) the UE's USIM is configured with indication that the UE is to receive the steering of roaming information due to initial registration in a VPLMN, but neither the list of preferred PLMN/access technology combinations nor the secured packet nor the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' is received in the REGISTRATION ACCEPT message, when the UE performs initial registration in a VPLMN or if the steering of roaming information is received but the security check is not successful; and

b) the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR", not part of "User Controlled PLMN Selector with Access Technology" list, the UE is not in manual mode of operation and the PDU session for emergency services is not pending to be activated;

then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container, release the current N1 NAS signalling connection locally, store the PLMN identity in the list of "PLMNs where registration was aborted due to SOR" and attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, and skip steps 9 to 12;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

9) The UE to the VPLMN AMF: If the UDM has requested an acknowledgement from the UE:

the UE verified that the steering of roaming information has been provided by the HPLMN in step 7, the UE sends the REGISTRATION COMPLETE message to the serving AMF with an SOR transparent container including the UE acknowledgement; and

if the steering of roaming information contained a secured packet and the security check was successful, then when the UE receives the USAT REFRESH command qualifier of type "Steering of Roaming", it performs items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6.

10) The AMF to the UDM: If an SOR transparent container is received in the REGISTRATION COMPLETE message, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge the successful security check of the received steering of roaming information in step 4, the UDM verifies that the acknowledgement is provided by the UE as specified in 3GPP TS 33.501 [66];

11) If the UE has a list of available PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired after the release of the N1 NAS signalling connection. If the N1 NAS signalling connection is not released after implementation dependent time, the UE may locally release the N1 signalling connection except when the UE is registered for emergency services or the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]); and

12) The UE deletes the list of "PLMNs where registration was aborted due to SOR".

The list of "PLMNs where registration was aborted due to SOR" is deleted when the UE is switched off or the USIM is removed.

6.3.1.4.3 Test Description

6.3.1.4.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.4.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.4.3.1-1. The MCC and MNC values corresponding to the PLMN identifier shall understood as those specified in TS 36.523-1 [42], Table 6.0.1-1.

Table 6.3.1.4.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

NR Cell 11 is set to "Serving Cell";

NR Cell 12 is set to "Serving Cell";

System Information Combination NR-1 as defined in TS 38.508 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Manual PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-10 in TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0

6.3.1.4.4 Test procedure sequence

Table 6.3.1.4.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE | - | - | - | - |
| 2 | PLMN13 is manually selected | - | - | - | - |
| 3-15 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 12 | - | - | - | - |
| 16 | The SS transmits a *DLInformationTransfer* message and a REGISTRATION ACCEPT message containing steering of roaming information, includes unmatched SOR-MAC-IAUSF that will result in unsuccessful security check while on UE reception | <-- | NR RRC: *DLInformationTransfer* 5G MM: REGISTRATION ACCEPT | - | - |
| 17 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message without including an SOR transparent container | --> | NR RRC: *ULInformationTransfer* 5G MM: REGISTRATION COMPLETE | 1 | P |
| 18-21a1 | Steps 16 to 19a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 | - | - | - | - |
| 22 | The SS transmits an *RRCRelease* message | <-- | NR RRC: *RRCRelease* | - | - |
| 23 | SS starts timer of 1 minute and waits this timer expires | - | - | - | - |
| 24 | Check: Does the UE is in state 5GC RRC\_IDLE on NR Cell 12 as specified in TS 38.508-1 [4] Table 4.9.4.2.2-1? | - | - | 1 | P |
| 25 | The SS configures:  - NR Cell 11 as a "Non-Suitable "off" cell ". | - | - | - | - |
| 26 | The user sets the UE in Automatic PLMN selection mode. | - | - | - | - |
| 27 | Wait for 300s to allow the UE to switch to automatic PLMN selection mode. | - | - | - | - |

6.3.1.4.5 Specific message contents

Table 6.3.1.4.5-1: REGISTRATION ACCEPT for NR Cell 12 (step 16, Table 6.3.1.4.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |

Table 6.3.1.4.5-2: SOR Transparent Container in REGISTRATION ACCEPT for NR Cell 12 (step 16, Table 6.3.1.4.4-1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Derivation Path: TS 24.501 [22] Figure 9.11.3.51.1 | | | | | | | |
| Information Element | | Value/remark | | Comment | | Condition | |
| SoR-MAC-IAUS | | Set to mismatch the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 | |  | |  | |
| CounterSOR | | Value generated as per TS 33.501 Cl 6.14.2.3 | |  | |  | |
| SOR data type | | 0 | | The SOR transparent container carries steering of roaming information. | |  | |
| List indication value | | 1 | | List of preferred PLMN/access technology combinations is provided | |  | |
| List type | | 1 | | The list type is a PLMN ID and access technology list | |  | |
| Acknowledgement (ACK) value | | 1 | | Acknowledgement requested | |  | |
| PLMN ID 1 | | PLMN2 | |  | |  | |
| Access Technology Identifier 1 | | NG-RAN | |  | |  | |

Table 6.3.1.4.5-3: REGISTRATION COMPLETE for NR Cell 12 (step 17, Table 6.3.1.4.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4] Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present | The SOR transparent container is not included in REGISTRATION COMPLETE message |  |

#### 6.3.1.5 Steering of UE in roaming during registration/UE configured to receive Steering of Roaming information but does not receive Steering of Roaming from Network

6.3.1.5.1 Test Purpose (TP)

(1)

**with** {the UE in Automatic PLMN Selection mode, VPLMN not part of “PLMNs where registration was aborted due to SOR” List and not part of “User Controlled PLMN Selector with Access Technology” & UE's USIM configured with indication that the UE is to receive Steering of Roaming information due to initial registration in a VPLMN and the PDU session for emergency services is not pending to be activated}

**ensure that** {

**when** {neither the list of preferred PLMN/access technology combinations nor the HPLMN indication that “no change of the ‘Operator Controlled PLMN Selector with Access Technology’ list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided” is received in the REGISTRATION ACCEPT message}

**then** {UE releases N1 NAS Signalling connection locally, adds PLMN to “PLMNs where registration was aborted due to SOR” and performs PLMN selection with current VPLMN considered as lowest priority}

}

6.3.1.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clauses C.1 and C.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.1]

If:

- the UE's USIM is configured to indicate that the UE shall expect to receive the steering of roaming information during initial registration procedure but did not receive it or security check on the steering of roaming information fails;

- the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR";

- the current chosen VPLMN is not part of "User Controlled PLMN Selector with Access Technology" list; and

- the UE is not in manual mode of operation;

then the UE will perform PLMN selection with the current VPLMN considered as lowest priority.

[TS 23.122, clause C.2]

6) The VPLMN AMF to the UE: The VPLMN AMF shall transparently send the received steering of roaming information to the UE in the REGISTRATION ACCEPT message;

7) If the steering of roaming information is received and the security check is successful, then:

a) if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]):

- if the UDM has not requested an acknowledgement from the UE the UE shall send the REGISTRATION COMPLETE message;

- the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41];

NOTE 1: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

- if the UDM has not requested an acknowledgement from the UE and the ME receives a USAT REFRESH command qualifier (3GPP TS 31.111 [41]) of type "Steering of Roaming" it shall perform items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6 and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

b) if the steering of roaming information contains the list of preferred PLMN/access technology combinations, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations. Additionally, if the UDM has not requested an acknowledgement from the UE and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container and then either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

8) If:

a) the UE's USIM is configured with indication that the UE is to receive the steering of roaming information due to initial registration in a VPLMN, but neither the list of preferred PLMN/access technology combinations nor the secured packet nor the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' is received in the REGISTRATION ACCEPT message, when the UE performs initial registration in a VPLMN or if the steering of roaming information is received but the security check is not successful; and

b) the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR", not part of "User Controlled PLMN Selector with Access Technology" list, the UE is not in manual mode of operation and the PDU session for emergency services is not pending to be activated;

then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container, release the current N1 NAS signalling connection locally, store the PLMN identity in the list of "PLMNs where registration was aborted due to SOR" and attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, and skip steps 9 to 12;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

9) The UE to the VPLMN AMF: If the UDM has requested an acknowledgement from the UE:

the UE verified that the steering of roaming information has been provided by the HPLMN in step 7, the UE sends the REGISTRATION COMPLETE message to the serving AMF with an SOR transparent container including the UE acknowledgement; and

if the steering of roaming information contained a secured packet and the security check was successful, then when the UE receives the USAT REFRESH command qualifier of type "Steering of Roaming", it performs items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6.

10) The AMF to the UDM: If an SOR transparent container is received in the REGISTRATION COMPLETE message, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge the successful security check of the received steering of roaming information in step 4, the UDM verifies that the acknowledgement is provided by the UE as specified in 3GPP TS 33.501 [66];

11) If the UE has a list of available PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired after the release of the N1 NAS signalling connection. If the N1 NAS signalling connection is not released after implementation dependent time, the UE may locally release the N1 signalling connection except when the UE is registered for emergency services or the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]); and

12) The UE deletes the list of "PLMNs where registration was aborted due to SOR".

The list of "PLMNs where registration was aborted due to SOR" is deleted when the UE is switched off or the USIM is removed.

6.3.1.5.3 Test Description

6.3.1.5.3.1 Pre-test conditions

System Simulator:

- Three inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.5.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.5.3.1-1. The MCC and MNC values corresponding to the PLMN identifier shall understood as those specified in TS 36.523-1 [42], Table 6.0.1-1.

Table 6.3.1.5.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |
| NR Cell 13 | PLMN14 |

NR Cell 11 is set to ''Serving Cell'';

NR Cell 12 is set to ''Serving Cell'';

NR Cell 13 is set to ''Serving Cell'';

System Information Combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-10 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.5.4 Test procedure sequence

Table 6.3.1.5.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE | - | - | - | - |
| 2-15 | Steps 1 to 14 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 13 | - | - | - | - |
| 16 | SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 17 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message without including an SOR transparent container | --> | NR RRC: *ULInformationTransfer*  5G MM: REGISTRATION COMPLETE | - | - |
| 18 | Void | - | - | - | - |
| 19 | Check: Does the UE transmits an *RRCSetupRequest* message on NR Cell 13 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 20 | Check: Does the UE transmits an *RRCSetupRequest* message on NR Cell 12 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 21 | The SS transmits an *RRCSetup* message on NR Cell 12. | <-- | NR RRC: *RRCSetup* | - | - |
| 22 | The UE transmits an *RRCSetupComplete* message and a REGISTRATION REQUEST message on NR Cell 12.  (Note 4) | --> | NR RRC: *RRCSetupComplete*  5GMM: REGISTRATION REQUEST | - | - |
| 22A – 22F | Steps 4 to 9 of the generic test procedure in TS 38.508-1 [4] Table 4.9.8.2.2-1 are performed. | - | - | - | - |
| 23 | Void |  |  |  |  |
| Note 1: Timer tmax in step 16, 19 and 20 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 5min is added to allow time for the UE to find the proper PLMN  Note 4: The 5GS registration type shall be only set as Mobility Registration for Rel-16 UEs according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to Rel-15 UEs. | | | | | |

6.3.1.5.5 Specific message contents

Table 6.3.1.5.5-1: REGISTRATION COMPLETE for NR Cell 13 (step 17 Table 6.3.1.5.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present | The SOR transparent container is not included in REGISTRATION COMPLETE message |  |

Table 6.3.1.5.5-1A: Void

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 0 | Acknowledgement is NOT requested |  |
| PLMN ID 1 | PLMN13 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |
| PLMN ID 2 | PLMN14 |  |  |
| Access Technology Identifier 2 | NG-RAN |  |  |
| PLMN ID 3 | PLMN2 |  |  |
| Access Technology Identifier 3 | NG-RAN |  |  |

Table 6.3.1.5.5-2: Void

Table 6.3.1.5.5-3: REGISTRATION REJECT (step 22E, Table 6.3.1.5.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-9 | | | |
| Information Element | | Value/remark | Comment | Condition |
| 5GMM cause | | ‘00010110’B | Cause #22 (Congestion) |  |
| T3346 Value | | ‘00100001’B | 1 minute |  |

#### 6.3.1.6 Void

#### 6.3.1.7 Steering of UE in roaming during registration/security check unsuccessful but emergency service pending to be activated

6.3.1.7.1 Test Purpose (TP)

(1)

**with** {the UE in Automatic PLMN Selection mode **and** current VPLMN not part of “PLMNs where registration was aborted due to SOR” List and not part of "User Controlled PLMN Selector with Access Technology" list **and** UE's USIM configured with indication that the UE is to receive Steering of Roaming information due to initial registration in a VPLMN **and** there is a PDU session for emergency services pending to be activated}

**ensure that** {

**when** {Steering of information is received but security check is unsuccessful}

**then** {UE will continue with the registration procedure on the VPLMN so as to be able to establish the emergency PDU session}

}

6.3.1.7.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.2]

6) The VPLMN AMF to the UE: The VPLMN AMF shall transparently send the received steering of roaming information to the UE in the REGISTRATION ACCEPT message;

7) If the steering of roaming information is received and the security check is successful, then:

a) if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]):

- if the UDM has not requested an acknowledgement from the UE the UE shall send the REGISTRATION COMPLETE message;

- the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41];

NOTE 1: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

- if the UDM has not requested an acknowledgement from the UE and the ME receives a USAT REFRESH command qualifier (3GPP TS 31.111 [41]) of type "Steering of Roaming" it shall perform items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6 and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

b) if the steering of roaming information contains the list of preferred PLMN/access technology combinations, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations. Additionally, if the UDM has not requested an acknowledgement from the UE and if the UE has a list of available and allowable PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container and then either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped; or

ii) not release the current N1 NAS signalling connection locally and skip steps 8 to 10;

8) If:

a) the UE's USIM is configured with indication that the UE is to receive the steering of roaming information due to initial registration in a VPLMN, but neither the list of preferred PLMN/access technology combinations nor the secured packet nor the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' is received in the REGISTRATION ACCEPT message, when the UE performs initial registration in a VPLMN or if the steering of roaming information is received but the security check is not successful; and

b) the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR", not part of "User Controlled PLMN Selector with Access Technology" list, the UE is not in manual mode of operation and the PDU session for emergency services is not pending to be activated;

then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container, release the current N1 NAS signalling connection locally, store the PLMN identity in the list of "PLMNs where registration was aborted due to SOR" and attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, and skip steps 9 to 12;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

9) The UE to the VPLMN AMF: If the UDM has requested an acknowledgement from the UE:

the UE verified that the steering of roaming information has been provided by the HPLMN in step 7, the UE sends the REGISTRATION COMPLETE message to the serving AMF with an SOR transparent container including the UE acknowledgement; and

if the steering of roaming information contained a secured packet and the security check was successful, then when the UE receives the USAT REFRESH command qualifier of type "Steering of Roaming", it performs items a), b) and c) of the procedure for steering of roaming in subclause 4.4.6.

10) The AMF to the UDM: If an SOR transparent container is received in the REGISTRATION COMPLETE message, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge the successful security check of the received steering of roaming information in step 4, the UDM verifies that the acknowledgement is provided by the UE as specified in 3GPP TS 33.501 [66];

11) If the UE has a list of available PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the currently camped chosen VPLMN and the UE is in automatic network selection mode, then the UE shall attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired after the release of the N1 NAS signalling connection. If the N1 NAS signalling connection is not released after implementation dependent time, the UE may locally release the N1 signalling connection except when the UE is registered for emergency services or the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]); and

12) The UE deletes the list of "PLMNs where registration was aborted due to SOR".

The list of "PLMNs where registration was aborted due to SOR" is deleted when the UE is switched off or the USIM is removed.

When the UE performs registration procedure for emergency services (see 3GPP TS 24.501 [64] and 3GPP TS 23.502 [63]) while the UE has a valid USIM and the AMF performs the authentication procedure, then based on HPLMN policy, the SOR procedure described in this subclause may apply.

NOTE 3: The HPLMN/UDM cannot distinguish between "initial registration" and "emergency registration" thus SOR implicitly applies for emergency registration.

6.3.1.7.3 Test Description

6.3.1.7.3.1 Pre-test conditions

System Simulator:

- One inter-frequency multi-PLMN NR Cell as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.7.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.7.3.1-1. The MCC and MNC values corresponding to the PLMN identifier shall understood as those specified in TS 36.523-1 [42], Table 6.0.1-1.

Table 6.3.1.7.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
| NR Cell 11 | PLMN2 |

NR Cell 11 is set to ''Serving Cell'';

System Information Combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-10 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.7.4 Test procedure sequence

Table 6.3.1.7.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE | - | - | - | - |
| 1A1-1A13 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 11. | - | - | - | - |
| 1B | SS transmits a REGISTRATION REJECT message with cause #22 (Congestion) and T3346 set to 3 minutes.  (Note 1) | <-- | NR RRC: *DLInformationTransfer*  5GMM: REGISTRATION REJECT | - | - |
| 1C | The SS releases the RRC connection. | - | - | - | - |
| 2 | Cause the UE to originate Emergency call. (Note 2) | - | - | - | - |
| 3 | The UE transmits an RRCSetupRequest message on NR Cell 11 with establishmentCause set to 'emergency'. | --> | NR RRC: RRCSetupRequest | - | - |
| 4-5 | Steps 3 to 4 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed. | - | - | - | - |
| 6 | The UE transmit a REGISTRATION REQUEST message with IE 5GS registration type set to "Emergency registration" or “Initial registration”.  (Note 3) | --> | 5G MM: REGISTRATION REQUEST | - | - |
| 7-14 | Steps 5 to 13 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 11 | - | - | - | - |
| 15 | The SS transmits a *DLInformationTransfer* message and a REGISTRATION ACCEPT message containing steering of roaming information, includes unmatched SOR-MAC-IAUSF that will result in unsuccessful security check while on UE reception | <-- | NR RRC: *DLInformationTransfer*  5G MM: REGISTRATION ACCEPT | - | - |
| 16 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message without including an SOR transparent container | --> | NR RRC: *ULInformationTransfer*  5G MM: REGISTRATION COMPLETE | - | - |
| 17 | Check: Does the UE transmit an UL NAS TRANSPORT message with "Request type" set to "initial emergency request", and a PDU SESSION ESTABLISHMENT REQUEST message on NR Cell 11 | --> | 5GMM: UL NAS TRANSPORT  5GSM: PDU SESSION ESTABLISHMENT REQUEST | 1 | P |
| - | EXCEPTION: Steps 17Aa1 describe behaviour depending on UE implementation; the "lower case letter" identifies a step sequence that take place if the UE performs a specific action. | - | - | - | - |
| - | EXCEPTION: The behaviour in step 17Aa1  occurs in parallel with steps 18-22. | - | - | - | - |
| 17Aa1 | IF 5GS registration type is set as Initial Registration in step 6, THEN the generic procedure for UE-requested PDU session establishment, specified in subclause 4.5A.2, takes place performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsSameConnection. | - | - | - | - |
| 18-22 | Steps 9 to 13 of the procedure of "IMS Emergency call establishment in 5GC with IMS emergency registration" described in TS 38.508-1 [4] Table 4.9.11.2.2-1 are performed. | - | - | - | - |
| 23 | Generic procedure of "Test Procedure for IMS MO Emergency call release" described in TS 38.508-1 [4] Table 4.9.12A.2.2-1 are performed. | - | - | - | - |
| 24 | The SS releases the RRC connection (Note4). | <-- | NR RRC: *RRCRelease* | - | - |
| Note 1: T3346 is set to 3 minutes.This is checked for 3 minutes less tolerance.  Note 2: This can be done by an AT/MMI command.  Note 3: 5GS registration type can set to either "initial registration" according to TS 24.501 clause5.2.2.3.3 or "emergency registration" according to TS 24.501 clause 5.5.1.2.  Note 4: The UE may optionally transmit a De-registration REQ during Step24. | | | | | |

6.3.1.7.5 Specific message contents

Table 6.3.1.7.5-0: REGISTRATION REJECT for NR Cell 11 (step 1B Table 6.3.1.7.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| 5GMM cause | ‘00010110’B | Cause #22 (Congestion) |  |
| T3346 value | ‘00100011’B | 3 minutes |  |

Table 6.3.1.7.5-1: REGISTRATION REQUEST for NR Cell 11 (step 6 Table 6.3.1.7.4-1)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6, Condition EMERGENCY or INITIAL. |

Table 6.3.1.7.5-2: REGISTRATION ACCEPT for NR Cell 11 11 (step 15, Table 6.3.1.7.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |

Table 6.3.1.7.5-3: SOR Transparent Container in REGISTRATION ACCEPT for NR Cell 13 (step 15, Table 6.3.1.7.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 24.501 [22] Figure 9.11.3.51.1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SoR-MAC-IAUS | Set to mismatch the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 1 | Acknowledgement requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |

Table 6.3.1.7.5-4: REGISTRATION COMPLETE for NR Cell 11 (step 16 Table 6.3.1.7.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present | The SOR transparent container is not included in REGISTRATION COMPLETE message |  |

Table 6.3.1.7.5-5:UL NAS TRANSPORT (step 17, Table 6.3.1.7.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10, condition INITIAL\_PDU\_REQUEST. | | | |
| Information Element | Value/remark | Comment | Condition |
| Request type | ‘011’B | initial emergency request |  |
| S-NSSAI | Not Present |  |  |
| DNN | Not Present |  |  |

Table 6.3.1.7.5-6:PDU SESSION ESTABLISHMENT REQUEST (step 17, Table 6.3.1.7.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.2-1. | | | |
| Information Element | Value/remark | Comment | Condition |
| PDU session ID | A value that is not currently being used by another PDU session |  |  |
| PTI | A value currently not used |  |  |
| SSC mode | ‘001’B | SSC mode 1 |  |

#### 6.3.1.8 Steering of UE in roaming after registration/Automatic PLMN selection mode

6.3.1.8.1 Test Purpose (TP)

(1)

**with** {UE being in automatic PLMN selection mode **and** UE has registered onto a VPLMN}

**ensure that** {

**when** {SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information **and** indicates ACK has been requested **and** security check is successful}

**then** {UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message **and** waits until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication before attempting to obtain service on a higher priority PLMN

}

6.3.1.8.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.3. Unless otherwise stated these are Rel-15 requirements

[TS 23.122, clause C.3]

2) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

3) Upon receiving the steering of roaming information, the UE shall perform a security check on the list of preferred PLMN/access technology combinations included in the DL NAS TRANSPORT message to verify that the list of preferred PLMN/access technology combinations is provided by HPLMN, and:

a) if the security check is successful and:

- if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]), the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41];

NOTE 1: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

When the ME receives a USAT REFRESH command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" it performs the procedure for steering of roaming in subclause 4.4.6 with an exception that if the UE is in automatic network selection mode, then the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN (specified in subclause 4.4.6 bullet d);

- otherwise, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations. If the UE is in automatic network selection mode, then the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired.

If the last established PDU session is an emergency PDU session then the UE shall attempt to perform the PLMN selection after the release of the emergency PDU session and expiration of timer T.

If the UDM has not requested an acknowledgement from the UE then steps 4 and 5 are skipped; and

b) if the security check is not successful and the UE is in automatic network selection mode, then the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority. If the last established PDU session is an emergency PDU session then the UE shall attempt to perform the PLMN selection after the release of the emergency PDU session and expiration of timer T.

If the UDM has not requested an acknowledgement from the UE then steps 4 and 5 are skipped;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

4) The UE to the AMF: if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message and the security check in step 2 was successful, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement;

6.3.1.8.3 Test Description

6.3.1.8.3.1 Pre-test conditions

System Simulator:

- Three inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.8.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.8.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.1.8.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN names** |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |
| NR Cell 13 | PLMN14 |

NR Cell 11 is set to "Serving Cell";

NR Cell 12 is set to "Serving Cell";

NR Cell 13 is set to "Serving Cell";

System Information Combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.8.4 Test procedure sequence

Table 6.3.1.8.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE | - | - | - | - |
| 2 | Whole registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 13, with “connected without release” | - | - | - | - |
| 3 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception | <-- | NR RRC: *DLInformationTransfer*  5GMM: DL NAS TRANSPORT | - | - |
| 4 | SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 5 | The UE transmits an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information | --> | NR RRC: *ULInformationTransfer*  5GMM:UL NAS TRANSPORT | 1 | P |
| 6 | The SS transmits an *RRCRelease* message | <-- | NR RRC: *RRCRelease* | - | - |
| 7 | Check: Does the UE transmits an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 8-9 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 4) | - | - | - | - |
| - | EXCEPTION: Steps 10a1 to 10b5a1 describe behaviours which depend on procedure parameters; the "lower case letter" identifies a step sequence that take place if a procedure parameter has a particular value | - | - | - | - |
| 10a1-10a15a1 | IF 5GS registration type is set as Initial Registration in step 9, THEN steps 5 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 11. | - | - | - | - |
| 10b1-10b2 | Void. | - | - | - | - |
| 10b3-10b5a1 | ELSE IF 5GS registration type is set as Mobility Registration in step 9, THEN steps 4 to 6a1 of the generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 11. | - | - | - | - |
| 11-12a1 | Void. | - | - | - | - |
| Note 1: Timer tmax in step 4 and 7 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 5min is added to allow time for the UE to find the proper PLMN  Note 4: The 5GS registration type shall be only set as Mobility Registration for R16 UEs according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to R15 UEs. | | | | | |

6.3.1.8.5 Specific message contents

Table 6.3.1.8.5-1: DL NAS TRANSPORT Message for NR Cell 13 (step 3, Table 6.3.1.8.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 | | | |
| Information Element | Value/remark | Comment | Condition |
| Payload Container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 1 | Acknowledgement requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |

Table 6.3.1.8.5-2: Void

Table 6.3.1.8.5-3: UL NAS TRANSPORT Message for NR Cell 13 (step 5, Table 6.3.1.8.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| Payload Container | Present | The SOR transparent container in the payload container IE carries acknowledgement of successful reception of the steering of roaming information. |  |
| SOR data type | 1 | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |

Table 6.3.1.8.5-4: Void

#### 6.3.1.9 Steering of UE in roaming after registration/Manual PLMN selection mode

6.3.1.9.1 Test Purpose (TP)

(1)

**with** {UE being in manual PLMN selection mode **and** UE has registered onto a VPLMN}

**ensure that** {

**when** {SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information **and** indicates ACK has been requested **and** security check is successful}

**then** {UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message **and** stays on the VPLMN

}

6.3.1.9.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.3. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.3]

2) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

3) Upon receiving the steering of roaming information, the UE shall perform a security check on the list of preferred PLMN/access technology combinations included in the DL NAS TRANSPORT message to verify that the list of preferred PLMN/access technology combinations is provided by HPLMN, and:

a) if the security check is successful and:

- if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]), the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41];

NOTE 1: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

When the ME receives a USAT REFRESH command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" it performs the procedure for steering of roaming in subclause 4.4.6 with an exception that if the UE is in automatic network selection mode, then the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN (specified in subclause 4.4.6 bullet d);

- otherwise, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations. If the UE is in automatic network selection mode, then the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired.

If the last established PDU session is an emergency PDU session then the UE shall attempt to perform the PLMN selection after the release of the emergency PDU session and expiration of timer T.

If the UDM has not requested an acknowledgement from the UE then steps 4 and 5 are skipped; and

b) if the security check is not successful and the UE is in automatic network selection mode, then the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority. If the last established PDU session is an emergency PDU session then the UE shall attempt to perform the PLMN selection after the release of the emergency PDU session and expiration of timer T.

If the UDM has not requested an acknowledgement from the UE then steps 4 and 5 are skipped;

NOTE 2: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

4) The UE to the AMF: if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message and the security check in step 2 was successful, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement;

6.3.1.9.3 Test Description

6.3.1.9.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.9.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.9.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.1.9.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

NR Cell 11 is set to ''ServingCell'';

NR Cell 12 is set to ''Serving Cell'';

System Information Combination NR-1 as defined in TS38.508 clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Manual PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.9.4 Test procedure sequence

Table 6.3.1.9.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE. | - | - | - | - |
| 2 | PLMN13 is manually selected. | - | - | - | - |
| 3 | Whole registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 12, with “connected without release”. | - | - | - | - |
| 4 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception. | <-- | NR RRC: *DLInformationTransfer*  5GMM: DL NAS TRANSPORT | - | - |
| 5 | The UE transmits an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information. | --> | NR RRC: *ULInformationTransfer*  5GMM:UL NAS TRANSPORT | 1 | P |
| 6 | The SS transmits an *RRCRelease* message. | <-- | NR RRC: *RRCRelease* | - | - |
| 7 | SS starts timer of 1 minute and waits this timer expires. | - | - | - | - |
| 8 | Check: Does the UE is in state 5GC RRC\_IDLE on NR Cell 12 as specified in TS 38.508-1 [4] Table 4.9.4.2.2-1? | - | - | 1 | P |
| 9 | The SS configures:  - NR Cell 11 as a "Non-Suitable "off" cell ". | - | - | - | - |
| 10 | The user sets the UE in Automatic PLMN selection mode. | - | - | - | - |
| 11 | Wait for 300s to allow the UE to switch to automatic PLMN selection mode. | - | - | - | - |

6.3.1.9.5 Specific message contents

Table 6.3.1.9.5-1: DL NAS TRANSPORT Message for NR Cell 12 (step 4, Table 6.3.1.9.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 | | | |
| Information Element | Value/remark | Comment | Condition |
| Payload Container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |

Table 6.3.1.9.5-2: SOR Transparent Container in Payload Container IE of DL NAS TRANSPORT Message for NR Cell 12 (step 4, Table 6.3.1.9.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 24.501 [22] Figure 9.11.3.51.1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 1 | Acknowledgement requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |

Table 6.3.1.9.5-3: UL NAS TRANSPORT Message for NR Cell 12 (step 5, Table 6.3.1.9.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| Payload Container | Present | The SOR transparent container in the payload container IE carries acknowledgement of successful reception of the steering of roaming information. |  |

Table 6.3.1.9.5-4: SOR Transparent Container in Payload Container IE of UL NAS TRANSPORT Message for NR Cell 12 (step 5, Table 6.3.1.9.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 24.501 [22] Figure 9.11.3.51.4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR data type | 1 | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |

#### 6.3.1.10 Steering of UE in roaming during mobility update registration

6.3.1.10.1 Test Purpose (TP)

(1)

**with** {UE being in automatic PLMN selection mode , current VPLMN not part of “PLMNs where registration was aborted due to SOR” List and not part of "User Controlled PLMN Selector with Access Technology" list and UE's USIM configured with indication that the UE is to receive Steering of Roaming information due to initial registration in a VPLMN}

**ensure that** {

**when** {UE performs mobility update Registration Procedure to cell belonging to VPLMN **and** chosen VPLMN does not provide Steering of Roaming info}

**then** {UE continues to camp on the chosen VPLMN}

}

6.3.1.10.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause C.2]

2) Upon receiving REGISTRATION REQUEST message, the VPLMN AMF executes the registration procedure as defined in subclause 4.2.2.2.2 of 3GPP TS 23.502 [63]. As part of the registration procedure:

a) if the VPLMN AMF does not have subscription data for the UE, the VPLMN AMF invokes Nudm\_SDM\_Get service operation to the HPLMN UDM to get amongst other information the Access and Mobility Subscription data for the UE (see step 14b in subclause 4.2.2.2.2 of 3GPP TS 23.502 [63]); or

b) if the VPLMN AMF already has subscription data for the UE and:

i) the 5GS registration type IE in the received REGISTRATION REQUEST message indicates "initial registration" and the "SoR Update Indicator for Initial Registration" field in the UE context is set to 'the UDM requests the AMF to retrieve SoR information when the UE performs NAS registration type "initial registration"' as specified in table 5.2.2.2.2-1 of 3GPP TS 23.502 [63]); or

ii) the 5GS registration type IE in the received REGISTRATION REQUEST message indicates "emergency registration" and the "SoR Update Indicator for Emergency Registration" field in the UE context is set to 'the UDM requests the AMF to retrieve SoR information when the UE performs NAS registration type "emergency registration"' as specified in table 5.2.2.2.2-1 of 3GPP TS 23.502 [63]);

then the VPLMN AMF invokes Nudm\_SDM\_Get service operation message to the HPLMN UDM to retrieve the steering of roaming information (see step 14b in subclause 4.2.2.2.2 of 3GPP TS 23.502 [63]);

otherwise the VPLMN AMF sends a REGISTRATION ACCEPT message without the steering of roaming information to the UE and steps 3a, 3b, 3c, 3d, 4, 5, 6 are skipped;

…

11) If the UE has a list of available PLMNs in the area and based on this list the UE determines that there is a higher priority PLMN than the selected VPLMN and the UE is in automatic network selection mode, then the UE shall attempt to obtain service on a higher priority PLMN as specified in subclause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired after the release of the N1 NAS signalling connection. If the N1 NAS signalling connection is not released after implementation dependent time, the UE may locally release the N1 signalling connection except when the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]).

6.3.1.10.3 Test Description

6.3.1.10.3.1 Pre-test conditions

System Simulator:

- Three inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.1.10.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.1.10.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.1.10.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN names |
|
| NR Cell 1 | PLMN14 |
| NR Cell 12 | PLMN13 |
| NR Cell 11 | PLMN14 |

- NR Cell 1 is set to ''ServingCell'';

- NR Cell 12 is set to ''Not-Suitable Cell'';

- NR Cell 11 is set to ''Not-Suitable Cell'';

- TAI of NR Cell 11 is set to ''TAI-2'' and TAI of NR Cell 1 is set to ''TAI-1';'

- System Information Combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-10 of TS 38.508-1 [4] will be used.

Preamble:

- Ensure that the UE has cleared the RPLMN. And the UE is in Switched OFF (State 0-A) as defined in TS 38.508-1 [4] Table 4.4A.2-0.

6.3.1.10.4 Test procedure sequence

Table 6.3.1.10.4-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE. | - |  | - | - |
| 2-14 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed on NR Cell 1. | - | - | - | - |
| 15 | The SS transmits an *DLInformationTransfer* message and a REGISTRATION ACCEPT message containing steering of roaming information indicating that acknowledgement is not requested from the UE for successful reception. | <-- | NR RRC: *DLInformationTransfer*  5G MM: REGISTRATION ACCEPT | - | - |
| 16 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message without SOR transparent container. | --> | NR RRC: *ULInformationTransfer*  5G MM: REGISTRATION COMPLETE | - | - |
| - | EXCEPTION: Step 16Aa1 is performed if pc\_noOf\_PDUsSameConnection > 0. | - | - | - | - |
| 16Aa1 | The generic procedure for UE-requested PDU session establishment, specified in subclause 4.5A.2, takes place performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsSameConnection. | - | - | - | - |
| 17 | The SS transmits an *RRCRelease* message. | <-- | NR RRC: *RRCRelease* | - | - |
| - | EXCEPTION: Step 17Aa1 is performed if pc\_noOf\_PDUsNewConnection > 0. | - | - | - | - |
| 17Aa1 | The generic procedure for UE-requested PDU session establishment, specified in subclause 4.5.2.2-4, takes place performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsNewConnection and then release the RRC Connection. | - | - | - | - |
| 18 | The SS configures:  - NR Cell 11 as "Serving cell"  - NR Cell 1 as "Non-Suitable cell"  - NR Cell 12 as "Non-Suitable cell". | - | - | - | - |
| 19 | The UE transmits an *RRCSetupRequest* message on NR Cell 11. | --> | NR RRC: *RRCSetupRequest* | - | - |
| 20 | SS transmits an *RRCSetup* message on NR Cell 11. | <-- | NR RRC: *RRCSetup* | - | - |
| 21 | The UE transmits an *RRCSetupComplete* message to confirm the successful completion of the connection establishment and a REGISTRATION REQUEST message indicating "mobility registration updating" on NR Cell 11. | --> | NR RRC: *RRCSetupComplete*  5GMM: REGISTRATION REQUEST | - | - |
| 22 | SS sends a REGISTRATION ACCEPTmessage without including SOR transparent container on NR Cell 11. | <-- | NR RRC: *DLInformationTransfer*  5GMM: REGISTRATION ACCEPT | - | - |
| 23 | Check: Does the UE send a REGISTRATION COMPLETE without including SOR transparent container on NR Cell 11? | --> | NR RRC: *ULInformationTransfer*  5GMM: REGISTRATION COMPLETE | 1 | P |
| 24 | The SS transmits an *RRCRelease* message on NR Cell 11. | <-- | NR RRC: *RRCRelease* | - | - |
| 25 | The SS configures:  - NR Cell 11 as "Serving cell"  - NR Cell 1 as "Non-Suitable cell"  - NR Cell 12 as "Serving cell". | - | - | - | - |
| 26 | Check: Does the UE transmit an *RRCSetupRequest* message on NR Cell 12 within timer T=6 minutes \*(1+10% tolerance)?  NOTE: The timer T shall be set to 396s (6 minutes \*(1+10% tolerance)), where the high priority PLMN search timer is defined in EFHPPLMN. | - | - | 1 | F |
| 27 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 11? | - | - | 1 | - |

6.3.1.10.5 Specific message contents

Table 6.3.1.10.5-1: REGISTRATION ACCEPT for NR Cell 1 (step 15, Table 6.3.1.10.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 0 | Acknowledgement is not requested |  |
| PLMN ID 1 | PLMN 14 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |
| PLMN ID 2 | PLMN 13 |  |  |
| Access Technology Identifier 2 | NG-RAN |  |  |

Table 6.3.1.10.5-2: REGISTRATION COMPLETE for NR Cell 1 (step 16, Table 6.3.1.10.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present |  |  |

Table 6.3.1.10.5-3: REGISTRATION ACCEPT for NR Cell 11 (step 22, Table 6.3.1.10.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present |  |  |

Table 6.3.1.10.5-4: REGISTRATION COMPLETE for NR Cell 11 (step 23, Table 6.3.1.10.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Not Present |  |  |

### 6.3.2 Steering of Roaming with using SOR-CMCI

#### 6.3.2.1 Steering of UE in roaming after registration / SOR-CMCI rule / DNN of the PDU session / DL NAS transport

6.3.2.1.1 Test Purpose (TP)

(1)

with { UE being in automatic PLMN selection mode and UE has registered onto a VPLMN with an established PDU session }

ensure that {

when { UE receives SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information with the SOR-CMCI field which includes Tsor-cm timer and Criterion type with setting as DNN of the PDU session }

then { UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message **and** UE sends DEREGISTRATION REQUEST message after Tsor-cm timerexpires **and** selects higher priority PLMN after DEREGISTRATION procedure is completed successfully }

}

6.3.2.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.4.1, C.4.2, and C.4.3. Unless otherwise stated these are Rel-17 requirements.

[TS 23.122, clause C.4.1]

The HPLMN or subscribed SNPN, based on operator policy, may provide the UE with SOR-CMCI to control the timing when the UE enters idle mode and performs higher priority PLMN/access technology or SNPN selection. This is achieved by the HPLMN indicating to the UE the criteria for releasing specific PDU session(s) or services and entering idle mode.

NOTE 1: The released PDU sessions may be re-established by the application once the UE successfully registers on a higher priority PLMN or SNPN. User interaction is required for some applications.

The HPLMN or subscribed SNPN may configure the SOR-CMCI in the UE, and may also provide the SOR-CMCI to the UE over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling takes precedence over the SOR-CMCI stored in the non-volatile memory of the ME or stored in the USIM.

NOTE 2: The SOR-CMCI received over N1 NAS signalling in the SOR information is either the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]) which is received in a secured packet, or the SOR-CMCI received in plain text.

If the UE receives SOR information containing the list of preferred PLMN/access technology combinations or SOR-SNPN-SI without SOR-CMCI, or the ME receives USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" without SOR-CMCI, or the security check of the received steering of roaming information is not successful as described in clause C.2, clause C.3 and clause C.4.3, then:

1) if the UE has SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the non-volatile memory of the ME; and

2) if the UE has no SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the USIM, if any.

The UE shall delete the stored SOR-CMCI, if any, in the non-volatile memory of the ME and store the received SOR-CMCI in the non-volatile memory of the ME when:

1) the ME receives SOR-CMCI in the USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming"; or

2) the UE receives the steering of roaming information containing the SOR-CMCI over N1 NAS signalling and the UE receives the "Store SOR-CMCI in ME" indicator set to "Store SOR-CMCI in ME";

The SOR-CMCI shall be stored in the non-volatile memory of the ME together with the SUPI from the USIM. The ME shall not delete the SOR-CMCI when the UE is switched off. The ME shall delete the SOR-CMCI when a new USIM is inserted.

SOR-CMCI consists of SOR-CMCI rules. Each SOR-CMCI rule consists of the following parameters:

i) a criterion of one of the following types:

- PDU session attribute type criterion;

- service type criterion;

- SOR security check criterion; or

- match all type criterion; and

ii) a value for Tsor-cm timer associated with each criterion presented in i) indicating the time the UE shall wait before releasing the PDU sessions or the services and entering idle mode.

SOR-CMCI contains zero, one or more SOR-CMCI rules with PDU session attribute type criterion, zero, one or more SOR-CMCI rules with service type criterion, and zero or one SOR-CMCI rule with match all type criterion.

PDU session attribute type criterion consists of one of the following:

a) DNN of the PDU session;

b) S-NSSAI STT of the PDU session; or

c) S-NSSAI SST and SD of the PDU session.

Service type criterion consists of one of the following:

a) IMS registration related signalling;

b) MMTEL voice call;

c) MMTEL video call; or

d) SMS over NAS or SMSoIP.

SOR security check criterion consists of:

a) SOR security check not successful.

Match all type criterion consists of:

a) match all.

When the SOR-CMCI received by the UE over N1 NAS signalling contains no SOR-CMCI rules, the UE shall stop all running Tsor-cm timers, if any, and act as if no SOR-CMCI is configured. Additionally:

- if the SOR-CMCI is received in plain text and it also contains the "Store SOR-CMCI in ME" indicator, the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any; and

- if the SOR-CMCI is received in a secured packet, and the USIM provides the ME with the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]), then the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any.

The HPLMN may update the SOR-CMCI in the USIM such that it contains no SOR-CMCI rules, in which case the UE behaviour described in clause C.4.2 applies. Also the HPLMN may make the SOR-CMCI file in the USIM unavailable (see 3GPP TS 31.102 [40]).

If there are more than one criterion applicable for a PDU session (e.g., a criterion for the PDU session and another one for the service) then the Tsor-cm timer with the highest value shall apply.

If there are more than one criterion applicable to different ongoing PDU sessions or services leading to multiple applicable Tsor-cm timers, then all the applicable Tsor-cm timers shall be started. Further handling of such cases is described in clause C.4.2.

If the value for Tsor-cm timer equals "infinity" then the UE shall wait until the PDU session is released or the service is stopped.

The Tsor-cm timer is applicable only if the UE is in automatic network selection mode.

Upon switching to the manual network selection mode, the UE shall stop any Tsor-cm timer, if running. In this case, the UE is not required to enter idle mode and perform the de-registration procedure.

The UE shall consider the following services as exempted from being forced to release the related established PDU session, if any, enter idle mode and perform high priority PLMN/access technology or SNPN selection. These services are known to the UE by default and the UE shall not follow the SOR-CMCI criteria even if configured to interrupt such services:

i) emergency services.

The UE configured with high priority access in the selected PLMN or SNPN shall consider all services and all related established PDU sessions, if any, to be exempted from being forced to be released to enter idle mode and perform high priority PLMN/access technology or SNPN selection.

[TS 23.122, clause C.4.2]

During SOR procedure and while applying SOR-CMCI, the UE shall determine the time to release the PDU session(s) or the services as follows:

- If the UE encounters SOR security check not successful on the received steering of roaming information, and a matching criterion "SOR security check not successful" is included in the SOR-CMCI stored in the non-volatile memory of the ME, then the UE shall:

- if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

- stop all other running Tsor-cm timers, if any; and

- not start any new Tsor-cm timer while Tsor-cm timer associated with "SOR security check not successful" criterion is running;

- If one or more SOR-CMCI rules are included in SOR-CMCI, where for each criterion:

a) DNN of the PDU session:

the UE shall check whether it has a PDU session with a DNN matching to the DNN included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b) S-NSSAI SST of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST matching the S-NSSAI SST included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b1) S-NSSAI SST and SD of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST and SD matching the S-NSSAI SST and SD included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

c) IMS registration related signalling:

the UE shall check whether IMS registration related signalling is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

d) MMTEL voice call:

the UE shall check whether MMTEL voice call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

e) MMTEL video call:

the UE shall check whether MMTEL video call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

f) SMS over NAS or SMSoIP:

the UE shall check whether SMS over NAS or SMSoIP services is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI; or

g) match all:

the UE shall check whether there are any PDU sessions or services for which there is no matching criterion in a) to f) above. If such PDU session or service exists, then for each of these PDU sessions or services, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI.

If the SOR-CMCI is available, and:

- the SOR-CMCI used is in the USIM, contains no SOR-CMCI rule;

- there are one or more SOR-CMCI rules but there is no criterion matched with any ongoing PDU session or service; or

- there are one or more SOR-CMCI rules and there is one or more criteria matched with an ongoing PDU session or service, but the highest Tsor-cm timer value associated with the matched criteria is equal to zero;

then there is no Tsor-cm timer started for any PDU session or service.

While one or more Tsor-cm timers are running, the UE shall check the newly established PDU session or service for a matching criterion in the SOR-CMCI:

- If a matching criterion is found and the applicable Tsor-cm timer indicated the value "infinity" then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value set to infinity; or

- For all other cases, if a matching criterion is found and the timer value is not zero then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value included in the SOR-CMCI, with the exception that if the value of the Tsor-cm timer included in the SOR-CMCI exceeds the highest value among the current values of all running Tsor-cm timers, then the value of the Tsor-cm timer for the newly established PDU session or service shall be set to the highest value among the current values of all running Tsor-cm timers.

NOTE 1: For newly established PDU session or service as described above, the timer is set irrespective of whether other ongoing PDU sessions or services that match the same criteria exist and for which corresponding Tsor-cm timers are running.

NOTE 2: NAS 5GMM layer will receive an explicit indication from the upper layers that a service is started or stopped. When a service is started, it is handled as a new service in the procedures described in this clause.

NOTE 3: While one or more Tsor-cm timers are running, the UE can trigger any 5GSM procedure or start new services.

While one or more Tsor-cm timers are running, upon receiving a new SOR-CMCI as described in annex C.4.3, the UE shall check if there is a matching criterion found for any ongoing PDU session or service in the new SOR-CMCI:

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI indicates the value "infinity", then:

a) if the Tsor-cm timer associated to the PDU session or service is not running, then the UE shall start the Tsor-cm timer associated to the PDU session or service with the value set to infinity; or

b) if the Tsor-cm timer associated to the PDU session or service is already running, then the UE shall set the value of the Tsor-cm timer associated to the PDU session or service to infinity without stopping and restarting the timer;

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI is other than infinity and is smaller than the current value of the running Tsor-cm timer for the associated PDU session or service, then the Tsor-cm timer value for the associated PDU session or service shall be replaced with the value in the new SOR-CMCI without stopping and restarting the timer; or

- for all other cases, the running Tsor-cm timers for the associated PDU sessions or services are kept unchanged.

The Tsor-cm timer shall be stopped when the associated PDU session is released or the associated service is stopped.

If the security check on the received steering of roaming information is successful, the UE shall stop the Tsor-cm timer associated with "SOR security check not successful", if running, and act on the received steering of roaming information. The current PLMN or SNPN is not considered as lowest priority.

NOTE 4: This also applies to the case when the current PLMN or SNPN is different from the PLMN or SNPN in which the Tsor-cm timer associated with "SOR security check not successful" was started.

If the UE, while one or more Tsor-cm timers are running:

a) enters idle mode not due to lower layer failure (see 3GPP TS 24.501 [64]);

b) is not able to successfully recover the N1 NAS signalling connection (see 3GPP TS 24.501 [64]); or

c) enters 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]);

then the UE shall stop the timer(s). In these cases, if:

a) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

b) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN using any other implementation specific means;

then the UE shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 5: When the UE enters idle mode due to lower layer failure while one or more Tsor-cm timers are running, then the UE does not stop Tsor-cm timer(s) as recovery of NAS signalling connection is possible (see 3GPP TS 24.501 [64]).

When the UE determines that no Tsor-cm timer is started for any PDU session or service, the last running Tsor-cm timer is stopped due to release of the associated PDU sessions or stop of the associated services, or the last running Tsor-cm timer expires, if:

i) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

ii) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPNusing any other implementation specific means;

then if the UE is in 5GMM-CONNECTED mode, the UE shall perform the deregistration procedure (see clause 4.2.2.3 of 3GPP TS 23.502 [63]) that releases all the established PDU sessions and services, if any, and once the UE enters idle mode it shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 6: The list of available and allowable PLMNs or SNPNs in the area is implementation specific.

The UE which has an emergency PDU session, receives a request from the upper layers to establish an emergency PDU session or perform emergency services fallback, registers for emergency services, or is configured for high priority access in the selected PLMN or SNPN is not required to enter idle mode if the last running Tsor-cm timer for any PDU session or service stops or expires. In this case, the UE shall attempt to perform the PLMN or SNPN selection after the emergency PDU session or the high priority service is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

If the UE selects a cell of any access technology other than NG-RAN, the ongoing SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.

NOTE 7: If the UE is served by any access technology other than NG-RAN, the HPLMN can initiate a steering of roaming procedure as specified in clause 4.4.6.

[TS 23.122, clause C.4.3]

The stage-2 flow for providing UE with SOR-CMCI in HPLMN, VPLMN, subscribed SNPN or non-subscribed SNPN after registration is indicated in figure C.4.3.1, when the ME supports the SOR-CMCI. The selected PLMN or SNPN can be the HPLMN, a VPLMN, the subscribed SNPN or a non-subscribed SNPN. The AMF is located in the selected PLMN or SNPN. The UDM is located in the HPLMN or the subscribed SNPN.

In this procedure, the SOR-CMCI is sent without the list of preferred PLMN/access technology combinations and the SOR-SNPN-SI. In this procedure, the SOR-CMCI is sent in plain text or is sent within the secured packet.

NOTE 1: The SOR-AF can determine that the ME supports the SOR-CMCI if the Nsoraf\_SoR\_Info service operation has returned the "ME support of SOR-CMCI" indicator. The UDM can determine that the ME supports the SOR-CMCI if the "ME support of SOR-CMCI" indicator is stored for the UE. How the SOR-AF determines that the USIM for the indicated SUPI supports SOR-CMCI is implementation specific.

NOTE 2: The secured packet provided by the SOR-AF can include SOR-CMCI only if the SOR-AF has determined that the ME supports the SOR-CMCI and the USIM of the indicated SUPI supports SOR-CMCI. Otherwise if only the "ME support of SOR-CMCI" indicator is stored for the UE, then SOR-CMCI, if any, cannot be included in the secured packet.

The procedure is triggered:

- If the UDM supports obtaining the parameters of the list of preferred PLMN/access technology combinations, the SOR-SNPN-SI, the SOR-CMCI, and the "Store SOR-CMCI in ME" indicator, if any, or a secured packet from the SOR-AF, the HPLMN or subscribed SNPN policy for the SOR-AF invocation is present in the UDM and the SOR-AF provides the UDM with the SOR-CMCI for a UE identified by SUPI; or

- When the SOR-CMCI becomes available in the UDM (i.e., retrieved from the UDR).

Figure C.4.3.1: Procedure for configuring UE with SOR-CMCI after registration

For the steps below, security protection is described in 3GPP TS 33.501 [24].

1) The SOR-AF to the UDM: Nudm\_ParameterProvision\_Update request is sent to the UDM to trigger the update of the UE with the SOR-CMCI (in plain text or secured packet). In case of providing SOR-CMCI in plain text, include the "Store SOR-CMCI in ME" indicator, if applicable. In case of providing SOR-CMCI in a secured packet, include an indication that "the list of preferred PLMN/access technology combinations is not included in the secured packet".

2) The UDM to the AMF: The UDM notifies the changes of the user profile to the affected AMF by the means of invoking Nudm\_SDM\_Notification service operation. The Nudm\_SDM\_Notification service operation contains the steering of roaming information that needs to be delivered transparently to the UE over NAS within the Access and Mobility Subscription data. If the HPLMN or subscribed SNPN decided that the UE is to acknowledge successful security check of the received steering of roaming information, the Nudm\_SDM\_Notification service operation also contains an indication that the UDM requests an acknowledgement from the UE as part of the steering of roaming information. The UDM:

- upon receiving the SOR-CMCI (in plain text), shall:

i) if the UE is registered in the HPLMN or a VPLMN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided';

ii) if the UE is registered in a non-subscribed SNPN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; and

iii) if the UE is registered in a subscribed SNPN and the AMF has reported to the UDM that the UE supports SOR-SNPN-SI, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; or

- upon receiving the SOR-CMCI in secured packet, shall include the secured packet into the steering of roaming information;

NOTE 3: The UDM considers "the list of preferred PLMN/access technology combinations is not included in the secured packet" received together with the secured packet from the SOR-AF to indicate that the UE is not expected to perform SOR based on the associated steering of roaming information sent to the UE. However, the SOR-CMCI included in the secured packet can be applied by the UE if the UE has one or more Tsor-cm timers running as described in C.4.2.

NOTE 4: The UDM cannot provide the SOR-CMCI, if any, to the AMF which does not support receiving SoR transparent container (see 3GPP TS 29.503 [78]).

3) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

4) Upon receiving the steering of roaming information containing the SOR-CMCI and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' or the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided', or the secured packet, the UE shall perform a security check on the steering of roaming information included in the DL NAS TRANSPORT message to verify that the steering of roaming information is provided by HPLMN or subscribed SNPN, and:

a) if the security check is successful, the UE shall store the SOR-CMCI according to clause C.4.1. If the UE has one or more Tsor-cm timers running, the UE shall apply the received SOR-CMCI as described in C.4.2.

If the steering of roaming information contains a secured packet and the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported" only after the ME receives UICC responses indicating that the UICC has received the secured packet successfully. Otherwise, if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported". Additionally, if the UE supports access to an SNPN using credentials from a credentials holder and the UE is in a PLMN, the UE may set the "ME support of SOR-SNPN-SI" indicator to "supported".

If the UDM has not requested an acknowledgement from the UE then step 5 is skipped; and

b) if the selected PLMN is a VPLMN or a non-subscribed SNPN, the security check is not successful and the UE is in automatic network selection mode, then:

- if the UE has a SOR-CMCI stored in the non-volatile memory of the ME, the current PLMN is considered as lowest priority and the UE shall apply the actions in clause C.4.2;

- otherwise, the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, or before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN or SNPN is a VPLMN or a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

Step 5 is skipped;

NOTE 5: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list or the current chosen non-subscribed SNPN is part of the user controlled prioritized list of preferred SNPNs for the selected entry of the "list of subscriber data" the selected PLMN subscription, the UE stays on the VPLMN or non-subscribed SNPN.

5) The AMF to the UDM: If the UL NAS TRANSPORT message with an SOR transparent container is received, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge successful security check of the received steering of roaming information in step 2, the UDM verifies that the acknowledgement is provided by the UE. The UDM shall store the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any; and

6) The UDM to the SOR-AF: Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery, "ME support of SOR-CMCI" indicator, "ME support of SOR-SNPN-SI" indicator, if any). If the HPLMN policy for the SOR-AF invocation is present and the HPLMN UDM received and verified the UE acknowledgement in step 5, then the UDM informs the SOR-AF about successful delivery of the SOR-CMCI to the UE. The UDM shall include the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any.

If the selected PLMN is a VPLMN or a non-subscribed SNPN and:

- the UE in manual mode of operation encounters security check failure of SOR information in DL NAS TRANSPORT message; and

- upon switching to automatic network selection mode the UE remembers that it is still registered on the PLMN the non-subscribed SNPN where the security check failure of SOR information was encountered;

the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3, by acting as if timer T that controls periodic attempts has expired, with an exception that the current registered PLMN is considered as lowest priority, or before attempting to obtained service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN is a VPLMN or the selected SNPN is a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

NOTE 6: The receipt of the steering of roaming information by itself does not trigger the release of the emergency PDU session.

6.3.2.1.3 Test description

6.3.2.1.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.2.1.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.2.1.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.2.1.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN names** |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

- NR Cell 11 is set to "Serving Cell";

- NR Cell 12 is set to "Serving Cell";

- System Information Combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is switched on and brought to state 3N-A, RRC\_CONNECTED Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4 need to be performed on NR Cell 12.

6.3.2.1.4 Test procedure sequence

**Table 6.3.2.1.4-1: Main behaviour**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | Void | - | - | - | - |
| 2-21a1 | Void | - | - | - | - |
| 22 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception | <-- | NR RRC: *DLInformationTransfer*  5GMM: DL NAS TRANSPORT | - | - |
| 23 | The SS starts timer with Tsor-cm timer value = 60s | - | - | - | - |
| 24 | The SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 25 | Check: Does the UE transmit an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information? | --> | NR RRC: ULInformationTransfer  5GMM:UL NAS TRANSPORT | 1 | P |
| 26 | Check: Does the UE transmit a DEREGISTRATION REQUEST after Tsor-cm timer expires? | --> | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION REQUEST | 1 | P |
| 27 | The SS transmits a DEREGISTRATION ACCEPT message. | <-- | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION ACCEPT | - | - |
| 27A | The SS releases the RRC connection on NR cell 12. | - | - | - | - |
| 28 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: RRCSetupRequest | 1 | P |
| 29-30 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. | - | - | - | - |
|  | EXCEPTION: Void | - | - | - | - |
| 31a1-31a16a1 | Void | - | - | - | - |
| 31b1-31b3a1 | Void | - | - | - | - |
| 32-47a1 | Steps 5 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 11. | - | - | - | - |
| Note 1: Timer tmax in step 24 and 28 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 2min is added to allow time for the UE to find the proper PLMN | | | | | |

6.3.2.1.5 Specific message contents

**Table 6.3.2.1.5-1: DL NAS TRANSPORT Message for NR Cell 12 (step 22, Table 6.3.2.1.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| Additional parameters (AP) value | 1 | Additional parameters included |  |
| Length of PLMN ID and access technology list | ‘05’O |  |  |
| PLMN ID and access technology list |  |  |  |
| PLMN ID 1 | PLMN2 |  |  |
| access technology identifier 1 | NG-RAN |  |  |
| SOR-CMCI | Present |  |  |
| Length of SOR-CMCI contents |  | Length value of SOR-CMCI rule1 |  |
| SOR-CMCI rule 1 |  |  |  |
| Length of SOR-CMCI rule contents |  | Length value of SOR-CMCI rule contents |  |
| Tsor-cm timer value | ‘00100001’B | 60s |  |
| Criterion type | ‘00000001’B | DNN |  |
| Criterion value | pc\_APN\_ID\_Internet |  |  |

**Table 6.3.2.1.5-2: UL NAS TRANSPORT Message for NR Cell 12 (step 25, Table 6.3.2.1.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| ME support of SOR-CMCI indicator (MSSI) value | 1 | SOR-CMCI supported by the ME |  |

Table 6.3.2.1.5-3:DEREGISTRATION REQUEST for NR Cell 12 (Step 26, Table 6.3.2.1.4-1)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-12 with condition NORMAL. |

#### 6.3.2.2 Steering of UE in roaming after registration / SOR-CMCI rule / MMTEL voice call / DL NAS transport

6.3.2.2.1 Test Purpose (TP)

(1)

with { UE being in automatic PLMN selection mode and UE has registered onto a VPLMN with an established IMS PDU session }

ensure that {

when { UE initiates MMTEL call in 5GS and completes it successfully, and, UE receives SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information with the SOR-CMCI field which indicates Tsor-cm timer and Criterion type with setting as MMTEL voice call }

then { UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message **and** UE sends DEREGISTRATION REQUEST message after Tsor-cm timerexpires **and** selects higher priority PLMN after DEREGISTRATION procedure is completed successfully }

}

6.3.2.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.4.1, C.4.2, and C.4.3. Unless otherwise stated these are Rel-17 requirements.

[TS 23.122, clause C.4.1]

The HPLMN or subscribed SNPN, based on operator policy, may provide the UE with SOR-CMCI to control the timing when the UE enters idle mode and performs higher priority PLMN/access technology or SNPN selection. This is achieved by the HPLMN indicating to the UE the criteria for releasing specific PDU session(s) or services and entering idle mode.

NOTE 1: The released PDU sessions may be re-established by the application once the UE successfully registers on a higher priority PLMN or SNPN. User interaction is required for some applications.

The HPLMN or subscribed SNPN may configure the SOR-CMCI in the UE, and may also provide the SOR-CMCI to the UE over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling takes precedence over the SOR-CMCI stored in the non-volatile memory of the ME or stored in the USIM.

NOTE 2: The SOR-CMCI received over N1 NAS signalling in the SOR information is either the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]) which is received in a secured packet, or the SOR-CMCI received in plain text.

If the UE receives SOR information containing the list of preferred PLMN/access technology combinations or SOR-SNPN-SI without SOR-CMCI, or the ME receives USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" without SOR-CMCI, or the security check of the received steering of roaming information is not successful as described in clause C.2, clause C.3 and clause C.4.3, then:

1) if the UE has SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the non-volatile memory of the ME; and

2) if the UE has no SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the USIM, if any.

The UE shall delete the stored SOR-CMCI, if any, in the non-volatile memory of the ME and store the received SOR-CMCI in the non-volatile memory of the ME when:

1) the ME receives SOR-CMCI in the USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming"; or

2) the UE receives the steering of roaming information containing the SOR-CMCI over N1 NAS signalling and the UE receives the "Store SOR-CMCI in ME" indicator set to "Store SOR-CMCI in ME";

The SOR-CMCI shall be stored in the non-volatile memory of the ME together with the SUPI from the USIM. The ME shall not delete the SOR-CMCI when the UE is switched off. The ME shall delete the SOR-CMCI when a new USIM is inserted.

SOR-CMCI consists of SOR-CMCI rules. Each SOR-CMCI rule consists of the following parameters:

i) a criterion of one of the following types:

- PDU session attribute type criterion;

- service type criterion;

- SOR security check criterion; or

- match all type criterion; and

ii) a value for Tsor-cm timer associated with each criterion presented in i) indicating the time the UE shall wait before releasing the PDU sessions or the services and entering idle mode.

SOR-CMCI contains zero, one or more SOR-CMCI rules with PDU session attribute type criterion, zero, one or more SOR-CMCI rules with service type criterion, and zero or one SOR-CMCI rule with match all type criterion.

PDU session attribute type criterion consists of one of the following:

a) DNN of the PDU session;

b) S-NSSAI STT of the PDU session; or

c) S-NSSAI SST and SD of the PDU session.

Service type criterion consists of one of the following:

a) IMS registration related signalling;

b) MMTEL voice call;

c) MMTEL video call; or

d) SMS over NAS or SMSoIP.

SOR security check criterion consists of:

a) SOR security check not successful.

Match all type criterion consists of:

a) match all.

When the SOR-CMCI received by the UE over N1 NAS signalling contains no SOR-CMCI rules, the UE shall stop all running Tsor-cm timers, if any, and act as if no SOR-CMCI is configured. Additionally:

- if the SOR-CMCI is received in plain text and it also contains the "Store SOR-CMCI in ME" indicator, the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any; and

- if the SOR-CMCI is received in a secured packet, and the USIM provides the ME with the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]), then the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any.

The HPLMN may update the SOR-CMCI in the USIM such that it contains no SOR-CMCI rules, in which case the UE behaviour described in clause C.4.2 applies. Also the HPLMN may make the SOR-CMCI file in the USIM unavailable (see 3GPP TS 31.102 [40]).

If there are more than one criterion applicable for a PDU session (e.g., a criterion for the PDU session and another one for the service) then the Tsor-cm timer with the highest value shall apply.

If there are more than one criterion applicable to different ongoing PDU sessions or services leading to multiple applicable Tsor-cm timers, then all the applicable Tsor-cm timers shall be started. Further handling of such cases is described in clause C.4.2.

If the value for Tsor-cm timer equals "infinity" then the UE shall wait until the PDU session is released or the service is stopped.

The Tsor-cm timer is applicable only if the UE is in automatic network selection mode.

Upon switching to the manual network selection mode, the UE shall stop any Tsor-cm timer, if running. In this case, the UE is not required to enter idle mode and perform the de-registration procedure.

The UE shall consider the following services as exempted from being forced to release the related established PDU session, if any, enter idle mode and perform high priority PLMN/access technology or SNPN selection. These services are known to the UE by default and the UE shall not follow the SOR-CMCI criteria even if configured to interrupt such services:

i) emergency services.

The UE configured with high priority access in the selected PLMN or SNPN shall consider all services and all related established PDU sessions, if any, to be exempted from being forced to be released to enter idle mode and perform high priority PLMN/access technology or SNPN selection.

[TS 23.122, clause C.4.2]

During SOR procedure and while applying SOR-CMCI, the UE shall determine the time to release the PDU session(s) or the services as follows:

- If the UE encounters SOR security check not successful on the received steering of roaming information, and a matching criterion "SOR security check not successful" is included in the SOR-CMCI stored in the non-volatile memory of the ME, then the UE shall:

- if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

- stop all other running Tsor-cm timers, if any; and

- not start any new Tsor-cm timer while Tsor-cm timer associated with "SOR security check not successful" criterion is running;

- If one or more SOR-CMCI rules are included in SOR-CMCI, where for each criterion:

a) DNN of the PDU session:

the UE shall check whether it has a PDU session with a DNN matching to the DNN included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b) S-NSSAI SST of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST matching the S-NSSAI SST included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b1) S-NSSAI SST and SD of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST and SD matching the S-NSSAI SST and SD included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

c) IMS registration related signalling:

the UE shall check whether IMS registration related signalling is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

d) MMTEL voice call:

the UE shall check whether MMTEL voice call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

e) MMTEL video call:

the UE shall check whether MMTEL video call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

f) SMS over NAS or SMSoIP:

the UE shall check whether SMS over NAS or SMSoIP services is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI; or

g) match all:

the UE shall check whether there are any PDU sessions or services for which there is no matching criterion in a) to f) above. If such PDU session or service exists, then for each of these PDU sessions or services, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI.

If the SOR-CMCI is available, and:

- the SOR-CMCI used is in the USIM, contains no SOR-CMCI rule;

- there are one or more SOR-CMCI rules but there is no criterion matched with any ongoing PDU session or service; or

- there are one or more SOR-CMCI rules and there is one or more criteria matched with an ongoing PDU session or service, but the highest Tsor-cm timer value associated with the matched criteria is equal to zero;

then there is no Tsor-cm timer started for any PDU session or service.

While one or more Tsor-cm timers are running, the UE shall check the newly established PDU session or service for a matching criterion in the SOR-CMCI:

- If a matching criterion is found and the applicable Tsor-cm timer indicated the value "infinity" then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value set to infinity; or

- For all other cases, if a matching criterion is found and the timer value is not zero then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value included in the SOR-CMCI, with the exception that if the value of the Tsor-cm timer included in the SOR-CMCI exceeds the highest value among the current values of all running Tsor-cm timers, then the value of the Tsor-cm timer for the newly established PDU session or service shall be set to the highest value among the current values of all running Tsor-cm timers.

NOTE 1: For newly established PDU session or service as described above, the timer is set irrespective of whether other ongoing PDU sessions or services that match the same criteria exist and for which corresponding Tsor-cm timers are running.

NOTE 2: NAS 5GMM layer will receive an explicit indication from the upper layers that a service is started or stopped. When a service is started, it is handled as a new service in the procedures described in this clause.

NOTE 3: While one or more Tsor-cm timers are running, the UE can trigger any 5GSM procedure or start new services.

While one or more Tsor-cm timers are running, upon receiving a new SOR-CMCI as described in annex C.4.3, the UE shall check if there is a matching criterion found for any ongoing PDU session or service in the new SOR-CMCI:

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI indicates the value "infinity", then:

a) if the Tsor-cm timer associated to the PDU session or service is not running, then the UE shall start the Tsor-cm timer associated to the PDU session or service with the value set to infinity; or

b) if the Tsor-cm timer associated to the PDU session or service is already running, then the UE shall set the value of the Tsor-cm timer associated to the PDU session or service to infinity without stopping and restarting the timer;

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI is other than infinity and is smaller than the current value of the running Tsor-cm timer for the associated PDU session or service, then the Tsor-cm timer value for the associated PDU session or service shall be replaced with the value in the new SOR-CMCI without stopping and restarting the timer; or

- for all other cases, the running Tsor-cm timers for the associated PDU sessions or services are kept unchanged.

The Tsor-cm timer shall be stopped when the associated PDU session is released or the associated service is stopped.

If the security check on the received steering of roaming information is successful, the UE shall stop the Tsor-cm timer associated with "SOR security check not successful", if running, and act on the received steering of roaming information. The current PLMN or SNPN is not considered as lowest priority.

NOTE 4: This also applies to the case when the current PLMN or SNPN is different from the PLMN or SNPN in which the Tsor-cm timer associated with "SOR security check not successful" was started.

If the UE, while one or more Tsor-cm timers are running:

a) enters idle mode not due to lower layer failure (see 3GPP TS 24.501 [64]);

b) is not able to successfully recover the N1 NAS signalling connection (see 3GPP TS 24.501 [64]); or

c) enters 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]);

then the UE shall stop the timer(s). In these cases, if:

a) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

b) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN using any other implementation specific means;

then the UE shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 5: When the UE enters idle mode due to lower layer failure while one or more Tsor-cm timers are running, then the UE does not stop Tsor-cm timer(s) as recovery of NAS signalling connection is possible (see 3GPP TS 24.501 [64]).

When the UE determines that no Tsor-cm timer is started for any PDU session or service, the last running Tsor-cm timer is stopped due to release of the associated PDU sessions or stop of the associated services, or the last running Tsor-cm timer expires, if:

i) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

ii) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPNusing any other implementation specific means;

then if the UE is in 5GMM-CONNECTED mode, the UE shall perform the deregistration procedure (see clause 4.2.2.3 of 3GPP TS 23.502 [63]) that releases all the established PDU sessions and services, if any, and once the UE enters idle mode it shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 6: The list of available and allowable PLMNs or SNPNs in the area is implementation specific.

The UE which has an emergency PDU session, receives a request from the upper layers to establish an emergency PDU session or perform emergency services fallback, registers for emergency services, or is configured for high priority access in the selected PLMN or SNPN is not required to enter idle mode if the last running Tsor-cm timer for any PDU session or service stops or expires. In this case, the UE shall attempt to perform the PLMN or SNPN selection after the emergency PDU session or the high priority service is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

If the UE selects a cell of any access technology other than NG-RAN, the ongoing SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.

NOTE 7: If the UE is served by any access technology other than NG-RAN, the HPLMN can initiate a steering of roaming procedure as specified in clause 4.4.6.

[TS 23.122, clause C.4.3]

The stage-2 flow for providing UE with SOR-CMCI in HPLMN, VPLMN, subscribed SNPN or non-subscribed SNPN after registration is indicated in figure C.4.3.1, when the ME supports the SOR-CMCI. The selected PLMN or SNPN can be the HPLMN, a VPLMN, the subscribed SNPN or a non-subscribed SNPN. The AMF is located in the selected PLMN or SNPN. The UDM is located in the HPLMN or the subscribed SNPN.

In this procedure, the SOR-CMCI is sent without the list of preferred PLMN/access technology combinations and the SOR-SNPN-SI. In this procedure, the SOR-CMCI is sent in plain text or is sent within the secured packet.

NOTE 1: The SOR-AF can determine that the ME supports the SOR-CMCI if the Nsoraf\_SoR\_Info service operation has returned the "ME support of SOR-CMCI" indicator. The UDM can determine that the ME supports the SOR-CMCI if the "ME support of SOR-CMCI" indicator is stored for the UE. How the SOR-AF determines that the USIM for the indicated SUPI supports SOR-CMCI is implementation specific.

NOTE 2: The secured packet provided by the SOR-AF can include SOR-CMCI only if the SOR-AF has determined that the ME supports the SOR-CMCI and the USIM of the indicated SUPI supports SOR-CMCI. Otherwise if only the "ME support of SOR-CMCI" indicator is stored for the UE, then SOR-CMCI, if any, cannot be included in the secured packet.

The procedure is triggered:

- If the UDM supports obtaining the parameters of the list of preferred PLMN/access technology combinations, the SOR-SNPN-SI, the SOR-CMCI, and the "Store SOR-CMCI in ME" indicator, if any, or a secured packet from the SOR-AF, the HPLMN or subscribed SNPN policy for the SOR-AF invocation is present in the UDM and the SOR-AF provides the UDM with the SOR-CMCI for a UE identified by SUPI; or

- When the SOR-CMCI becomes available in the UDM (i.e., retrieved from the UDR).

Figure C.4.3.1: Procedure for configuring UE with SOR-CMCI after registration

For the steps below, security protection is described in 3GPP TS 33.501 [24].

1) The SOR-AF to the UDM: Nudm\_ParameterProvision\_Update request is sent to the UDM to trigger the update of the UE with the SOR-CMCI (in plain text or secured packet). In case of providing SOR-CMCI in plain text, include the "Store SOR-CMCI in ME" indicator, if applicable. In case of providing SOR-CMCI in a secured packet, include an indication that "the list of preferred PLMN/access technology combinations is not included in the secured packet".

2) The UDM to the AMF: The UDM notifies the changes of the user profile to the affected AMF by the means of invoking Nudm\_SDM\_Notification service operation. The Nudm\_SDM\_Notification service operation contains the steering of roaming information that needs to be delivered transparently to the UE over NAS within the Access and Mobility Subscription data. If the HPLMN or subscribed SNPN decided that the UE is to acknowledge successful security check of the received steering of roaming information, the Nudm\_SDM\_Notification service operation also contains an indication that the UDM requests an acknowledgement from the UE as part of the steering of roaming information. The UDM:

- upon receiving the SOR-CMCI (in plain text), shall:

i) if the UE is registered in the HPLMN or a VPLMN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided';

ii) if the UE is registered in a non-subscribed SNPN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; and

iii) if the UE is registered in a subscribed SNPN and the AMF has reported to the UDM that the UE supports SOR-SNPN-SI, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; or

- upon receiving the SOR-CMCI in secured packet, shall include the secured packet into the steering of roaming information;

NOTE 3: The UDM considers "the list of preferred PLMN/access technology combinations is not included in the secured packet" received together with the secured packet from the SOR-AF to indicate that the UE is not expected to perform SOR based on the associated steering of roaming information sent to the UE. However, the SOR-CMCI included in the secured packet can be applied by the UE if the UE has one or more Tsor-cm timers running as described in C.4.2.

NOTE 4: The UDM cannot provide the SOR-CMCI, if any, to the AMF which does not support receiving SoR transparent container (see 3GPP TS 29.503 [78]).

3) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

4) Upon receiving the steering of roaming information containing the SOR-CMCI and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' or the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided', or the secured packet, the UE shall perform a security check on the steering of roaming information included in the DL NAS TRANSPORT message to verify that the steering of roaming information is provided by HPLMN or subscribed SNPN, and:

a) if the security check is successful, the UE shall store the SOR-CMCI according to clause C.4.1. If the UE has one or more Tsor-cm timers running, the UE shall apply the received SOR-CMCI as described in C.4.2.

If the steering of roaming information contains a secured packet and the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported" only after the ME receives UICC responses indicating that the UICC has received the secured packet successfully. Otherwise, if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported". Additionally, if the UE supports access to an SNPN using credentials from a credentials holder and the UE is in a PLMN, the UE may set the "ME support of SOR-SNPN-SI" indicator to "supported".

If the UDM has not requested an acknowledgement from the UE then step 5 is skipped; and

b) if the selected PLMN is a VPLMN or a non-subscribed SNPN, the security check is not successful and the UE is in automatic network selection mode, then:

- if the UE has a SOR-CMCI stored in the non-volatile memory of the ME, the current PLMN is considered as lowest priority and the UE shall apply the actions in clause C.4.2;

- otherwise, the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, or before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN or SNPN is a VPLMN or a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

Step 5 is skipped;

NOTE 5: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list or the current chosen non-subscribed SNPN is part of the user controlled prioritized list of preferred SNPNs for the selected entry of the "list of subscriber data" the selected PLMN subscription, the UE stays on the VPLMN or non-subscribed SNPN.

5) The AMF to the UDM: If the UL NAS TRANSPORT message with an SOR transparent container is received, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge successful security check of the received steering of roaming information in step 2, the UDM verifies that the acknowledgement is provided by the UE. The UDM shall store the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any; and

6) The UDM to the SOR-AF: Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery, "ME support of SOR-CMCI" indicator, "ME support of SOR-SNPN-SI" indicator, if any). If the HPLMN policy for the SOR-AF invocation is present and the HPLMN UDM received and verified the UE acknowledgement in step 5, then the UDM informs the SOR-AF about successful delivery of the SOR-CMCI to the UE. The UDM shall include the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any.

If the selected PLMN is a VPLMN or a non-subscribed SNPN and:

- the UE in manual mode of operation encounters security check failure of SOR information in DL NAS TRANSPORT message; and

- upon switching to automatic network selection mode the UE remembers that it is still registered on the PLMN the non-subscribed SNPN where the security check failure of SOR information was encountered;

the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3, by acting as if timer T that controls periodic attempts has expired, with an exception that the current registered PLMN is considered as lowest priority, or before attempting to obtained service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN is a VPLMN or the selected SNPN is a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

NOTE 6: The receipt of the steering of roaming information by itself does not trigger the release of the emergency PDU session.

6.3.2.2.3 Test description

6.3.2.2.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.2.2.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.2.2.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.2.2.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN names** |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

- NR Cell 11 is set to "Serving Cell";

- NR Cell 12 is set to "Serving Cell";

- System Information Combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is switched on and brought to state 3N-A, RRC\_CONNECTED Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4 and IMS PDU session establishment and IMS registration procedure need to be performed on NR Cell 12.

6.3.2.2.4 Test procedure sequence

**Table 6.3.2.2.4-1: Main behaviour**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | Void | - | - | - | - |
| 2-21a1 | Void | - | - | - | - |
| 22-34 | Steps 1 to 13 from test procedure for IMS MO speech call establishment as described in TS 38.508-1 [4] Table 4.9.15.2.2-1 are performed. | - | - | - | - |
| 35 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception | <-- | NR RRC: DLInformationTransfer  5GMM: DL NAS TRANSPORT | - | - |
| 36 | The SS starts timer with Tsor-cm timer value = 60s. | - | - | - | - |
| 37 | The SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 38 | Check: Does the UE transmit an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information? | --> | NR RRC: ULInformationTransfer  5GMM:UL NAS TRANSPORT | 1 | P |
| 38A | Generic procedure for IMS MO speech call release as described in TS 38.508-1 [4] Table 4.9.17.2.2-1 is performed after Tsor-cm timer expires. | - | - | - | - |
| 39 | Check: Does the UE transmit a DEREGISTRATION REQUEST after Tsor-cm timer expires? | --> | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION REQUEST | 1 | P |
| 40 | The SS transmits a DEREGISTRATION ACCEPT message. | <-- | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION ACCEPT | - | - |
| 40A | The SS releases the RRC connection on NR cell 12. | - | - | - | - |
| 41 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: RRCSetupRequest | 1 | P |
| 42-43 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. (Note 4) | - | - | - | - |
|  | EXCEPTION: Void | - | - | - | - |
| 44a1-44a16a1 | Void | - | - | - | - |
| 44b1-44b3a1 | Void | - | - | - | - |
| 45-60a1 | Steps 5 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 11. | - | - | - | - |
| Note 1: Timer tmax in step 37 and 41 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 2min is added to allow time for the UE to find the proper PLMN | | | | | |

6.3.2.2.5 Specific message contents

**Table 6.3.2.2.5-1: DL NAS TRANSPORT Message** **for NR Cell 12 (step 35, Table 6.3.2.2.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| Additional parameters (AP) value | 1 | Additional parameters included |  |
| Length of PLMN ID and access technology list | ‘05’O |  |  |
| PLMN ID and access technology list |  |  |  |
| PLMN ID 1 | PLMN2 |  |  |
| access technology identifier 1 | NG-RAN |  |  |
| SOR-CMCI | Present |  |  |
| Length of SOR-CMCI contents |  | Length value of SOR-CMCI rule1 |  |
| SOR-CMCI rule 1 |  |  |  |
| Length of SOR-CMCI rule contents |  | Length value of SOR-CMCI rule contents |  |
| Tsor-cm timer value | ‘00100001’B | 60s |  |
| Criterion type | ‘00000101’B | MMTEL voice call |  |
| Criterion value | Not Present |  |  |

**Table 6.3.2.2.5-2: UL NAS TRANSPORT Message for NR Cell 12 (step 38, Table 6.3.2.2.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| ME support of SOR-CMCI indicator (MSSI) value | 1 | SOR-CMCI supported by the ME |  |

**Table 6.3.2.2.5-3:DEREGISTRATION REQUEST for NR Cell 12 (Step 39, Table 6.3.2.2.4-1)**

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-12 with condition NORMAL. |

#### 6.3.2.3 Steering of UE in roaming after registration / SOR-CMCI rule / match all / DL NAS transport

6.3.2.3.1 Test Purpose (TP)

(1)

with { UE being in automatic PLMN selection mode and UE has registered onto a VPLMN with an established PDU session }

ensure that {

when { UE receives SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information with the SOR-CMCI field which includes Tsor-cm timer and Criterion type with setting as match all }

then { UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message **and** UE sends DEREGISTRATION REQUEST message after Tsor-cm timerexpires **and** selects higher priority PLMN after DEREGISTRATION procedure is completed successfully }

}

6.3.2.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.4.1, C.4.2, and C.4.3. Unless otherwise stated these are Rel-17 requirements.

[TS 23.122, clause C.4.1]

The HPLMN or subscribed SNPN, based on operator policy, may provide the UE with SOR-CMCI to control the timing when the UE enters idle mode and performs higher priority PLMN/access technology or SNPN selection. This is achieved by the HPLMN indicating to the UE the criteria for releasing specific PDU session(s) or services and entering idle mode.

NOTE 1: The released PDU sessions may be re-established by the application once the UE successfully registers on a higher priority PLMN or SNPN. User interaction is required for some applications.

The HPLMN or subscribed SNPN may configure the SOR-CMCI in the UE, and may also provide the SOR-CMCI to the UE over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling takes precedence over the SOR-CMCI stored in the non-volatile memory of the ME or stored in the USIM.

NOTE 2: The SOR-CMCI received over N1 NAS signalling in the SOR information is either the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]) which is received in a secured packet, or the SOR-CMCI received in plain text.

If the UE receives SOR information containing the list of preferred PLMN/access technology combinations or SOR-SNPN-SI without SOR-CMCI, or the ME receives USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" without SOR-CMCI, or the security check of the received steering of roaming information is not successful as described in clause C.2, clause C.3 and clause C.4.3, then:

1) if the UE has SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the non-volatile memory of the ME; and

2) if the UE has no SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the USIM, if any.

The UE shall delete the stored SOR-CMCI, if any, in the non-volatile memory of the ME and store the received SOR-CMCI in the non-volatile memory of the ME when:

1) the ME receives SOR-CMCI in the USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming"; or

2) the UE receives the steering of roaming information containing the SOR-CMCI over N1 NAS signalling and the UE receives the "Store SOR-CMCI in ME" indicator set to "Store SOR-CMCI in ME";

The SOR-CMCI shall be stored in the non-volatile memory of the ME together with the SUPI from the USIM. The ME shall not delete the SOR-CMCI when the UE is switched off. The ME shall delete the SOR-CMCI when a new USIM is inserted.

SOR-CMCI consists of SOR-CMCI rules. Each SOR-CMCI rule consists of the following parameters:

i) a criterion of one of the following types:

- PDU session attribute type criterion;

- service type criterion;

- SOR security check criterion; or

- match all type criterion; and

ii) a value for Tsor-cm timer associated with each criterion presented in i) indicating the time the UE shall wait before releasing the PDU sessions or the services and entering idle mode.

SOR-CMCI contains zero, one or more SOR-CMCI rules with PDU session attribute type criterion, zero, one or more SOR-CMCI rules with service type criterion, and zero or one SOR-CMCI rule with match all type criterion.

PDU session attribute type criterion consists of one of the following:

a) DNN of the PDU session;

b) S-NSSAI STT of the PDU session; or

c) S-NSSAI SST and SD of the PDU session.

Service type criterion consists of one of the following:

a) IMS registration related signalling;

b) MMTEL voice call;

c) MMTEL video call; or

d) SMS over NAS or SMSoIP.

SOR security check criterion consists of:

a) SOR security check not successful.

Match all type criterion consists of:

a) match all.

When the SOR-CMCI received by the UE over N1 NAS signalling contains no SOR-CMCI rules, the UE shall stop all running Tsor-cm timers, if any, and act as if no SOR-CMCI is configured. Additionally:

- if the SOR-CMCI is received in plain text and it also contains the "Store SOR-CMCI in ME" indicator, the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any; and

- if the SOR-CMCI is received in a secured packet, and the USIM provides the ME with the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]), then the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any.

The HPLMN may update the SOR-CMCI in the USIM such that it contains no SOR-CMCI rules, in which case the UE behaviour described in clause C.4.2 applies. Also the HPLMN may make the SOR-CMCI file in the USIM unavailable (see 3GPP TS 31.102 [40]).

If there are more than one criterion applicable for a PDU session (e.g., a criterion for the PDU session and another one for the service) then the Tsor-cm timer with the highest value shall apply.

If there are more than one criterion applicable to different ongoing PDU sessions or services leading to multiple applicable Tsor-cm timers, then all the applicable Tsor-cm timers shall be started. Further handling of such cases is described in clause C.4.2.

If the value for Tsor-cm timer equals "infinity" then the UE shall wait until the PDU session is released or the service is stopped.

The Tsor-cm timer is applicable only if the UE is in automatic network selection mode.

Upon switching to the manual network selection mode, the UE shall stop any Tsor-cm timer, if running. In this case, the UE is not required to enter idle mode and perform the de-registration procedure.

The UE shall consider the following services as exempted from being forced to release the related established PDU session, if any, enter idle mode and perform high priority PLMN/access technology or SNPN selection. These services are known to the UE by default and the UE shall not follow the SOR-CMCI criteria even if configured to interrupt such services:

i) emergency services.

The UE configured with high priority access in the selected PLMN or SNPN shall consider all services and all related established PDU sessions, if any, to be exempted from being forced to be released to enter idle mode and perform high priority PLMN/access technology or SNPN selection.

[TS 23.122, clause C.4.2]

During SOR procedure and while applying SOR-CMCI, the UE shall determine the time to release the PDU session(s) or the services as follows:

- If the UE encounters SOR security check not successful on the received steering of roaming information, and a matching criterion "SOR security check not successful" is included in the SOR-CMCI stored in the non-volatile memory of the ME, then the UE shall:

- if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

- stop all other running Tsor-cm timers, if any; and

- not start any new Tsor-cm timer while Tsor-cm timer associated with "SOR security check not successful" criterion is running;

- If one or more SOR-CMCI rules are included in SOR-CMCI, where for each criterion:

a) DNN of the PDU session:

the UE shall check whether it has a PDU session with a DNN matching to the DNN included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b) S-NSSAI SST of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST matching the S-NSSAI SST included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b1) S-NSSAI SST and SD of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST and SD matching the S-NSSAI SST and SD included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

c) IMS registration related signalling:

the UE shall check whether IMS registration related signalling is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

d) MMTEL voice call:

the UE shall check whether MMTEL voice call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

e) MMTEL video call:

the UE shall check whether MMTEL video call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

f) SMS over NAS or SMSoIP:

the UE shall check whether SMS over NAS or SMSoIP services is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI; or

g) match all:

the UE shall check whether there are any PDU sessions or services for which there is no matching criterion in a) to f) above. If such PDU session or service exists, then for each of these PDU sessions or services, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI.

If the SOR-CMCI is available, and:

- the SOR-CMCI used is in the USIM, contains no SOR-CMCI rule;

- there are one or more SOR-CMCI rules but there is no criterion matched with any ongoing PDU session or service; or

- there are one or more SOR-CMCI rules and there is one or more criteria matched with an ongoing PDU session or service, but the highest Tsor-cm timer value associated with the matched criteria is equal to zero;

then there is no Tsor-cm timer started for any PDU session or service.

While one or more Tsor-cm timers are running, the UE shall check the newly established PDU session or service for a matching criterion in the SOR-CMCI:

- If a matching criterion is found and the applicable Tsor-cm timer indicated the value "infinity" then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value set to infinity; or

- For all other cases, if a matching criterion is found and the timer value is not zero then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value included in the SOR-CMCI, with the exception that if the value of the Tsor-cm timer included in the SOR-CMCI exceeds the highest value among the current values of all running Tsor-cm timers, then the value of the Tsor-cm timer for the newly established PDU session or service shall be set to the highest value among the current values of all running Tsor-cm timers.

NOTE 1: For newly established PDU session or service as described above, the timer is set irrespective of whether other ongoing PDU sessions or services that match the same criteria exist and for which corresponding Tsor-cm timers are running.

NOTE 2: NAS 5GMM layer will receive an explicit indication from the upper layers that a service is started or stopped. When a service is started, it is handled as a new service in the procedures described in this clause.

NOTE 3: While one or more Tsor-cm timers are running, the UE can trigger any 5GSM procedure or start new services.

While one or more Tsor-cm timers are running, upon receiving a new SOR-CMCI as described in annex C.4.3, the UE shall check if there is a matching criterion found for any ongoing PDU session or service in the new SOR-CMCI:

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI indicates the value "infinity", then:

a) if the Tsor-cm timer associated to the PDU session or service is not running, then the UE shall start the Tsor-cm timer associated to the PDU session or service with the value set to infinity; or

b) if the Tsor-cm timer associated to the PDU session or service is already running, then the UE shall set the value of the Tsor-cm timer associated to the PDU session or service to infinity without stopping and restarting the timer;

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI is other than infinity and is smaller than the current value of the running Tsor-cm timer for the associated PDU session or service, then the Tsor-cm timer value for the associated PDU session or service shall be replaced with the value in the new SOR-CMCI without stopping and restarting the timer; or

- for all other cases, the running Tsor-cm timers for the associated PDU sessions or services are kept unchanged.

The Tsor-cm timer shall be stopped when the associated PDU session is released or the associated service is stopped.

If the security check on the received steering of roaming information is successful, the UE shall stop the Tsor-cm timer associated with "SOR security check not successful", if running, and act on the received steering of roaming information. The current PLMN or SNPN is not considered as lowest priority.

NOTE 4: This also applies to the case when the current PLMN or SNPN is different from the PLMN or SNPN in which the Tsor-cm timer associated with "SOR security check not successful" was started.

If the UE, while one or more Tsor-cm timers are running:

a) enters idle mode not due to lower layer failure (see 3GPP TS 24.501 [64]);

b) is not able to successfully recover the N1 NAS signalling connection (see 3GPP TS 24.501 [64]); or

c) enters 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]);

then the UE shall stop the timer(s). In these cases, if:

a) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

b) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN using any other implementation specific means;

then the UE shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 5: When the UE enters idle mode due to lower layer failure while one or more Tsor-cm timers are running, then the UE does not stop Tsor-cm timer(s) as recovery of NAS signalling connection is possible (see 3GPP TS 24.501 [64]).

When the UE determines that no Tsor-cm timer is started for any PDU session or service, the last running Tsor-cm timer is stopped due to release of the associated PDU sessions or stop of the associated services, or the last running Tsor-cm timer expires, if:

i) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

ii) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPNusing any other implementation specific means;

then if the UE is in 5GMM-CONNECTED mode, the UE shall perform the deregistration procedure (see clause 4.2.2.3 of 3GPP TS 23.502 [63]) that releases all the established PDU sessions and services, if any, and once the UE enters idle mode it shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 6: The list of available and allowable PLMNs or SNPNs in the area is implementation specific.

The UE which has an emergency PDU session, receives a request from the upper layers to establish an emergency PDU session or perform emergency services fallback, registers for emergency services, or is configured for high priority access in the selected PLMN or SNPN is not required to enter idle mode if the last running Tsor-cm timer for any PDU session or service stops or expires. In this case, the UE shall attempt to perform the PLMN or SNPN selection after the emergency PDU session or the high priority service is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

If the UE selects a cell of any access technology other than NG-RAN, the ongoing SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.

NOTE 7: If the UE is served by any access technology other than NG-RAN, the HPLMN can initiate a steering of roaming procedure as specified in clause 4.4.6.

[TS 23.122, clause C.4.3]

The stage-2 flow for providing UE with SOR-CMCI in HPLMN, VPLMN, subscribed SNPN or non-subscribed SNPN after registration is indicated in figure C.4.3.1, when the ME supports the SOR-CMCI. The selected PLMN or SNPN can be the HPLMN, a VPLMN, the subscribed SNPN or a non-subscribed SNPN. The AMF is located in the selected PLMN or SNPN. The UDM is located in the HPLMN or the subscribed SNPN.

In this procedure, the SOR-CMCI is sent without the list of preferred PLMN/access technology combinations and the SOR-SNPN-SI. In this procedure, the SOR-CMCI is sent in plain text or is sent within the secured packet.

NOTE 1: The SOR-AF can determine that the ME supports the SOR-CMCI if the Nsoraf\_SoR\_Info service operation has returned the "ME support of SOR-CMCI" indicator. The UDM can determine that the ME supports the SOR-CMCI if the "ME support of SOR-CMCI" indicator is stored for the UE. How the SOR-AF determines that the USIM for the indicated SUPI supports SOR-CMCI is implementation specific.

NOTE 2: The secured packet provided by the SOR-AF can include SOR-CMCI only if the SOR-AF has determined that the ME supports the SOR-CMCI and the USIM of the indicated SUPI supports SOR-CMCI. Otherwise if only the "ME support of SOR-CMCI" indicator is stored for the UE, then SOR-CMCI, if any, cannot be included in the secured packet.

The procedure is triggered:

- If the UDM supports obtaining the parameters of the list of preferred PLMN/access technology combinations, the SOR-SNPN-SI, the SOR-CMCI, and the "Store SOR-CMCI in ME" indicator, if any, or a secured packet from the SOR-AF, the HPLMN or subscribed SNPN policy for the SOR-AF invocation is present in the UDM and the SOR-AF provides the UDM with the SOR-CMCI for a UE identified by SUPI; or

- When the SOR-CMCI becomes available in the UDM (i.e., retrieved from the UDR).

**Figure C.4.3.1: Procedure for configuring UE with SOR-CMCI after registration**

For the steps below, security protection is described in 3GPP TS 33.501 [24].

1) The SOR-AF to the UDM: Nudm\_ParameterProvision\_Update request is sent to the UDM to trigger the update of the UE with the SOR-CMCI (in plain text or secured packet). In case of providing SOR-CMCI in plain text, include the "Store SOR-CMCI in ME" indicator, if applicable. In case of providing SOR-CMCI in a secured packet, include an indication that "the list of preferred PLMN/access technology combinations is not included in the secured packet".

2) The UDM to the AMF: The UDM notifies the changes of the user profile to the affected AMF by the means of invoking Nudm\_SDM\_Notification service operation. The Nudm\_SDM\_Notification service operation contains the steering of roaming information that needs to be delivered transparently to the UE over NAS within the Access and Mobility Subscription data. If the HPLMN or subscribed SNPN decided that the UE is to acknowledge successful security check of the received steering of roaming information, the Nudm\_SDM\_Notification service operation also contains an indication that the UDM requests an acknowledgement from the UE as part of the steering of roaming information. The UDM:

- upon receiving the SOR-CMCI (in plain text), shall:

i) if the UE is registered in the HPLMN or a VPLMN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided';

ii) if the UE is registered in a non-subscribed SNPN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; and

iii) if the UE is registered in a subscribed SNPN and the AMF has reported to the UDM that the UE supports SOR-SNPN-SI, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; or

- upon receiving the SOR-CMCI in secured packet, shall include the secured packet into the steering of roaming information;

NOTE 3: The UDM considers "the list of preferred PLMN/access technology combinations is not included in the secured packet" received together with the secured packet from the SOR-AF to indicate that the UE is not expected to perform SOR based on the associated steering of roaming information sent to the UE. However, the SOR-CMCI included in the secured packet can be applied by the UE if the UE has one or more Tsor-cm timers running as described in C.4.2.

NOTE 4: The UDM cannot provide the SOR-CMCI, if any, to the AMF which does not support receiving SoR transparent container (see 3GPP TS 29.503 [78]).

3) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

4) Upon receiving the steering of roaming information containing the SOR-CMCI and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' or the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided', or the secured packet, the UE shall perform a security check on the steering of roaming information included in the DL NAS TRANSPORT message to verify that the steering of roaming information is provided by HPLMN or subscribed SNPN, and:

a) if the security check is successful, the UE shall store the SOR-CMCI according to clause C.4.1. If the UE has one or more Tsor-cm timers running, the UE shall apply the received SOR-CMCI as described in C.4.2.

If the steering of roaming information contains a secured packet and the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported" only after the ME receives UICC responses indicating that the UICC has received the secured packet successfully. Otherwise, if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported". Additionally, if the UE supports access to an SNPN using credentials from a credentials holder and the UE is in a PLMN, the UE may set the "ME support of SOR-SNPN-SI" indicator to "supported".

If the UDM has not requested an acknowledgement from the UE then step 5 is skipped; and

b) if the selected PLMN is a VPLMN or a non-subscribed SNPN, the security check is not successful and the UE is in automatic network selection mode, then:

- if the UE has a SOR-CMCI stored in the non-volatile memory of the ME, the current PLMN is considered as lowest priority and the UE shall apply the actions in clause C.4.2;

- otherwise, the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, or before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN or SNPN is a VPLMN or a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

Step 5 is skipped;

NOTE 5: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list or the current chosen non-subscribed SNPN is part of the user controlled prioritized list of preferred SNPNs for the selected entry of the "list of subscriber data" the selected PLMN subscription, the UE stays on the VPLMN or non-subscribed SNPN.

5) The AMF to the UDM: If the UL NAS TRANSPORT message with an SOR transparent container is received, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge successful security check of the received steering of roaming information in step 2, the UDM verifies that the acknowledgement is provided by the UE. The UDM shall store the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any; and

6) The UDM to the SOR-AF: Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery, "ME support of SOR-CMCI" indicator, "ME support of SOR-SNPN-SI" indicator, if any). If the HPLMN policy for the SOR-AF invocation is present and the HPLMN UDM received and verified the UE acknowledgement in step 5, then the UDM informs the SOR-AF about successful delivery of the SOR-CMCI to the UE. The UDM shall include the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any.

If the selected PLMN is a VPLMN or a non-subscribed SNPN and:

- the UE in manual mode of operation encounters security check failure of SOR information in DL NAS TRANSPORT message; and

- upon switching to automatic network selection mode the UE remembers that it is still registered on the PLMN the non-subscribed SNPN where the security check failure of SOR information was encountered;

the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3, by acting as if timer T that controls periodic attempts has expired, with an exception that the current registered PLMN is considered as lowest priority, or before attempting to obtained service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN is a VPLMN or the selected SNPN is a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

NOTE 6: The receipt of the steering of roaming information by itself does not trigger the release of the emergency PDU session.

6.3.2.3.3 Test description

6.3.2.3.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.2.3.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.2.3.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.2.3.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN names** |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

- NR Cell 11 is set to "Serving Cell";

- NR Cell 12 is set to "Serving Cell";

- System Information Combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is switched on and brought to state 3N-A, RRC\_CONNECTED Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4 need to be performed on NR Cell 12.

6.3.2.3.4 Test procedure sequence

**Table 6.3.2.3.4-1: Main behaviour**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | Void | - | - | - | - |
| 2-21a1 | Void | - | - | - | - |
| 22 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception | <-- | NR RRC: DLInformationTransfer  5GMM: DL NAS TRANSPORT | - | - |
| 23 | The SS starts timer with Tsor-cm timer value = 60s | - | - | - | - |
| 24 | The SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 25 | Check: Does the UE transmit an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information? | --> | NR RRC: ULInformationTransfer  5GMM:UL NAS TRANSPORT | 1 | P |
| 26 | Check: Does the UE transmit a DEREGISTRATION REQUEST after Tsor-cm timer expires? | --> | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION REQUEST | 1 | P |
| 27 | The SS transmits a DEREGISTRATION ACCEPT message. | <-- | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION ACCEPT | - | - |
| 27A | The SS releases the RRC connection on NR cell 12. | - | - | - | - |
| 28 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: RRCSetupRequest | 1 | P |
| 29-30 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. | - | - | - | - |
|  | EXCEPTION:Void | - | - | - | - |
| 31a1-31a16a1 | Void | - | - | - | - |
| 31b1-31b3a1 | Void | - | - | - | - |
| 32-47a1 | Steps 5 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 11. | - | - | - | - |
| Note 1: Timer tmax in step 24 and 28 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 2min is added to allow time for the UE to find the proper PLMN | | | | | |

6.3.2.3.5 Specific message contents

**Table 6.3.2.3.5-1: DL NAS TRANSPORT Message for NR Cell 12 (step 22, Table 6.3.2.3.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| Additional parameters (AP) value | 1 | Additional parameters included |  |
| Length of PLMN ID and access technology list | ‘05’O | PLMN2 |  |
| PLMN ID and access technology list |  | NG-RAN |  |
| PLMN ID 1 | PLMN2 |  |  |
| access technology identifier 1 | NG-RAN |  |  |
| SOR-CMCI | Present |  |  |
| Length of SOR-CMCI contents |  | Length value of SOR-CMCI rule1 |  |
| SOR-CMCI rule 1 |  |  |  |
| Length of SOR-CMCI rule contents |  | Length value of SOR-CMCI rule contents |  |
| Tsor-cm timer value | ‘00100001’B | 60s |  |
| Criterion type | ‘11111111’B | match all |  |
| Criterion value | Not Present |  |  |

**Table 6.3.2.3.5-2: UL NAS TRANSPORT Message for NR Cell 12 (step 25, Table 6.3.2.3.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| ME support of SOR-CMCI indicator (MSSI) value | 1 | SOR-CMCI supported by the ME |  |

Table 6.3.2.3.5-3:DEREGISTRATION REQUEST for NR Cell 12 (Step 26, Table 6.3.2.3.4-1)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-12 with condition NORMAL. |

#### 6.3.2.4 Steering of UE in roaming after registration / SOR-CMCI rule / DNN of the PDU session / update Tsor-cm Timer / DL NAS transport

6.3.2.4.1 Test Purpose (TP)

(1)

with { UE being in automatic PLMN selection mode and UE has registered onto a VPLMN with an established PDU session }

ensure that {

when { UE receives SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information with the SOR-CMCI field which includes Tsor-cm timer and Criterion type with setting as DNN of the PDU session, and, UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message, and, UE receives SOR Transparent container included in DL NAS TRANSPORT message with Tsor-cm timer value is other than infinity and is smaller than the current value of the running Tsor-cm timer, and, UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message }

then { UE sends DEREGISTRATION REQUEST message after Tsor-cm timerexpires,and, selects higher priority PLMN after DEREGISTRATION procedure is completed successfully }

}

6.3.2.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.4.1, C.4.2, and C.4.3. Unless otherwise stated these are Rel-17 requirements.

[TS 23.122, clause C.4.1]

The HPLMN or subscribed SNPN, based on operator policy, may provide the UE with SOR-CMCI to control the timing when the UE enters idle mode and performs higher priority PLMN/access technology or SNPN selection. This is achieved by the HPLMN indicating to the UE the criteria for releasing specific PDU session(s) or services and entering idle mode.

NOTE 1: The released PDU sessions may be re-established by the application once the UE successfully registers on a higher priority PLMN or SNPN. User interaction is required for some applications.

The HPLMN or subscribed SNPN may configure the SOR-CMCI in the UE, and may also provide the SOR-CMCI to the UE over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling takes precedence over the SOR-CMCI stored in the non-volatile memory of the ME or stored in the USIM.

NOTE 2: The SOR-CMCI received over N1 NAS signalling in the SOR information is either the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]) which is received in a secured packet, or the SOR-CMCI received in plain text.

If the UE receives SOR information containing the list of preferred PLMN/access technology combinations or SOR-SNPN-SI without SOR-CMCI, or the ME receives USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" without SOR-CMCI, or the security check of the received steering of roaming information is not successful as described in clause C.2, clause C.3 and clause C.4.3, then:

1) if the UE has SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the non-volatile memory of the ME; and

2) if the UE has no SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the USIM, if any.

The UE shall delete the stored SOR-CMCI, if any, in the non-volatile memory of the ME and store the received SOR-CMCI in the non-volatile memory of the ME when:

1) the ME receives SOR-CMCI in the USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming"; or

2) the UE receives the steering of roaming information containing the SOR-CMCI over N1 NAS signalling and the UE receives the "Store SOR-CMCI in ME" indicator set to "Store SOR-CMCI in ME";

The SOR-CMCI shall be stored in the non-volatile memory of the ME together with the SUPI from the USIM. The ME shall not delete the SOR-CMCI when the UE is switched off. The ME shall delete the SOR-CMCI when a new USIM is inserted.

SOR-CMCI consists of SOR-CMCI rules. Each SOR-CMCI rule consists of the following parameters:

i) a criterion of one of the following types:

- PDU session attribute type criterion;

- service type criterion;

- SOR security check criterion; or

- match all type criterion; and

ii) a value for Tsor-cm timer associated with each criterion presented in i) indicating the time the UE shall wait before releasing the PDU sessions or the services and entering idle mode.

SOR-CMCI contains zero, one or more SOR-CMCI rules with PDU session attribute type criterion, zero, one or more SOR-CMCI rules with service type criterion, and zero or one SOR-CMCI rule with match all type criterion.

PDU session attribute type criterion consists of one of the following:

a) DNN of the PDU session;

b) S-NSSAI STT of the PDU session; or

c) S-NSSAI SST and SD of the PDU session.

Service type criterion consists of one of the following:

a) IMS registration related signalling;

b) MMTEL voice call;

c) MMTEL video call; or

d) SMS over NAS or SMSoIP.

SOR security check criterion consists of:

a) SOR security check not successful.

Match all type criterion consists of:

a) match all.

When the SOR-CMCI received by the UE over N1 NAS signalling contains no SOR-CMCI rules, the UE shall stop all running Tsor-cm timers, if any, and act as if no SOR-CMCI is configured. Additionally:

- if the SOR-CMCI is received in plain text and it also contains the "Store SOR-CMCI in ME" indicator, the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any; and

- if the SOR-CMCI is received in a secured packet, and the USIM provides the ME with the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]), then the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any.

The HPLMN may update the SOR-CMCI in the USIM such that it contains no SOR-CMCI rules, in which case the UE behaviour described in clause C.4.2 applies. Also the HPLMN may make the SOR-CMCI file in the USIM unavailable (see 3GPP TS 31.102 [40]).

If there are more than one criterion applicable for a PDU session (e.g., a criterion for the PDU session and another one for the service) then the Tsor-cm timer with the highest value shall apply.

If there are more than one criterion applicable to different ongoing PDU sessions or services leading to multiple applicable Tsor-cm timers, then all the applicable Tsor-cm timers shall be started. Further handling of such cases is described in clause C.4.2.

If the value for Tsor-cm timer equals "infinity" then the UE shall wait until the PDU session is released or the service is stopped.

The Tsor-cm timer is applicable only if the UE is in automatic network selection mode.

Upon switching to the manual network selection mode, the UE shall stop any Tsor-cm timer, if running. In this case, the UE is not required to enter idle mode and perform the de-registration procedure.

The UE shall consider the following services as exempted from being forced to release the related established PDU session, if any, enter idle mode and perform high priority PLMN/access technology or SNPN selection. These services are known to the UE by default and the UE shall not follow the SOR-CMCI criteria even if configured to interrupt such services:

i) emergency services.

The UE configured with high priority access in the selected PLMN or SNPN shall consider all services and all related established PDU sessions, if any, to be exempted from being forced to be released to enter idle mode and perform high priority PLMN/access technology or SNPN selection.

[TS 23.122, clause C.4.2]

During SOR procedure and while applying SOR-CMCI, the UE shall determine the time to release the PDU session(s) or the services as follows:

- If the UE encounters SOR security check not successful on the received steering of roaming information, and a matching criterion "SOR security check not successful" is included in the SOR-CMCI stored in the non-volatile memory of the ME, then the UE shall:

- if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

- stop all other running Tsor-cm timers, if any; and

- not start any new Tsor-cm timer while Tsor-cm timer associated with "SOR security check not successful" criterion is running;

- If one or more SOR-CMCI rules are included in SOR-CMCI, where for each criterion:

a) DNN of the PDU session:

the UE shall check whether it has a PDU session with a DNN matching to the DNN included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b) S-NSSAI SST of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST matching the S-NSSAI SST included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b1) S-NSSAI SST and SD of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST and SD matching the S-NSSAI SST and SD included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

c) IMS registration related signalling:

the UE shall check whether IMS registration related signalling is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

d) MMTEL voice call:

the UE shall check whether MMTEL voice call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

e) MMTEL video call:

the UE shall check whether MMTEL video call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

f) SMS over NAS or SMSoIP:

the UE shall check whether SMS over NAS or SMSoIP services is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI; or

g) match all:

the UE shall check whether there are any PDU sessions or services for which there is no matching criterion in a) to f) above. If such PDU session or service exists, then for each of these PDU sessions or services, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI.

If the SOR-CMCI is available, and:

- the SOR-CMCI used is in the USIM, contains no SOR-CMCI rule;

- there are one or more SOR-CMCI rules but there is no criterion matched with any ongoing PDU session or service; or

- there are one or more SOR-CMCI rules and there is one or more criteria matched with an ongoing PDU session or service, but the highest Tsor-cm timer value associated with the matched criteria is equal to zero;

then there is no Tsor-cm timer started for any PDU session or service.

While one or more Tsor-cm timers are running, the UE shall check the newly established PDU session or service for a matching criterion in the SOR-CMCI:

- If a matching criterion is found and the applicable Tsor-cm timer indicated the value "infinity" then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value set to infinity; or

- For all other cases, if a matching criterion is found and the timer value is not zero then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value included in the SOR-CMCI, with the exception that if the value of the Tsor-cm timer included in the SOR-CMCI exceeds the highest value among the current values of all running Tsor-cm timers, then the value of the Tsor-cm timer for the newly established PDU session or service shall be set to the highest value among the current values of all running Tsor-cm timers.

NOTE 1: For newly established PDU session or service as described above, the timer is set irrespective of whether other ongoing PDU sessions or services that match the same criteria exist and for which corresponding Tsor-cm timers are running.

NOTE 2: NAS 5GMM layer will receive an explicit indication from the upper layers that a service is started or stopped. When a service is started, it is handled as a new service in the procedures described in this clause.

NOTE 3: While one or more Tsor-cm timers are running, the UE can trigger any 5GSM procedure or start new services.

While one or more Tsor-cm timers are running, upon receiving a new SOR-CMCI as described in annex C.4.3, the UE shall check if there is a matching criterion found for any ongoing PDU session or service in the new SOR-CMCI:

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI indicates the value "infinity", then:

a) if the Tsor-cm timer associated to the PDU session or service is not running, then the UE shall start the Tsor-cm timer associated to the PDU session or service with the value set to infinity; or

b) if the Tsor-cm timer associated to the PDU session or service is already running, then the UE shall set the value of the Tsor-cm timer associated to the PDU session or service to infinity without stopping and restarting the timer;

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI is other than infinity and is smaller than the current value of the running Tsor-cm timer for the associated PDU session or service, then the Tsor-cm timer value for the associated PDU session or service shall be replaced with the value in the new SOR-CMCI without stopping and restarting the timer; or

- for all other cases, the running Tsor-cm timers for the associated PDU sessions or services are kept unchanged.

The Tsor-cm timer shall be stopped when the associated PDU session is released or the associated service is stopped.

If the security check on the received steering of roaming information is successful, the UE shall stop the Tsor-cm timer associated with "SOR security check not successful", if running, and act on the received steering of roaming information. The current PLMN or SNPN is not considered as lowest priority.

NOTE 4: This also applies to the case when the current PLMN or SNPN is different from the PLMN or SNPN in which the Tsor-cm timer associated with "SOR security check not successful" was started.

If the UE, while one or more Tsor-cm timers are running:

a) enters idle mode not due to lower layer failure (see 3GPP TS 24.501 [64]);

b) is not able to successfully recover the N1 NAS signalling connection (see 3GPP TS 24.501 [64]); or

c) enters 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]);

then the UE shall stop the timer(s). In these cases, if:

a) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

b) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN using any other implementation specific means;

then the UE shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 5: When the UE enters idle mode due to lower layer failure while one or more Tsor-cm timers are running, then the UE does not stop Tsor-cm timer(s) as recovery of NAS signalling connection is possible (see 3GPP TS 24.501 [64]).

When the UE determines that no Tsor-cm timer is started for any PDU session or service, the last running Tsor-cm timer is stopped due to release of the associated PDU sessions or stop of the associated services, or the last running Tsor-cm timer expires, if:

i) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

ii) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPNusing any other implementation specific means;

then if the UE is in 5GMM-CONNECTED mode, the UE shall perform the deregistration procedure (see clause 4.2.2.3 of 3GPP TS 23.502 [63]) that releases all the established PDU sessions and services, if any, and once the UE enters idle mode it shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 6: The list of available and allowable PLMNs or SNPNs in the area is implementation specific.

The UE which has an emergency PDU session, receives a request from the upper layers to establish an emergency PDU session or perform emergency services fallback, registers for emergency services, or is configured for high priority access in the selected PLMN or SNPN is not required to enter idle mode if the last running Tsor-cm timer for any PDU session or service stops or expires. In this case, the UE shall attempt to perform the PLMN or SNPN selection after the emergency PDU session or the high priority service is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

If the UE selects a cell of any access technology other than NG-RAN, the ongoing SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.

NOTE 7: If the UE is served by any access technology other than NG-RAN, the HPLMN can initiate a steering of roaming procedure as specified in clause 4.4.6.

[TS 23.122, clause C.4.3]

The stage-2 flow for providing UE with SOR-CMCI in HPLMN, VPLMN, subscribed SNPN or non-subscribed SNPN after registration is indicated in figure C.4.3.1, when the ME supports the SOR-CMCI. The selected PLMN or SNPN can be the HPLMN, a VPLMN, the subscribed SNPN or a non-subscribed SNPN. The AMF is located in the selected PLMN or SNPN. The UDM is located in the HPLMN or the subscribed SNPN.

In this procedure, the SOR-CMCI is sent without the list of preferred PLMN/access technology combinations and the SOR-SNPN-SI. In this procedure, the SOR-CMCI is sent in plain text or is sent within the secured packet.

NOTE 1: The SOR-AF can determine that the ME supports the SOR-CMCI if the Nsoraf\_SoR\_Info service operation has returned the "ME support of SOR-CMCI" indicator. The UDM can determine that the ME supports the SOR-CMCI if the "ME support of SOR-CMCI" indicator is stored for the UE. How the SOR-AF determines that the USIM for the indicated SUPI supports SOR-CMCI is implementation specific.

NOTE 2: The secured packet provided by the SOR-AF can include SOR-CMCI only if the SOR-AF has determined that the ME supports the SOR-CMCI and the USIM of the indicated SUPI supports SOR-CMCI. Otherwise if only the "ME support of SOR-CMCI" indicator is stored for the UE, then SOR-CMCI, if any, cannot be included in the secured packet.

The procedure is triggered:

- If the UDM supports obtaining the parameters of the list of preferred PLMN/access technology combinations, the SOR-SNPN-SI, the SOR-CMCI, and the "Store SOR-CMCI in ME" indicator, if any, or a secured packet from the SOR-AF, the HPLMN or subscribed SNPN policy for the SOR-AF invocation is present in the UDM and the SOR-AF provides the UDM with the SOR-CMCI for a UE identified by SUPI; or

- When the SOR-CMCI becomes available in the UDM (i.e., retrieved from the UDR).

Figure C.4.3.1: Procedure for configuring UE with SOR-CMCI after registration

For the steps below, security protection is described in 3GPP TS 33.501 [24].

1) The SOR-AF to the UDM: Nudm\_ParameterProvision\_Update request is sent to the UDM to trigger the update of the UE with the SOR-CMCI (in plain text or secured packet). In case of providing SOR-CMCI in plain text, include the "Store SOR-CMCI in ME" indicator, if applicable. In case of providing SOR-CMCI in a secured packet, include an indication that "the list of preferred PLMN/access technology combinations is not included in the secured packet".

2) The UDM to the AMF: The UDM notifies the changes of the user profile to the affected AMF by the means of invoking Nudm\_SDM\_Notification service operation. The Nudm\_SDM\_Notification service operation contains the steering of roaming information that needs to be delivered transparently to the UE over NAS within the Access and Mobility Subscription data. If the HPLMN or subscribed SNPN decided that the UE is to acknowledge successful security check of the received steering of roaming information, the Nudm\_SDM\_Notification service operation also contains an indication that the UDM requests an acknowledgement from the UE as part of the steering of roaming information. The UDM:

- upon receiving the SOR-CMCI (in plain text), shall:

i) if the UE is registered in the HPLMN or a VPLMN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided';

ii) if the UE is registered in a non-subscribed SNPN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; and

iii) if the UE is registered in a subscribed SNPN and the AMF has reported to the UDM that the UE supports SOR-SNPN-SI, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; or

- upon receiving the SOR-CMCI in secured packet, shall include the secured packet into the steering of roaming information;

NOTE 3: The UDM considers "the list of preferred PLMN/access technology combinations is not included in the secured packet" received together with the secured packet from the SOR-AF to indicate that the UE is not expected to perform SOR based on the associated steering of roaming information sent to the UE. However, the SOR-CMCI included in the secured packet can be applied by the UE if the UE has one or more Tsor-cm timers running as described in C.4.2.

NOTE 4: The UDM cannot provide the SOR-CMCI, if any, to the AMF which does not support receiving SoR transparent container (see 3GPP TS 29.503 [78]).

3) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

4) Upon receiving the steering of roaming information containing the SOR-CMCI and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' or the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided', or the secured packet, the UE shall perform a security check on the steering of roaming information included in the DL NAS TRANSPORT message to verify that the steering of roaming information is provided by HPLMN or subscribed SNPN, and:

a) if the security check is successful, the UE shall store the SOR-CMCI according to clause C.4.1. If the UE has one or more Tsor-cm timers running, the UE shall apply the received SOR-CMCI as described in C.4.2.

If the steering of roaming information contains a secured packet and the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported" only after the ME receives UICC responses indicating that the UICC has received the secured packet successfully. Otherwise, if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported". Additionally, if the UE supports access to an SNPN using credentials from a credentials holder and the UE is in a PLMN, the UE may set the "ME support of SOR-SNPN-SI" indicator to "supported".

If the UDM has not requested an acknowledgement from the UE then step 5 is skipped; and

b) if the selected PLMN is a VPLMN or a non-subscribed SNPN, the security check is not successful and the UE is in automatic network selection mode, then:

- if the UE has a SOR-CMCI stored in the non-volatile memory of the ME, the current PLMN is considered as lowest priority and the UE shall apply the actions in clause C.4.2;

- otherwise, the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, or before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN or SNPN is a VPLMN or a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

Step 5 is skipped;

NOTE 5: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list or the current chosen non-subscribed SNPN is part of the user controlled prioritized list of preferred SNPNs for the selected entry of the "list of subscriber data" the selected PLMN subscription, the UE stays on the VPLMN or non-subscribed SNPN.

5) The AMF to the UDM: If the UL NAS TRANSPORT message with an SOR transparent container is received, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge successful security check of the received steering of roaming information in step 2, the UDM verifies that the acknowledgement is provided by the UE. The UDM shall store the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any; and

6) The UDM to the SOR-AF: Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery, "ME support of SOR-CMCI" indicator, "ME support of SOR-SNPN-SI" indicator, if any). If the HPLMN policy for the SOR-AF invocation is present and the HPLMN UDM received and verified the UE acknowledgement in step 5, then the UDM informs the SOR-AF about successful delivery of the SOR-CMCI to the UE. The UDM shall include the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any.

If the selected PLMN is a VPLMN or a non-subscribed SNPN and:

- the UE in manual mode of operation encounters security check failure of SOR information in DL NAS TRANSPORT message; and

- upon switching to automatic network selection mode the UE remembers that it is still registered on the PLMN the non-subscribed SNPN where the security check failure of SOR information was encountered;

the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3, by acting as if timer T that controls periodic attempts has expired, with an exception that the current registered PLMN is considered as lowest priority, or before attempting to obtained service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN is a VPLMN or the selected SNPN is a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

NOTE 6: The receipt of the steering of roaming information by itself does not trigger the release of the emergency PDU session.

6.3.2.4.3 Test description

6.3.2.4.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.2.4.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.2.4.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.2.4.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN names** |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

- NR Cell 11 is set to "Serving Cell";

- NR Cell 12 is set to "Serving Cell";

- System Information Combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is switched on and brought to state 3N-A, RRC\_CONNECTED Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4 need to be performed on NR Cell 12.

6.3.2.4.4 Test procedure sequence

**Table 6.3.2.4.4-1: Main behaviour**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | Void | - | - | - | - |
| 2-21a1 | Void | - | - | - | - |
| 22 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception. | <-- | NR RRC: DLInformationTransfer  5GMM: DL NAS TRANSPORT | - | - |
| 23 | The SS starts timer with Tsor-cm timer value = 60s. | - | - | - | - |
| 24 | The UE transmits an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information | --> | NR RRC: ULInformationTransfer  5GMM:UL NAS TRANSPORT | - | - |
| 25 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception within 49s after transmitting DL NAS transport in step22. | <-- | NR RRC: DLInformationTransfer  5GMM: DL NAS TRANSPORT | - | - |
| 26 | The SS updates timer of Tsor-cm timer. | - | - | - | - |
| 27 | The SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 28 | The UE transmits an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information | --> | NR RRC: ULInformationTransfer  5GMM:UL NAS TRANSPORT | - | - |
| 29 | Check: Does the UE transmit a DEREGISTRATION REQUEST after Tsor-cm timer expires? | --> | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION REQUEST | 1 | P |
| 30 | The SS transmits a DEREGISTRATION ACCEPT message. | <-- | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION ACCEPT | - | - |
| 30A | The SS releases the RRC connection on NR cell 12. | - | - | - | - |
| 31 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: RRCSetupRequest | 1 | P |
| 32-33 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. | - | - | - | - |
|  | EXCEPTION: Void | - | - | - | - |
| 34a1-34a16a1 | Void | - | - | - | - |
| 34b1-34b3a1 | Void | - | - | - | - |
| 35-50a1 | Steps 5 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 11. | - | - | - | - |
| Note 1: Timer tmax in step 27 and 31 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 2min is added to allow time for the UE to find the proper PLMN | | | | | |

6.3.2.4.5 Specific message contents

**Table 6.3.2.4.5-1: DL NAS TRANSPORT Message for NR Cell 12 (step 22, Table 6.3.2.4.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| Additional parameters (AP) value | 1 | Additional parameters included |  |
| Length of PLMN ID and access technology list | ‘05’O |  |  |
| PLMN ID and access technology list |  |  |  |
| PLMN ID 1 | PLMN2 |  |  |
| access technology identifier 1 | NG-RAN |  |  |
| SOR-CMCI | Present |  |  |
| Length of SOR-CMCI contents |  | Length value of SOR-CMCI rule1 |  |
| SOR-CMCI rule 1 |  |  |  |
| Length of SOR-CMCI rule contents |  | Length value of SOR-CMCI rule contents |  |
| Tsor-cm timer value | ‘00100001’B | 60s |  |
| Criterion type | ‘00000001’B | DNN |  |
| Criterion value | pc\_APN\_ID\_Internet |  |  |

**Table 6.3.2.4.5-2: UL NAS TRANSPORT Message for NR Cell 12 (step 24, Table 6.3.2.4.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| ME support of SOR-CMCI indicator (MSSI) value | 1 | SOR-CMCI supported by the ME |  |

**Table 6.3.2.4.5-3: DL NAS TRANSPORT Message for NR Cell 12 (step 25, Table 6.3.2.4.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| Additional parameters (AP) value | 1 | Additional parameters included |  |
| Length of PLMN ID and access technology list |  |  |  |
| PLMN ID and access technology list |  |  |  |
| PLMN ID 1 | PLMN2 |  |  |
| access technology identifier 1 | NG-RAN |  |  |
| SOR-CMCI | Present |  |  |
| Length of SOR-CMCI contents |  |  |  |
| SOR-CMCI rule 1 |  |  |  |
| Length of SOR-CMCI rule contents |  |  |  |
| Tsor-cm timer value | 00001010 | 10s |  |
| Criterion type | 00000001 | DNN |  |
| Criterion value | pc\_APN\_ID\_Internet |  |  |

**Table 6.3.2.4.5-4: UL NAS TRANSPORT Message for NR Cell 12 (step 28, Table 6.3.2.4.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| ME support of SOR-CMCI indicator (MSSI) value | 1 | SOR-CMCI supported by the ME |  |

Table 6.3.2.4.5-5:DEREGISTRATION REQUEST for NR Cell 12 (Step 29, Table 6.3.2.4.4-1)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-12 with condition NORMAL. |

#### 6.3.2.5 Steering of UE in roaming after registration / SOR-CMCI rule / DNN of the PDU session / store SOR-CMCI in ME / DL NAS transport

6.3.2.5.1 Test Purpose (TP)

(1)

with { UE being in automatic PLMN selection mode and UE has registered onto a VPLMN with an established PDU session }

ensure that {

when { UE receives SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information with the SOR-CMCI field which includes Tsor-cm timer and Criterion type with setting as DNN of the PDU session, and, UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message, and, power off and on the UE, and, UE has registered onto a VPLMN with an established PDU session }

then { UE sends DEREGISTRATION REQUEST message after Tsor-cm timerexpires,and, selects higher priority PLMN after DEREGISTRATION procedure is completed successfully }

}

6.3.2.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.4.1, C.4.2, and C.4.3. Unless otherwise stated these are Rel-17 requirements.

[TS 23.122, clause C.4.1]

The HPLMN or subscribed SNPN, based on operator policy, may provide the UE with SOR-CMCI to control the timing when the UE enters idle mode and performs higher priority PLMN/access technology or SNPN selection. This is achieved by the HPLMN indicating to the UE the criteria for releasing specific PDU session(s) or services and entering idle mode.

NOTE 1: The released PDU sessions may be re-established by the application once the UE successfully registers on a higher priority PLMN or SNPN. User interaction is required for some applications.

The HPLMN or subscribed SNPN may configure the SOR-CMCI in the UE, and may also provide the SOR-CMCI to the UE over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling takes precedence over the SOR-CMCI stored in the non-volatile memory of the ME or stored in the USIM.

NOTE 2: The SOR-CMCI received over N1 NAS signalling in the SOR information is either the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]) which is received in a secured packet, or the SOR-CMCI received in plain text.

If the UE receives SOR information containing the list of preferred PLMN/access technology combinations or SOR-SNPN-SI without SOR-CMCI, or the ME receives USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" without SOR-CMCI, or the security check of the received steering of roaming information is not successful as described in clause C.2, clause C.3 and clause C.4.3, then:

1) if the UE has SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the non-volatile memory of the ME; and

2) if the UE has no SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the USIM, if any.

The UE shall delete the stored SOR-CMCI, if any, in the non-volatile memory of the ME and store the received SOR-CMCI in the non-volatile memory of the ME when:

1) the ME receives SOR-CMCI in the USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming"; or

2) the UE receives the steering of roaming information containing the SOR-CMCI over N1 NAS signalling and the UE receives the "Store SOR-CMCI in ME" indicator set to "Store SOR-CMCI in ME";

The SOR-CMCI shall be stored in the non-volatile memory of the ME together with the SUPI from the USIM. The ME shall not delete the SOR-CMCI when the UE is switched off. The ME shall delete the SOR-CMCI when a new USIM is inserted.

SOR-CMCI consists of SOR-CMCI rules. Each SOR-CMCI rule consists of the following parameters:

i) a criterion of one of the following types:

- PDU session attribute type criterion;

- service type criterion;

- SOR security check criterion; or

- match all type criterion; and

ii) a value for Tsor-cm timer associated with each criterion presented in i) indicating the time the UE shall wait before releasing the PDU sessions or the services and entering idle mode.

SOR-CMCI contains zero, one or more SOR-CMCI rules with PDU session attribute type criterion, zero, one or more SOR-CMCI rules with service type criterion, and zero or one SOR-CMCI rule with match all type criterion.

PDU session attribute type criterion consists of one of the following:

a) DNN of the PDU session;

b) S-NSSAI STT of the PDU session; or

c) S-NSSAI SST and SD of the PDU session.

Service type criterion consists of one of the following:

a) IMS registration related signalling;

b) MMTEL voice call;

c) MMTEL video call; or

d) SMS over NAS or SMSoIP.

SOR security check criterion consists of:

a) SOR security check not successful.

Match all type criterion consists of:

a) match all.

When the SOR-CMCI received by the UE over N1 NAS signalling contains no SOR-CMCI rules, the UE shall stop all running Tsor-cm timers, if any, and act as if no SOR-CMCI is configured. Additionally:

- if the SOR-CMCI is received in plain text and it also contains the "Store SOR-CMCI in ME" indicator, the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any; and

- if the SOR-CMCI is received in a secured packet, and the USIM provides the ME with the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]), then the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any.

The HPLMN may update the SOR-CMCI in the USIM such that it contains no SOR-CMCI rules, in which case the UE behaviour described in clause C.4.2 applies. Also the HPLMN may make the SOR-CMCI file in the USIM unavailable (see 3GPP TS 31.102 [40]).

If there are more than one criterion applicable for a PDU session (e.g., a criterion for the PDU session and another one for the service) then the Tsor-cm timer with the highest value shall apply.

If there are more than one criterion applicable to different ongoing PDU sessions or services leading to multiple applicable Tsor-cm timers, then all the applicable Tsor-cm timers shall be started. Further handling of such cases is described in clause C.4.2.

If the value for Tsor-cm timer equals "infinity" then the UE shall wait until the PDU session is released or the service is stopped.

The Tsor-cm timer is applicable only if the UE is in automatic network selection mode.

Upon switching to the manual network selection mode, the UE shall stop any Tsor-cm timer, if running. In this case, the UE is not required to enter idle mode and perform the de-registration procedure.

The UE shall consider the following services as exempted from being forced to release the related established PDU session, if any, enter idle mode and perform high priority PLMN/access technology or SNPN selection. These services are known to the UE by default and the UE shall not follow the SOR-CMCI criteria even if configured to interrupt such services:

i) emergency services.

The UE configured with high priority access in the selected PLMN or SNPN shall consider all services and all related established PDU sessions, if any, to be exempted from being forced to be released to enter idle mode and perform high priority PLMN/access technology or SNPN selection.

[TS 23.122, clause C.4.2]

During SOR procedure and while applying SOR-CMCI, the UE shall determine the time to release the PDU session(s) or the services as follows:

- If the UE encounters SOR security check not successful on the received steering of roaming information, and a matching criterion "SOR security check not successful" is included in the SOR-CMCI stored in the non-volatile memory of the ME, then the UE shall:

- if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

- stop all other running Tsor-cm timers, if any; and

- not start any new Tsor-cm timer while Tsor-cm timer associated with "SOR security check not successful" criterion is running;

- If one or more SOR-CMCI rules are included in SOR-CMCI, where for each criterion:

a) DNN of the PDU session:

the UE shall check whether it has a PDU session with a DNN matching to the DNN included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b) S-NSSAI SST of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST matching the S-NSSAI SST included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b1) S-NSSAI SST and SD of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST and SD matching the S-NSSAI SST and SD included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

c) IMS registration related signalling:

the UE shall check whether IMS registration related signalling is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

d) MMTEL voice call:

the UE shall check whether MMTEL voice call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

e) MMTEL video call:

the UE shall check whether MMTEL video call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

f) SMS over NAS or SMSoIP:

the UE shall check whether SMS over NAS or SMSoIP services is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI; or

g) match all:

the UE shall check whether there are any PDU sessions or services for which there is no matching criterion in a) to f) above. If such PDU session or service exists, then for each of these PDU sessions or services, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI.

If the SOR-CMCI is available, and:

- the SOR-CMCI used is in the USIM, contains no SOR-CMCI rule;

- there are one or more SOR-CMCI rules but there is no criterion matched with any ongoing PDU session or service; or

- there are one or more SOR-CMCI rules and there is one or more criteria matched with an ongoing PDU session or service, but the highest Tsor-cm timer value associated with the matched criteria is equal to zero;

then there is no Tsor-cm timer started for any PDU session or service.

While one or more Tsor-cm timers are running, the UE shall check the newly established PDU session or service for a matching criterion in the SOR-CMCI:

- If a matching criterion is found and the applicable Tsor-cm timer indicated the value "infinity" then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value set to infinity; or

- For all other cases, if a matching criterion is found and the timer value is not zero then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value included in the SOR-CMCI, with the exception that if the value of the Tsor-cm timer included in the SOR-CMCI exceeds the highest value among the current values of all running Tsor-cm timers, then the value of the Tsor-cm timer for the newly established PDU session or service shall be set to the highest value among the current values of all running Tsor-cm timers.

NOTE 1: For newly established PDU session or service as described above, the timer is set irrespective of whether other ongoing PDU sessions or services that match the same criteria exist and for which corresponding Tsor-cm timers are running.

NOTE 2: NAS 5GMM layer will receive an explicit indication from the upper layers that a service is started or stopped. When a service is started, it is handled as a new service in the procedures described in this clause.

NOTE 3: While one or more Tsor-cm timers are running, the UE can trigger any 5GSM procedure or start new services.

While one or more Tsor-cm timers are running, upon receiving a new SOR-CMCI as described in annex C.4.3, the UE shall check if there is a matching criterion found for any ongoing PDU session or service in the new SOR-CMCI:

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI indicates the value "infinity", then:

a) if the Tsor-cm timer associated to the PDU session or service is not running, then the UE shall start the Tsor-cm timer associated to the PDU session or service with the value set to infinity; or

b) if the Tsor-cm timer associated to the PDU session or service is already running, then the UE shall set the value of the Tsor-cm timer associated to the PDU session or service to infinity without stopping and restarting the timer;

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI is other than infinity and is smaller than the current value of the running Tsor-cm timer for the associated PDU session or service, then the Tsor-cm timer value for the associated PDU session or service shall be replaced with the value in the new SOR-CMCI without stopping and restarting the timer; or

- for all other cases, the running Tsor-cm timers for the associated PDU sessions or services are kept unchanged.

The Tsor-cm timer shall be stopped when the associated PDU session is released or the associated service is stopped.

If the security check on the received steering of roaming information is successful, the UE shall stop the Tsor-cm timer associated with "SOR security check not successful", if running, and act on the received steering of roaming information. The current PLMN or SNPN is not considered as lowest priority.

NOTE 4: This also applies to the case when the current PLMN or SNPN is different from the PLMN or SNPN in which the Tsor-cm timer associated with "SOR security check not successful" was started.

If the UE, while one or more Tsor-cm timers are running:

a) enters idle mode not due to lower layer failure (see 3GPP TS 24.501 [64]);

b) is not able to successfully recover the N1 NAS signalling connection (see 3GPP TS 24.501 [64]); or

c) enters 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]);

then the UE shall stop the timer(s). In these cases, if:

a) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

b) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN using any other implementation specific means;

then the UE shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 5: When the UE enters idle mode due to lower layer failure while one or more Tsor-cm timers are running, then the UE does not stop Tsor-cm timer(s) as recovery of NAS signalling connection is possible (see 3GPP TS 24.501 [64]).

When the UE determines that no Tsor-cm timer is started for any PDU session or service, the last running Tsor-cm timer is stopped due to release of the associated PDU sessions or stop of the associated services, or the last running Tsor-cm timer expires, if:

i) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

ii) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPNusing any other implementation specific means;

then if the UE is in 5GMM-CONNECTED mode, the UE shall perform the deregistration procedure (see clause 4.2.2.3 of 3GPP TS 23.502 [63]) that releases all the established PDU sessions and services, if any, and once the UE enters idle mode it shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 6: The list of available and allowable PLMNs or SNPNs in the area is implementation specific.

The UE which has an emergency PDU session, receives a request from the upper layers to establish an emergency PDU session or perform emergency services fallback, registers for emergency services, or is configured for high priority access in the selected PLMN or SNPN is not required to enter idle mode if the last running Tsor-cm timer for any PDU session or service stops or expires. In this case, the UE shall attempt to perform the PLMN or SNPN selection after the emergency PDU session or the high priority service is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

If the UE selects a cell of any access technology other than NG-RAN, the ongoing SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.

NOTE 7: If the UE is served by any access technology other than NG-RAN, the HPLMN can initiate a steering of roaming procedure as specified in clause 4.4.6.

[TS 23.122, clause C.4.3]

The stage-2 flow for providing UE with SOR-CMCI in HPLMN, VPLMN, subscribed SNPN or non-subscribed SNPN after registration is indicated in figure C.4.3.1, when the ME supports the SOR-CMCI. The selected PLMN or SNPN can be the HPLMN, a VPLMN, the subscribed SNPN or a non-subscribed SNPN. The AMF is located in the selected PLMN or SNPN. The UDM is located in the HPLMN or the subscribed SNPN.

In this procedure, the SOR-CMCI is sent without the list of preferred PLMN/access technology combinations and the SOR-SNPN-SI. In this procedure, the SOR-CMCI is sent in plain text or is sent within the secured packet.

NOTE 1: The SOR-AF can determine that the ME supports the SOR-CMCI if the Nsoraf\_SoR\_Info service operation has returned the "ME support of SOR-CMCI" indicator. The UDM can determine that the ME supports the SOR-CMCI if the "ME support of SOR-CMCI" indicator is stored for the UE. How the SOR-AF determines that the USIM for the indicated SUPI supports SOR-CMCI is implementation specific.

NOTE 2: The secured packet provided by the SOR-AF can include SOR-CMCI only if the SOR-AF has determined that the ME supports the SOR-CMCI and the USIM of the indicated SUPI supports SOR-CMCI. Otherwise if only the "ME support of SOR-CMCI" indicator is stored for the UE, then SOR-CMCI, if any, cannot be included in the secured packet.

The procedure is triggered:

- If the UDM supports obtaining the parameters of the list of preferred PLMN/access technology combinations, the SOR-SNPN-SI, the SOR-CMCI, and the "Store SOR-CMCI in ME" indicator, if any, or a secured packet from the SOR-AF, the HPLMN or subscribed SNPN policy for the SOR-AF invocation is present in the UDM and the SOR-AF provides the UDM with the SOR-CMCI for a UE identified by SUPI; or

- When the SOR-CMCI becomes available in the UDM (i.e., retrieved from the UDR).

Figure C.4.3.1: Procedure for configuring UE with SOR-CMCI after registration

For the steps below, security protection is described in 3GPP TS 33.501 [24].

1) The SOR-AF to the UDM: Nudm\_ParameterProvision\_Update request is sent to the UDM to trigger the update of the UE with the SOR-CMCI (in plain text or secured packet). In case of providing SOR-CMCI in plain text, include the "Store SOR-CMCI in ME" indicator, if applicable. In case of providing SOR-CMCI in a secured packet, include an indication that "the list of preferred PLMN/access technology combinations is not included in the secured packet".

2) The UDM to the AMF: The UDM notifies the changes of the user profile to the affected AMF by the means of invoking Nudm\_SDM\_Notification service operation. The Nudm\_SDM\_Notification service operation contains the steering of roaming information that needs to be delivered transparently to the UE over NAS within the Access and Mobility Subscription data. If the HPLMN or subscribed SNPN decided that the UE is to acknowledge successful security check of the received steering of roaming information, the Nudm\_SDM\_Notification service operation also contains an indication that the UDM requests an acknowledgement from the UE as part of the steering of roaming information. The UDM:

- upon receiving the SOR-CMCI (in plain text), shall:

i) if the UE is registered in the HPLMN or a VPLMN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided';

ii) if the UE is registered in a non-subscribed SNPN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; and

iii) if the UE is registered in a subscribed SNPN and the AMF has reported to the UDM that the UE supports SOR-SNPN-SI, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; or

- upon receiving the SOR-CMCI in secured packet, shall include the secured packet into the steering of roaming information;

NOTE 3: The UDM considers "the list of preferred PLMN/access technology combinations is not included in the secured packet" received together with the secured packet from the SOR-AF to indicate that the UE is not expected to perform SOR based on the associated steering of roaming information sent to the UE. However, the SOR-CMCI included in the secured packet can be applied by the UE if the UE has one or more Tsor-cm timers running as described in C.4.2.

NOTE 4: The UDM cannot provide the SOR-CMCI, if any, to the AMF which does not support receiving SoR transparent container (see 3GPP TS 29.503 [78]).

3) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

4) Upon receiving the steering of roaming information containing the SOR-CMCI and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' or the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided', or the secured packet, the UE shall perform a security check on the steering of roaming information included in the DL NAS TRANSPORT message to verify that the steering of roaming information is provided by HPLMN or subscribed SNPN, and:

a) if the security check is successful, the UE shall store the SOR-CMCI according to clause C.4.1. If the UE has one or more Tsor-cm timers running, the UE shall apply the received SOR-CMCI as described in C.4.2.

If the steering of roaming information contains a secured packet and the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported" only after the ME receives UICC responses indicating that the UICC has received the secured packet successfully. Otherwise, if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported". Additionally, if the UE supports access to an SNPN using credentials from a credentials holder and the UE is in a PLMN, the UE may set the "ME support of SOR-SNPN-SI" indicator to "supported".

If the UDM has not requested an acknowledgement from the UE then step 5 is skipped; and

b) if the selected PLMN is a VPLMN or a non-subscribed SNPN, the security check is not successful and the UE is in automatic network selection mode, then:

- if the UE has a SOR-CMCI stored in the non-volatile memory of the ME, the current PLMN is considered as lowest priority and the UE shall apply the actions in clause C.4.2;

- otherwise, the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, or before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN or SNPN is a VPLMN or a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

Step 5 is skipped;

NOTE 5: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list or the current chosen non-subscribed SNPN is part of the user controlled prioritized list of preferred SNPNs for the selected entry of the "list of subscriber data" the selected PLMN subscription, the UE stays on the VPLMN or non-subscribed SNPN.

5) The AMF to the UDM: If the UL NAS TRANSPORT message with an SOR transparent container is received, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge successful security check of the received steering of roaming information in step 2, the UDM verifies that the acknowledgement is provided by the UE. The UDM shall store the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any; and

6) The UDM to the SOR-AF: Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery, "ME support of SOR-CMCI" indicator, "ME support of SOR-SNPN-SI" indicator, if any). If the HPLMN policy for the SOR-AF invocation is present and the HPLMN UDM received and verified the UE acknowledgement in step 5, then the UDM informs the SOR-AF about successful delivery of the SOR-CMCI to the UE. The UDM shall include the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any.

If the selected PLMN is a VPLMN or a non-subscribed SNPN and:

- the UE in manual mode of operation encounters security check failure of SOR information in DL NAS TRANSPORT message; and

- upon switching to automatic network selection mode the UE remembers that it is still registered on the PLMN the non-subscribed SNPN where the security check failure of SOR information was encountered;

the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3, by acting as if timer T that controls periodic attempts has expired, with an exception that the current registered PLMN is considered as lowest priority, or before attempting to obtained service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN is a VPLMN or the selected SNPN is a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

NOTE 6: The receipt of the steering of roaming information by itself does not trigger the release of the emergency PDU session.

6.3.2.5.3 Test description

6.3.2.5.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.2.5.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.2.5.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.2.5.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN names** |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

- NR Cell 11 is set to "Serving Cell";

- NR Cell 12 is set to "Serving Cell";

- System Information Combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is switched on and brought to state 3N-A, RRC\_CONNECTED Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4 need to be performed on NR Cell 12.

6.3.2.5.4 Test procedure sequence

**Table 6.3.2.5.4-1: Main behaviour**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | Void | - | - | - | - |
| 2-21a1 | Void | - | - | - | - |
| 22 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception. | <-- | NR RRC: DLInformationTransfer  5GMM: DL NAS TRANSPORT | - | - |
| 23 | The SS starts timer with Tsor-cm timer value = 60s. | - | - | - | - |
| 24 | The UE transmits an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information. | --> | NR RRC: ULInformationTransfer  5GMM:UL NAS TRANSPORT | - | - |
| 25a1-25b1 | Steps 5a1 to 5b1 of Switch off procedure described in TS 38.508-1 [4] Table 4.9.6.3-1 are performed on NR Cell 12 before Tsor-cm timer expires. | - | - | - | - |
| 26 | Power on the UE or inter USIM (Note 1) | - | - | - | - |
| 27-39 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed on NR Cell 12. | - | - | - | - |
| 40 | The SS transmits an *DLInformationTransfer* message and an REGISTRATION ACCEPT message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception. | <-- | NR RRC: DLInformationTransfer  5G MM: REGISTRATION ACCEPT | - | - |
| 41 | The SS starts timer of Tsor-cm timer. | - | - | - | - |
| 42 | The SS starts timer of tmax =(6 minutes + cell selection time)  (Note 2, 3 and 4) | - | - | - | - |
| 43 | The UE transmits an *ULInformationTransfer* message and REGISTRATION COMPLETE message carrying acknowledgement of successful reception of the steering of roaming information. | --> | NR RRC: ULInformationTransfer  5G MM: REGISTRATION COMPLETE | - | - |
|  | EXCEPTION: Step 44a1 is performed in pc\_noOf\_PDUsSameConnection > 0. | - | - | - | - |
| 44a1 | The generic procedure for UE-requested PDU session establishment, specified in subclause 4.5A.2, takes place performing establishment of UE-requested PDU session(s) with ExpectedNumberOfNewPDUSessions = pc\_noOf\_PDUsSameConnection. | - | - | - | - |
| 45 | Check: Does the UE transmit a DEREGISTRATION REQUEST after Tsor-cm timer expires? | --> | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION REQUEST | 1 | P |
| 46 | The SS transmits a DEREGISTRATION ACCEPT message. | <-- | NR RRC: DLInformationTransfer  5GMM: DEREGISTRATION ACCEPT | - | - |
| 46A | The SS releases the RRC connection on NR cell 12. | - | - | - | - |
| 47 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 2, 3 and 4) | --> | NR RRC: RRCSetupRequest | 1 | P |
| 48-49 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. | - | - | - | - |
|  | EXCEPTION: Void | - | - | - | - |
| 50a1-50a16a1 | Void | - | - | - | - |
| 50b1-50b3a1 | Void | - | - | - | - |
| 51-66a1 | Steps 5 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 11. | - | - | - | - |
| Note 1: If pc\_USIM\_Removal is selected, use same USIM  Note 2: Timer tmax in step 42 and 47 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 4: Tolerance of 2min is added to allow time for the UE to find the proper PLMN | | | | | |

6.3.2.5.5 Specific message contents

**Table 6.3.2.5.5-1: DL NAS TRANSPORT Message for NR Cell 12 (step 22, Table 6.3.2.5.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| Length of payload container contents |  | 2 octet |  |
| Payload container contents |  |  |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| Additional parameters (AP) value | 1 | Additional parameters included |  |
| Length of PLMN ID and access technology list | ‘05’O |  |  |
| PLMN ID and access technology list |  |  |  |
| PLMN ID 1 | PLMN2 |  |  |
| access technology identifier 1 | NG-RAN |  |  |
| Store SOR-CMCI in ME indicator (SSCMI) value | 1 | Store SOR-CMCI in ME |  |
| SOR-CMCI | Present |  |  |
| Length of SOR-CMCI contents |  | Length value of SOR-CMCI rule1 |  |
| SOR-CMCI rule 1 |  |  |  |
| Length of SOR-CMCI rule contents |  | Length value of SOR-CMCI rule contents |  |
| Tsor-cm timer value | ‘00100001’B | 60s |  |
| Criterion type | ‘00000001’B | DNN |  |
| Criterion value | pc\_APN\_ID\_Internet |  |  |

**Table 6.3.2.5.5-2: UL NAS TRANSPORT Message for NR Cell 12 (step 24, Table 6.3.2.5.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| ME support of SOR-CMCI indicator (MSSI) value | 1 | SOR-CMCI supported by the ME |  |

Table 6.3.2.5.5-3 REGISTRATION ACCEPT for NR Cell 12 (step 40, Table 6.3.2.5.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries steering of roaming information. |  |
| SoR-MAC-IAUS | Set to match the calculated SoR-MAC-IAUS as the way defined in TS 33.501 A.17 |  |  |
| CounterSOR | Value generated as per TS 33.501 Cl 6.14.2.3 |  |  |
| SOR data type | 0 | The SOR transparent container carries steering of roaming information. |  |
| List indication value | 1 | List of preferred PLMN/access technology combinations is provided |  |
| List type | 1 | The list type is a PLMN ID and access technology list |  |
| Acknowledgement (ACK) value | 1 | Acknowledgement requested |  |
| PLMN ID 1 | PLMN2 |  |  |
| Access Technology Identifier 1 | NG-RAN |  |  |

Table 6.3.2.5.5-4: REGISTRATION COMPLETE for NR Cell 12 (step 43, Table 6.3.2.5.4-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 Table 4.7.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| SOR Transparent Container | Present | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |
| SOR data type | 1 | The SOR transparent container carries acknowledgement of successful reception of the steering of roaming information. |  |

Table 6.3.2.5.5-5:DEREGISTRATION REQUEST for NR Cell 12 (Step 45, Table 6.3.2.5.4-1)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-12 with condition NORMAL. |

#### 6.3.2.6 Steering of UE in roaming after registration / SOR-CMCI rule / match all / Emergency call / DL NAS transport

6.3.2.6.1 Test Purpose (TP)

(1)

with { UE being in automatic PLMN selection mode and UE has registered onto a VPLMN with an established IMS PDU session }

ensure that {

when { UE receives SOR Transparent container included in DL NAS TRANSPORT message contains steering of roaming information with the SOR-CMCI field which includes Tsor-cm timer and Criterion type with setting as match all, and, UE sends an SOR transparent container with ACK in UL NAS TRANSPORT message, and, UE initiates Emergency call in 5GS and completes it successfully }

then { UE sends RRCSetupRequest message after releasing Emergency call with expiring Tsor-cm timer **and** selects higher priority PLMN }

}

6.3.2.6.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause C.2, C.4.1, C.4.2, and C.4.3. Unless otherwise stated these are Rel-17 requirements.

[TS 23.122, clause C.2]

The stage-2 flow for the case when the UE registers with VPLMN AMF is described below in figure C.2.1. The selected PLMN is the VPLMN. The AMF is located in the selected VPLMN.

Figure C.2.1: Procedure for providing list of preferred PLMN/access technology combinations and the SOR-CMCI, if any, or secured packet during registration

For the steps below, security protection is described in 3GPP TS 33.501 [24].

...

7) If the steering of roaming information is received and the security check is successful, then:

a) if the UDM has not requested an acknowledgement from the UE, then the UE shall send the REGISTRATION COMPLETE message to the serving AMF without including an SOR transparent container;

b) if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]):

- the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41], if the service "data download via SMS Point-to-point" is allocated and activated in the USIM Service Table (see 3GPP TS 31.102 [40]);

NOTE 14: How the ME handles UICC responses and failures in communication between the ME and UICC is implementation specific and out of scope of this release of the specification.

- if the UDM has not requested an acknowledgement from the UE and:

A) the ME receives a USAT REFRESH with command qualifier (3GPP TS 31.111 [41]) of type "Steering of Roaming" and either a SOR-CMCI is included, or the UE is configured with the SOR-CMCI, the UE shall perform items a), b) and c) of the procedure for steering of roaming in clause 4.4.6, and if the UE is in automatic network selection mode then it shall apply the actions in clause C.4.2. In this case steps 8 to 11 are skipped; or

B) the ME receives a USAT REFRESH command qualifier (3GPP TS 31.111 [41]) of type "Steering of Roaming" and neither a SOR-CMCI is included, nor the UE is configured with the SOR-CMCI, it shall perform items a), b) and c) of the procedure for steering of roaming in clause 4.4.6 and if:

i) the UE has a list of available and allowable PLMNs in the area and based on this list or any other implementation specific means the UE determines that there is a higher priority PLMN than the selected VPLMN; or

ii) the UE does not have a list of available and allowable PLMNs in the area and is unable to determine whether there is a higher priority PLMN than the selected VPLMN using any other implementation specific means;

and the UE is in automatic network selection mode, then the UE shall either:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped. The UE shall suspend the transmission of 5GSM messages until the N1 NAS signalling is released. The UE shall not initiate the establishment of a new N1 NAS signalling connection, unless for the purpose of initiating a registration procedure or establishing an emergency PDU session, until the attempts to obtain service on a higher priority PLMN are completed. If the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]), the receipt of the steering of roaming information shall not trigger the release of the N1 NAS signalling connection. If camped on a NG-RAN cell, the UE shall release the current N1 NAS signalling connection locally subsequently after the emergency PDU session is released, otherwise the UE shall not take any further actions; or

ii) not release the current N1 NAS signalling connection locally (e.g. if the UE has established PDU session(s)) and skip steps 8 to 10;

c) if the steering of roaming information contains the list of preferred PLMN/access technology combinations, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations, and delete the PLMNs identified by the list of preferred PLMN/access technology combinations from the Forbidden PLMN list and from the Forbidden PLMNs for GPRS service list, if they are present in these lists. Additionally, if:

i) the UE has a list of available and allowable PLMNs in the area and based on this list or any other implementation specific means the UE determines that there is a higher priority PLMN than the selected VPLMN; or

ii) the UE does not have a list of available and allowable PLMNs in the area and is unable to determine whether there is a higher priority PLMN than the selected VPLMN using any other implementation specific means;

and the UE is in automatic network selection mode:

A) if the UE is configured with the SOR-CMCI or received the SOR-CMCI over N1 NAS signalling, the UE shall apply the actions in clause C.4.2. In this case steps 8 to 11 are skipped;

B) otherwise, the UE shall:

i) release the current N1 NAS signalling connection locally and then attempt to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired. In this case, steps 8 to 11 are skipped. The UE shall suspend the transmission of 5GSM messages until the N1 NAS signalling is released. The UE shall not initiate the establishment of a new N1 NAS signalling connection, unless for the purpose of initiating a registration procedure or establishing an emergency PDU session, until the attempts to obtain service on a higher priority PLMN are completed. If the UE has an established emergency PDU session (see 3GPP TS 24.501 [64]), the receipt of the steering of roaming information shall not trigger the release of the N1 NAS signalling connection. If camped on a NG-RAN cell, he UE shall release the current N1 NAS signalling connection locally subsequently after the emergency PDU session is released, otherwise the UE shall not take any further actions. If the UE needs to disable the N1 mode capability (see 3GPP TS 24.501 [64]) and there is no emergency service pending, the UE shall first attempt to obtain service on a higher priority PLMN as described in this step, and if no higher priority PLMN can be selected but the last registered PLMN is selected, then the UE shall disable the N1 mode capability; or

ii) not release the current N1 NAS signalling connection locally (e.g. if the UE has established PDU session(s)) and skip steps 8 to 10;

NOTE 15: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list, the UE stays on the VPLMN.

[TS 23.122, clause C.4.1]

The HPLMN or subscribed SNPN, based on operator policy, may provide the UE with SOR-CMCI to control the timing when the UE enters idle mode and performs higher priority PLMN/access technology or SNPN selection. This is achieved by the HPLMN indicating to the UE the criteria for releasing specific PDU session(s) or services and entering idle mode.

NOTE 1: The released PDU sessions may be re-established by the application once the UE successfully registers on a higher priority PLMN or SNPN. User interaction is required for some applications.

The HPLMN or subscribed SNPN may configure the SOR-CMCI in the UE, and may also provide the SOR-CMCI to the UE over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling takes precedence over the SOR-CMCI stored in the non-volatile memory of the ME or stored in the USIM.

NOTE 2: The SOR-CMCI received over N1 NAS signalling in the SOR information is either the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]) which is received in a secured packet, or the SOR-CMCI received in plain text.

If the UE receives SOR information containing the list of preferred PLMN/access technology combinations or SOR-SNPN-SI without SOR-CMCI, or the ME receives USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming" without SOR-CMCI, or the security check of the received steering of roaming information is not successful as described in clause C.2, clause C.3 and clause C.4.3, then:

1) if the UE has SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the non-volatile memory of the ME; and

2) if the UE has no SOR-CMCI stored in the non-volatile memory of the ME, the UE shall use the SOR-CMCI stored in the USIM, if any.

The UE shall delete the stored SOR-CMCI, if any, in the non-volatile memory of the ME and store the received SOR-CMCI in the non-volatile memory of the ME when:

1) the ME receives SOR-CMCI in the USAT REFRESH with command qualifier (see 3GPP TS 31.111 [41]) of type "Steering of Roaming"; or

2) the UE receives the steering of roaming information containing the SOR-CMCI over N1 NAS signalling and the UE receives the "Store SOR-CMCI in ME" indicator set to "Store SOR-CMCI in ME";

The SOR-CMCI shall be stored in the non-volatile memory of the ME together with the SUPI from the USIM. The ME shall not delete the SOR-CMCI when the UE is switched off. The ME shall delete the SOR-CMCI when a new USIM is inserted.

SOR-CMCI consists of SOR-CMCI rules. Each SOR-CMCI rule consists of the following parameters:

i) a criterion of one of the following types:

- PDU session attribute type criterion;

- service type criterion;

- SOR security check criterion; or

- match all type criterion; and

ii) a value for Tsor-cm timer associated with each criterion presented in i) indicating the time the UE shall wait before releasing the PDU sessions or the services and entering idle mode.

SOR-CMCI contains zero, one or more SOR-CMCI rules with PDU session attribute type criterion, zero, one or more SOR-CMCI rules with service type criterion, and zero or one SOR-CMCI rule with match all type criterion.

PDU session attribute type criterion consists of one of the following:

a) DNN of the PDU session;

b) S-NSSAI STT of the PDU session; or

c) S-NSSAI SST and SD of the PDU session.

Service type criterion consists of one of the following:

a) IMS registration related signalling;

b) MMTEL voice call;

c) MMTEL video call; or

d) SMS over NAS or SMSoIP.

SOR security check criterion consists of:

a) SOR security check not successful.

Match all type criterion consists of:

a) match all.

When the SOR-CMCI received by the UE over N1 NAS signalling contains no SOR-CMCI rules, the UE shall stop all running Tsor-cm timers, if any, and act as if no SOR-CMCI is configured. Additionally:

- if the SOR-CMCI is received in plain text and it also contains the "Store SOR-CMCI in ME" indicator, the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any; and

- if the SOR-CMCI is received in a secured packet, and the USIM provides the ME with the SOR-CMCI in the USAT REFRESH with command qualifier of type "Steering of Roaming" (see 3GPP TS 31.111 [41]), then the UE shall delete the stored SOR-CMCI in the non-volatile memory of the ME, if any.

The HPLMN may update the SOR-CMCI in the USIM such that it contains no SOR-CMCI rules, in which case the UE behaviour described in clause C.4.2 applies. Also the HPLMN may make the SOR-CMCI file in the USIM unavailable (see 3GPP TS 31.102 [40]).

If there are more than one criterion applicable for a PDU session (e.g., a criterion for the PDU session and another one for the service) then the Tsor-cm timer with the highest value shall apply.

If there are more than one criterion applicable to different ongoing PDU sessions or services leading to multiple applicable Tsor-cm timers, then all the applicable Tsor-cm timers shall be started. Further handling of such cases is described in clause C.4.2.

If the value for Tsor-cm timer equals "infinity" then the UE shall wait until the PDU session is released or the service is stopped.

The Tsor-cm timer is applicable only if the UE is in automatic network selection mode.

Upon switching to the manual network selection mode, the UE shall stop any Tsor-cm timer, if running. In this case, the UE is not required to enter idle mode and perform the de-registration procedure.

The UE shall consider the following services as exempted from being forced to release the related established PDU session, if any, enter idle mode and perform high priority PLMN/access technology or SNPN selection. These services are known to the UE by default and the UE shall not follow the SOR-CMCI criteria even if configured to interrupt such services:

i) emergency services.

The UE configured with high priority access in the selected PLMN or SNPN shall consider all services and all related established PDU sessions, if any, to be exempted from being forced to be released to enter idle mode and perform high priority PLMN/access technology or SNPN selection.

[TS 23.122, clause C.4.2]

During SOR procedure and while applying SOR-CMCI, the UE shall determine the time to release the PDU session(s) or the services as follows:

- If the UE encounters SOR security check not successful on the received steering of roaming information, and a matching criterion "SOR security check not successful" is included in the SOR-CMCI stored in the non-volatile memory of the ME, then the UE shall:

- if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

- stop all other running Tsor-cm timers, if any; and

- not start any new Tsor-cm timer while Tsor-cm timer associated with "SOR security check not successful" criterion is running;

- If one or more SOR-CMCI rules are included in SOR-CMCI, where for each criterion:

a) DNN of the PDU session:

the UE shall check whether it has a PDU session with a DNN matching to the DNN included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b) S-NSSAI SST of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST matching the S-NSSAI SST included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b1) S-NSSAI SST and SD of the PDU session:

the UE shall check whether it has a PDU session with a S-NSSAI SST and SD matching the S-NSSAI SST and SD included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

c) IMS registration related signalling:

the UE shall check whether IMS registration related signalling is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

d) MMTEL voice call:

the UE shall check whether MMTEL voice call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

e) MMTEL video call:

the UE shall check whether MMTEL video call is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

f) SMS over NAS or SMSoIP:

the UE shall check whether SMS over NAS or SMSoIP services is ongoing, and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI; or

g) match all:

the UE shall check whether there are any PDU sessions or services for which there is no matching criterion in a) to f) above. If such PDU session or service exists, then for each of these PDU sessions or services, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI.

If the SOR-CMCI is available, and:

- the SOR-CMCI used is in the USIM, contains no SOR-CMCI rule;

- there are one or more SOR-CMCI rules but there is no criterion matched with any ongoing PDU session or service; or

- there are one or more SOR-CMCI rules and there is one or more criteria matched with an ongoing PDU session or service, but the highest Tsor-cm timer value associated with the matched criteria is equal to zero;

then there is no Tsor-cm timer started for any PDU session or service.

While one or more Tsor-cm timers are running, the UE shall check the newly established PDU session or service for a matching criterion in the SOR-CMCI:

- If a matching criterion is found and the applicable Tsor-cm timer indicated the value "infinity" then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value set to infinity; or

- For all other cases, if a matching criterion is found and the timer value is not zero then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value included in the SOR-CMCI, with the exception that if the value of the Tsor-cm timer included in the SOR-CMCI exceeds the highest value among the current values of all running Tsor-cm timers, then the value of the Tsor-cm timer for the newly established PDU session or service shall be set to the highest value among the current values of all running Tsor-cm timers.

NOTE 1: For newly established PDU session or service as described above, the timer is set irrespective of whether other ongoing PDU sessions or services that match the same criteria exist and for which corresponding Tsor-cm timers are running.

NOTE 2: NAS 5GMM layer will receive an explicit indication from the upper layers that a service is started or stopped. When a service is started, it is handled as a new service in the procedures described in this clause.

NOTE 3: While one or more Tsor-cm timers are running, the UE can trigger any 5GSM procedure or start new services.

While one or more Tsor-cm timers are running, upon receiving a new SOR-CMCI as described in annex C.4.3, the UE shall check if there is a matching criterion found for any ongoing PDU session or service in the new SOR-CMCI:

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI indicates the value "infinity", then:

a) if the Tsor-cm timer associated to the PDU session or service is not running, then the UE shall start the Tsor-cm timer associated to the PDU session or service with the value set to infinity; or

b) if the Tsor-cm timer associated to the PDU session or service is already running, then the UE shall set the value of the Tsor-cm timer associated to the PDU session or service to infinity without stopping and restarting the timer;

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI is other than infinity and is smaller than the current value of the running Tsor-cm timer for the associated PDU session or service, then the Tsor-cm timer value for the associated PDU session or service shall be replaced with the value in the new SOR-CMCI without stopping and restarting the timer; or

- for all other cases, the running Tsor-cm timers for the associated PDU sessions or services are kept unchanged.

The Tsor-cm timer shall be stopped when the associated PDU session is released or the associated service is stopped.

If the security check on the received steering of roaming information is successful, the UE shall stop the Tsor-cm timer associated with "SOR security check not successful", if running, and act on the received steering of roaming information. The current PLMN or SNPN is not considered as lowest priority.

NOTE 4: This also applies to the case when the current PLMN or SNPN is different from the PLMN or SNPN in which the Tsor-cm timer associated with "SOR security check not successful" was started.

If the UE, while one or more Tsor-cm timers are running:

a) enters idle mode not due to lower layer failure (see 3GPP TS 24.501 [64]);

b) is not able to successfully recover the N1 NAS signalling connection (see 3GPP TS 24.501 [64]); or

c) enters 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]);

then the UE shall stop the timer(s). In these cases, if:

a) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

b) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN using any other implementation specific means;

then the UE shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 5: When the UE enters idle mode due to lower layer failure while one or more Tsor-cm timers are running, then the UE does not stop Tsor-cm timer(s) as recovery of NAS signalling connection is possible (see 3GPP TS 24.501 [64]).

When the UE determines that no Tsor-cm timer is started for any PDU session or service, the last running Tsor-cm timer is stopped due to release of the associated PDU sessions or stop of the associated services, or the last running Tsor-cm timer expires, if:

i) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

ii) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPNusing any other implementation specific means;

then if the UE is in 5GMM-CONNECTED mode, the UE shall perform the deregistration procedure (see clause 4.2.2.3 of 3GPP TS 23.502 [63]) that releases all the established PDU sessions and services, if any, and once the UE enters idle mode it shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 6: The list of available and allowable PLMNs or SNPNs in the area is implementation specific.

The UE which has an emergency PDU session, receives a request from the upper layers to establish an emergency PDU session or perform emergency services fallback, registers for emergency services, or is configured for high priority access in the selected PLMN or SNPN is not required to enter idle mode if the last running Tsor-cm timer for any PDU session or service stops or expires. In this case, the UE shall attempt to perform the PLMN or SNPN selection after the emergency PDU session or the high priority service is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

If the UE selects a cell of any access technology other than NG-RAN, the ongoing SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.

NOTE 7: If the UE is served by any access technology other than NG-RAN, the HPLMN can initiate a steering of roaming procedure as specified in clause 4.4.6.

[TS 23.122, clause C.4.3]

The stage-2 flow for providing UE with SOR-CMCI in HPLMN, VPLMN, subscribed SNPN or non-subscribed SNPN after registration is indicated in figure C.4.3.1, when the ME supports the SOR-CMCI. The selected PLMN or SNPN can be the HPLMN, a VPLMN, the subscribed SNPN or a non-subscribed SNPN. The AMF is located in the selected PLMN or SNPN. The UDM is located in the HPLMN or the subscribed SNPN.

In this procedure, the SOR-CMCI is sent without the list of preferred PLMN/access technology combinations and the SOR-SNPN-SI. In this procedure, the SOR-CMCI is sent in plain text or is sent within the secured packet.

NOTE 1: The SOR-AF can determine that the ME supports the SOR-CMCI if the Nsoraf\_SoR\_Info service operation has returned the "ME support of SOR-CMCI" indicator. The UDM can determine that the ME supports the SOR-CMCI if the "ME support of SOR-CMCI" indicator is stored for the UE. How the SOR-AF determines that the USIM for the indicated SUPI supports SOR-CMCI is implementation specific.

NOTE 2: The secured packet provided by the SOR-AF can include SOR-CMCI only if the SOR-AF has determined that the ME supports the SOR-CMCI and the USIM of the indicated SUPI supports SOR-CMCI. Otherwise if only the "ME support of SOR-CMCI" indicator is stored for the UE, then SOR-CMCI, if any, cannot be included in the secured packet.

The procedure is triggered:

- If the UDM supports obtaining the parameters of the list of preferred PLMN/access technology combinations, the SOR-SNPN-SI, the SOR-CMCI, and the "Store SOR-CMCI in ME" indicator, if any, or a secured packet from the SOR-AF, the HPLMN or subscribed SNPN policy for the SOR-AF invocation is present in the UDM and the SOR-AF provides the UDM with the SOR-CMCI for a UE identified by SUPI; or

- When the SOR-CMCI becomes available in the UDM (i.e., retrieved from the UDR).

Figure C.4.3.1: Procedure for configuring UE with SOR-CMCI after registration

For the steps below, security protection is described in 3GPP TS 33.501 [24].

1) The SOR-AF to the UDM: Nudm\_ParameterProvision\_Update request is sent to the UDM to trigger the update of the UE with the SOR-CMCI (in plain text or secured packet). In case of providing SOR-CMCI in plain text, include the "Store SOR-CMCI in ME" indicator, if applicable. In case of providing SOR-CMCI in a secured packet, include an indication that "the list of preferred PLMN/access technology combinations is not included in the secured packet".

2) The UDM to the AMF: The UDM notifies the changes of the user profile to the affected AMF by the means of invoking Nudm\_SDM\_Notification service operation. The Nudm\_SDM\_Notification service operation contains the steering of roaming information that needs to be delivered transparently to the UE over NAS within the Access and Mobility Subscription data. If the HPLMN or subscribed SNPN decided that the UE is to acknowledge successful security check of the received steering of roaming information, the Nudm\_SDM\_Notification service operation also contains an indication that the UDM requests an acknowledgement from the UE as part of the steering of roaming information. The UDM:

- upon receiving the SOR-CMCI (in plain text), shall:

i) if the UE is registered in the HPLMN or a VPLMN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided';

ii) if the UE is registered in a non-subscribed SNPN, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; and

iii) if the UE is registered in a subscribed SNPN and the AMF has reported to the UDM that the UE supports SOR-SNPN-SI, include the SOR-CMCI, the "Store SOR-CMCI in ME" indicator, if any, and the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided'; or

- upon receiving the SOR-CMCI in secured packet, shall include the secured packet into the steering of roaming information;

NOTE 3: The UDM considers "the list of preferred PLMN/access technology combinations is not included in the secured packet" received together with the secured packet from the SOR-AF to indicate that the UE is not expected to perform SOR based on the associated steering of roaming information sent to the UE. However, the SOR-CMCI included in the secured packet can be applied by the UE if the UE has one or more Tsor-cm timers running as described in C.4.2.

NOTE 4: The UDM cannot provide the SOR-CMCI, if any, to the AMF which does not support receiving SoR transparent container (see 3GPP TS 29.503 [78]).

3) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

4) Upon receiving the steering of roaming information containing the SOR-CMCI and the HPLMN indication that 'no change of the "Operator Controlled PLMN Selector with Access Technology" list stored in the UE is needed and thus no list of preferred PLMN/access technology combinations is provided' or the HPLMN or subscribed SNPN indication that 'no change of the SOR-SNPN-SI stored in the UE is needed and thus no SOR-SNPN-SI is provided', or the secured packet, the UE shall perform a security check on the steering of roaming information included in the DL NAS TRANSPORT message to verify that the steering of roaming information is provided by HPLMN or subscribed SNPN, and:

a) if the security check is successful, the UE shall store the SOR-CMCI according to clause C.4.1. If the UE has one or more Tsor-cm timers running, the UE shall apply the received SOR-CMCI as described in C.4.2.

If the steering of roaming information contains a secured packet and the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported" only after the ME receives UICC responses indicating that the UICC has received the secured packet successfully. Otherwise, if the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-CMCI" indicator to "supported". Additionally, if the UE supports access to an SNPN using credentials from a credentials holder and the UE is in a PLMN, the UE may set the "ME support of SOR-SNPN-SI" indicator to "supported".

If the UDM has not requested an acknowledgement from the UE then step 5 is skipped; and

b) if the selected PLMN is a VPLMN or a non-subscribed SNPN, the security check is not successful and the UE is in automatic network selection mode, then:

- if the UE has a SOR-CMCI stored in the non-volatile memory of the ME, the current PLMN is considered as lowest priority and the UE shall apply the actions in clause C.4.2;

- otherwise, the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired, with an exception that the current PLMN is considered as lowest priority, or before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN or SNPN is a VPLMN or a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

Step 5 is skipped;

NOTE 5: When the UE is in the manual mode of operation or the current chosen VPLMN is part of the "User Controlled PLMN Selector with Access Technology" list or the current chosen non-subscribed SNPN is part of the user controlled prioritized list of preferred SNPNs for the selected entry of the "list of subscriber data" the selected PLMN subscription, the UE stays on the VPLMN or non-subscribed SNPN.

5) The AMF to the UDM: If the UL NAS TRANSPORT message with an SOR transparent container is received, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge successful security check of the received steering of roaming information in step 2, the UDM verifies that the acknowledgement is provided by the UE. The UDM shall store the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any; and

6) The UDM to the SOR-AF: Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery, "ME support of SOR-CMCI" indicator, "ME support of SOR-SNPN-SI" indicator, if any). If the HPLMN policy for the SOR-AF invocation is present and the HPLMN UDM received and verified the UE acknowledgement in step 5, then the UDM informs the SOR-AF about successful delivery of the SOR-CMCI to the UE. The UDM shall include the "ME support of SOR-CMCI" indicator and the "ME support of SOR-SNPN-SI" indicator, if any.

If the selected PLMN is a VPLMN or a non-subscribed SNPN and:

- the UE in manual mode of operation encounters security check failure of SOR information in DL NAS TRANSPORT message; and

- upon switching to automatic network selection mode the UE remembers that it is still registered on the PLMN the non-subscribed SNPN where the security check failure of SOR information was encountered;

the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority PLMN as specified in clause 4.4.3.3, by acting as if timer T that controls periodic attempts has expired, with an exception that the current registered PLMN is considered as lowest priority, or before attempting to obtained service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the selected PLMN is a VPLMN or the selected SNPN is a non-subscribed SNPN and the UE has an established emergency PDU session then the UE shall attempt to perform the PLMN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

NOTE 6: The receipt of the steering of roaming information by itself does not trigger the release of the emergency PDU session.

6.3.2.6.3 Test description

6.3.2.6.3.1 Pre-test conditions

System Simulator:

- Two inter-frequency multi-PLMN NR Cells as specified in TS 38.508-1 [4] Table 4.4.2-1 are configured broadcasting PLMNs as indicated in Table 6.3.2.6.3.1-1.

- The PLMNs are identified in the test by the identifiers in Table 6.3.2.6.3.1-1. The MCC and MNC values of PLMN identifiers are specified in TS 36.523-1 [13], Table 6.0.1-1.

Table 6.3.2.6.3.1-1: PLMN identifiers

|  |  |
| --- | --- |
| **NR Cell** | **PLMN names** |
|
| NR Cell 11 | PLMN2 |
| NR Cell 12 | PLMN13 |

NR Cell 11 is set to "Serving Cell";

NR Cell 12 is set to "Serving Cell";

System Information Combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in Table 6.4.1-21 of TS 38.508-1 [4] will be used.

Preamble:

- The UE is switched on and brought to state 3N-A, RRC\_CONNECTED Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.4 and IMS PDU session establishment and IMS registration procedure need to be performed on NR Cell 12.

6.3.2.6.4 Test procedure sequence

**Table 6.3.2.6.4-1: Main behaviour**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | Void | - | - | - | - |
| 2-21a1 | Void | - | - | - | - |
| 22 | The SS transmits an DLInformationTransfer message containing steering of roaming information indicating list of preferred PLMN/access technology combination provided with acknowledgment requested from the UE for successful reception. | <-- | NR RRC: DLInformationTransfer  5GMM: DL NAS TRANSPORT | - | - |
| 23 | The SS starts timer with Tsor-cm timer value = 60s. | - | - | - | - |
| 24 | The SS starts timer of tmax =(6 minutes + cell selection time)  (Note 1, 2 and 3) | - | - | - | - |
| 25 | The UE transmits an ULInformationTransfer message carrying acknowledgement of successful reception of the steering of roaming information. | --> | NR RRC: ULInformationTransfer  5GMM:UL NAS TRANSPORT | - | - |
| 26 | Make the UE attempt an IMS emergency call dialling an emergency number e.g. 112 or 911. (Note 4) | - | - | - | - |
| 27 | Generic procedure fo IMS Emergency call establishment in 5GC with IMS emergency registration as described in TS 38.508-1 [4] Table 4.9.11.2.2-1 is performed. | - | - | - | - |
| 28 | The SS waits for timer of Tsor-cm timer expiry. | - | - | - | - |
| 29 | Make the UE release the emergency call. | - | - | - | - |
| 30 | The Generic test procedure for IMS MO Emergency call release as specified in TS 38.508-1 [4], subclause 4.9.12A takes place. | - | - | - | - |
| 30A | The SS releases the RRC connection on NR cell 12. | - | - | - | - |
| 31 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 11 before tmax expires?  (Note 1, 2 and 3) | --> | NR RRC: RRCSetupRequest | 1 | P |
| 32-33 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed. | - | - | - | - |
|  | EXCEPTION: Void | - | - | - | - |
| 34a1-34a16a1 | Void | - | - | - | - |
| 34b1-34b3a1 | Void | - | - | - | - |
| 35-50a1 | Steps 5 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 11. | - | - | - | - |
| Note 1: Timer tmax in step 24 and 31 are derived from the high priority PLMN search timer T defined by EFHPPLMN  Note 2: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 Rel-12). Hence, window between 120s to T+Tolerance is being used , where the high priority PLMN search timer T defined by EFHPPLMN  Note 3: Tolerance of 2min is added to allow time for the UE to find the proper PLMN  Note 4: This could be done by e.g. MMI or AT command. | | | | | |

6.3.2.6.5 Specific message contents

**Table 6.3.2.6.5-1: DL NAS TRANSPORT Message for NR Cell 12 (step 22, Table 6.3.2.6.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-11 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| Additional parameters (AP) value | 1 | Additional parameters included |  |
| Length of PLMN ID and access technology list | ‘05’O | PLMN2 |  |
| PLMN ID and access technology list |  | NG-RAN |  |
| PLMN ID 1 | PLMN2 |  |  |
| access technology identifier 1 | NG-RAN |  |  |
| SOR-CMCI | Present |  |  |
| Length of SOR-CMCI contents |  | Length value of SOR-CMCI rule1 |  |
| SOR-CMCI rule 1 |  |  |  |
| Length of SOR-CMCI rule contents |  | Length value of SOR-CMCI rule contents |  |
| Tsor-cm timer value | ‘00100001’B | 60s |  |
| Criterion type | ‘11111111’B | match all |  |
| Criterion value | Not Present |  |  |

**Table 6.3.2.6.5-2: UL NAS TRANSPORT Message for NR Cell 12 (step 25, Table 6.3.2.6.4-1)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.7.1-10 with condition 5GS\_SOR\_CMCI. | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| Payload container | Present | The SOR transparent container in the payload container IE carries steering of roaming information. |  |
| SOR transparent container | Present | The SOR transparent container carries steering of roaming information. |  |
| SOR header |  | 1 octet |  |
| ME support of SOR-CMCI indicator (MSSI) value | 1 | SOR-CMCI supported by the ME |  |

## 6.4 UE Procedures in RRC\_INACTIVE state

### 6.4.1 NG-RAN Only PLMN Selection in RRC\_INACTIVE state

#### 6.4.1.1 PLMN Selection/Higher priority/HPLMN in Automatic PLMN Selection Mode

6.4.1.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state on an NG-RAN VPLMN cell }

**ensure that** {

**when** { UE performs PLMN Selection to a PLMN that is equivalent PLMN of the registered PLMN }

**then** { UE remains in RRC\_INACTIVE state after moving to the Equivalent PLMN cell. }

}

(2)

**with** { UE in NR RRC\_INACTIVE state on an NG-RAN VPLMN cell and cells of a higher priority NG-RAN PLMN available }

**ensure that** {

**when** { Higher priority PLMN search timer T expires }

**then** { UE selects the higher priority PLMN cell, moves to RRC\_IDLE and attempts Registration on the selected cell. }

}

6.4.1.1.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122 clauses 4.4.3.3, TS 38.304 clauses 4.1 and clauses 4.2 and TS 24.501 clauses 5.3.1.4. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.3]

If the MS is in a VPLMN, the MS shall periodically attempt to obtain service on its HPLMN (if the EHPLMN list is not present or is empty) or one of its EHPLMNs (if the EHPLMN list is present) or a higher priority PLMN/access technology combinations listed in "user controlled PLMN selector" or "operator controlled PLMN selector" by scanning in accordance with the requirements that are applicable to i), ii) and iii) as defined in the Automatic Network Selection Mode in subclause 4.4.3.1.1. In the case that the mobile has a stored "Equivalent PLMNs" list the mobile shall only select a PLMN if it is of a higher priority than those of the same country as the current serving PLMN which are stored in the "Equivalent PLMNs" list. For this purpose, a value of timer T may be stored in the SIM. The interpretation of the stored value depends on the radio capabilities supported by the MS:

- For an MS that does not support any of the following: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 6 minutes to 8 hours in 6 minute steps or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 60 minutes is used for T.

- For an MS that only supports any of the following or a combination of: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 2 hours to 240 hours, using 2 hour steps from 2 hours to 80 hours and 4 hour steps from 84 hours to 240 hours, or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 72 hours is used.

- For an MS that supports both:

a) any of the following or a combination of: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]); and

b) any access technology other than the following: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]),

then T is interpreted depending on the access technology in use as specified below:

1) if the MS is using any of the following at the time of starting timer T: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 2 hours to 240 hours, using 2 hour steps from 2 hours to 80 hours and 4 hour steps from 84 hours to 240 hours, or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 72 hours is used; and

2) if the MS is not using any of the following at the time of starting timer T: EC-GSM-IoT, Category M1 or Category NB1 (as defined in 3GPP TS 36.306 [54]), T is either in the range 6 minutes to 8 hours in 6 minute steps or it indicates that no periodic attempts shall be made. If no value for T is stored in the SIM, a default value of 60 minutes is use

for T.

If the MS is configured with the MinimumPeriodicSearchTimer as specified in 3GPP TS 24.368 [50] or 3GPP TS 31.102 [40], the MS shall not use a value for T that is less than the MinimumPeriodicSearchTimer. If the value stored in the SIM, or the default value for T (when no value is stored in the SIM), is less than the MinimumPeriodicSearchTimer, then T shall be set to the MinimumPeriodicSearchTimer.

The MS does not stop timer T, as described in 3GPP TS 24.008 [23] and 3GPP TS 24.301 [23A], when it activates power saving mode (PSM) (see 3GPP TS 23.682 [27A]).

The MS can be configured for Fast First Higher Priority PLMN search as specified in 3GPP TS 31.102 [40] or 3GPP TS 24.368 [50]. Fast First Higher Priority PLMN search is enabled if the corresponding configuration parameter is present and set to enabled. Otherwise, Fast First Higher Priority PLMN search is disabled.

The attempts to access the HPLMN or an EHPLMN or higher priority PLMN shall be as specified below:

a) The periodic attempts shall only be performed in automatic mode when the MS is roaming, and not while the MS is attached for emergency bearer services, is registered for emergency services, has a PDU session for emergency services or has a PDN connection for emergency bearer services;

b) The MS shall make the first attempt after a period of at least 2 minutes and at most T minutes:

- only after switch on if Fast First Higher Priority PLMN search is disabled; or

- after switch on or upon selecting a VPLMN if Fast First Higher Priority PLMN search is enabled.

c) The MS shall make the following attempts if the MS is on the VPLMN at time T after the last attempt;

d) Periodic attempts shall only be performed by the MS while in idle mode;

d1) Periodic attempts may be postponed while the MS is in power saving mode (PSM) (see 3GPP TS 23.682 [27A]).

d2) Periodic attempts may be postponed while the MS is receiving eMBMS transport service in idle mode (see 3GPP TS 23.246 [68]).

e) If the HPLMN (if the EHPLMN list is not present or is empty) or a EHPLMN (if the list is present) or a higher priority PLMN is not found, the MS shall remain on the VPLMN.

f) In steps i), ii) and iii) of subclause 4.4.3.1.1 the MS shall limit its attempts to access higher priority PLMN/access technology combinations to PLMN/access technology combinations of the same country as the current serving VPLMN, as defined in Annex B.

g) Only the priority levels of Equivalent PLMNs of the same country as the current serving VPLMN, as defined in Annex B, shall be taken into account to compare with the priority level of a selected PLMN.

h) If the PLMN of the highest priority PLMN/access technology combination available is the current VPLMN, or one of the PLMNs in the "Equivalent PLMNs" list, the MS shall remain on the current PLMN/access technology combination.

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

When a UE is switched on, a public land mobile network (PLMN) is selected by NAS. For the selected PLMN, associated RAT(s) may be set, as specified in TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN then becomes the registered PLMN, as specified in TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

When the UE is in RRC\_IDLE state, upper layers may deactivate AS layer when MICO mode is activated as specified in TS 24.501 [14]. When MICO mode is activated, the AS configuration (e.g. priorities provided by dedicated signalling) is kept and all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while MICO mode is activated it is up to the UE implementation whether it performs the corresponding action immediately or the latest when MICO mode is deactivated. When MICO mode is deactivated, the UE shall perform all idle mode tasks.

[TS 38.304, clause 4.2]

Table 4.2-1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in RRC\_IDLE state and RRC\_INACTIVE states. The NAS part is specified in TS 23.122 [9] and the AS part in the present document.

Table 4.2-1: Functional division between AS and NAS in RRC\_IDLE state and RRC\_INACTIVE state

| RRC\_IDLE and RRC\_INACTIVE state Process | UE Non-Access Stratum | UE Access Stratum |
| --- | --- | --- |
| PLMN Selection | Maintain a list of PLMNs in priority order according to TS 23.122 [9]. Select a PLMN using automatic or manual mode as specified in TS 23.122 [9] and request AS to select a cell belonging to this PLMN. For each PLMN, associated RAT(s) may be set.  Evaluate reports of available PLMNs from AS for PLMN selection.  Maintain a list of equivalent PLMN identities. | Search for available PLMNs.  If associated RAT(s) is (are) set for the PLMN, search in this (these) RAT(s) and other RAT(s) for that PLMN as specified in TS 23.122 [9].  Perform measurements to support PLMN selection.  Synchronise to a broadcast channel to identify found PLMNs.  Report available PLMNs with associated RAT(s) to NAS on request from NAS or autonomously. |
| Cell  Selection | Control cell selection for example by indicating RAT(s) associated with the selected PLMN to be used initially in the search of a cell in the cell selection.  Maintain a list of "Forbidden Tracking Areas" and provide the list to AS. | Perform measurements needed to support cell selection.  Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.  Search for a suitable cell. The cells broadcast one or more 'PLMN identity' in the system information. Respond to NAS whether such cell is found or not.  If associated RATs is (are) set for the PLMN, perform the search in this (these) RAT(s) and other RATs for that PLMN as specified in TS 23.122 [9].  If a cell is found which satisfies cell selection criteria, camp on that cell. |
| Cell  Reselection | Maintain a list of equivalent PLMN identities and provide the list to AS.  Maintain a list of "Forbidden Tracking Areas" and provide the list to AS. | Perform measurements needed to support cell reselection.  Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.  Change cell if a more suitable cell is found. |
| Location registration | Register the UE as active after power on.  Register the UE's presence in a registration area, for instance regularly or when entering a new tracking area.  Deregister UE when shutting down.  Maintain a list of "Forbidden Tracking Areas". | Report registration area information to NAS. |
| RAN Notification Area Update | Not applicable. | Register the UE's presence in a RAN-based notification area (RNA), periodically or when entering a new RNA. |

[TS 24.501, clause 5.3.1.4]

This subclause is only applicable for UE's 5GMM mode over 3GPP access.

The UE is in 5GMM-CONNECTED mode with RRC inactive indication when the UE is in:

a) 5GMM-CONNECTED mode over 3GPP access at the NAS layer; and

b) RRC\_INACTIVE state at the AS layer (see 3GPP TS 38.300 [27]).

Unless stated otherwise, the UE behaviour in 5GMM-CONNECTED mode with RRC inactive indication follows the UE behaviour in 5GMM-CONNECTED over 3GPP access, except that:

a) the UE shall apply the mobility restrictions; and

b) the UE shall perform the PLMN selection procedures as in 5GMM-IDLE mode over 3GPP access.

The UE shall transition from 5GMM-CONNECTED mode over 3GPP access to 5GMM-CONNECTED mode with RRC inactive indication upon receiving an indication from the lower layers that the UE has transitioned to RRC\_INACTIVE state.

…

The UE shall trigger a transition from 5GMM-CONNECTED mode with RRC inactive indication to 5GMM-IDLE mode upon selection of a PLMN that is not an equivalent PLMN to the registered PLMN. The UE shall not trigger a transition from 5GMM-CONNECTED mode with RRC inactive indication to 5GMM-IDLE mode upon entering a new PLMN which is in the list of equivalent PLMNs.

6.4.1.1.3 Test description

6.4.1.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 12, NR Cell 13 and NR Cell 1 are configured according to TS 38.508-1 [4], Table 4.4.2-3.

- The PLMNs are identified in the test by the identifiers in Table 6.4.1.1.3.1-1 and the PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1..

Table 6.4.1.1.3.1–1: PLMN identifiers

|  |  |
| --- | --- |
| NR Cell | PLMN name |
| 12 | PLMN15 |
| 13 | PLMN16 |
| 1 | PLMN1 |

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2-1 is used in NR cells.

UE:

- The UE is in Automatic PLMN selection mode.

- USIM configuration as defined in TS 38.508-1 [4] Table 6.4.1-1 will be loaded. The high priority PLMN search timer T defined by EFHPPLMN is 6min.

Preamble:

- The UE is in state Switched OFF (state 0-A) according to TS 38.508-1 [4].

6.4.1.1.3.2 Test procedure sequence

Table 6.4.1.1.3.2-1 for FR1 and Table 6.4.1.1.3.2-2 for FR2 illustrates the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while column marked "T1"is to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.4.1.1.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 12 | NR Cell 13 | NR Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | “Off” | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -78 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -88 | -88 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |

Table 6.4.1.1.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 12 | NR Cell 13 | NR Cell 1 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | “Off” | ”Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2 |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -82 | ”Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -82 | -82 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2 |

Table 6.4.1.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0A | SS adjusts cell levels according to row T0 of table 6.4.1.1.3.2-1/2. | - | - | - | - |
| 0B | The UE is switched on. | - | - | - | - |
| 0C1-0C19a1 | The steps 1-19a1 specified in generic procedure TS 38.508-1 Table 4.5.3.2-1 are performed. | - | - | - | - |
| 0D | SS starts timers of tmin = 2min and tmax = (6 min + 5min) (Note 1). | - | - | - | - |
| 0Ea1-0F | The steps 19Aa1-20 specified in generic procedure TS 38.508-1 Table 4.5.3.2-1 are performed. | - | - | - | - |
| 1 | SS adjusts cell levels according to row T1 of table 6.4.1.1.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the UE transmit an *RRCResumeRequest* message on NR Cell 13? | - | NR RRC: *RRCResumeRequest* | 1 | P |
| 3 | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 4 | The UE transmits an *RRCResumeComplete* message and a REGISTRATION REQUEST message indicating "mobility registration updating" is sent to update the registration of NR Cell13. | --> | NR RRC: *RRCResumComplete*  5GMM: REGISTRATION REQUEST | - | - |
| 4A-4B | Steps 4 to 5 of the generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 with condition MOBILITY are performed. | - | - | - | - |
| 5 | The SS transmits an *RRCRelease* message with suspend. | <-- | NR RRC: *RRCRelease* | - | - |
| 6 | Void | - | - | - | - |
| 7 | The SS transmits a *Paging* message including a matched identity (correct *fullI-RNTI*) on NR Cell 13. | <-- | NR RRC: *Paging* | - | - |
| 8 | Check: Does the UE transmit an *RRCResumeRequest* message to resume RRC Connection by setting *resumeIdentity* to the stored *shortI-RNTI* value on NR Cell 13? | --> | NR RRC: *RRCResumeRequest* | 1 | P |
| 9 | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 10 | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 11 | The SS transmits an *RRCRelease* message with suspend. | <-- | NR RRC: *RRCRelease* | - | - |
| 12 | SS adjusts cell levels according to row T2 of table 6.4.1.1.3.2-1/2. | - | - | - | - |
| 13 | Check: Does the UE send an *RRCSetupRequest* message on NR Cell 1 after tmin expires but before tmax expires (Note 1)? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 14 | Steps 3-4 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed | - | - | 2 | P |
| - | EXCEPTION: Steps 14a1 to 14b5a1 describe behaviours which depend on procedure parameters; the "lower case letter" identifies a step sequence that take place if a procedure parameter has a particular value. | - | - | - | - |
| 14a1-14a16a1 | IF 5GS registration type is set as Initial Registration in step 14, THEN steps 5 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1. Note 2 | - | - | - | - |
| 14b1-14b5a1 | ELSE IF 5GS registration type is set as Mobility Registration in step 14, THEN steps 4 to 6a1 of the generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 1. Note 2 | - | - | - | - |
| Note 1: Following attempts to access the HPLMN/EHPLMN/higher priority PLMN in VPLMN is operator specific setting (Refer to TS 23.122 [38] Rel-15).Hence, window between 2min to T+Tolerance is being used, where the high priority PLMN search timer T defined by EFHPPLMN. Tolerance of 5min is added to allow time for the UE to find the proper PLMN.  Note 2: The 5GS registration type shall be only set as Mobility Registration for R16 UEs according to TS 24.501 [22] subclause 5.2.3.2.5 specified in Release 16. The EXCEPTION description applies only to R15 UEs. | | | | | |

6.4.1.1.3.3 Specific message contents

Table 6.4.1.1.3.3-1: *SIB4* for NR Cell 12 (preamble and all steps, Table 6.4.1.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 13 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.1.1.3.3-2: *SIB4* for NR Cell 13 (preamble and all steps, Table 6.4.1.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 12 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.1.1.3.3-3: REGISTRATION ACCEPT for NR Cell 12 (step 0D, Table 6.4.1.1.3.2-3; step 14, TS 38.508-1 [4], Table 4.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| Equivalent PLMNs | PLMN16 |  |  |

Table 6.4.1.1.3.3-4: RRCResumeRequest (Step 2, Table 6.4.1.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCResumeRequest ::= SEQUENCE { | |  |  |  |
| rrcResumeRequest SEQUENCE { | |  |  |  |
| resumeCause | | mo-Signalling |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.4.1.2 Cell reselection of ePLMN in manual mode

6.4.1.2.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state on a NR cell in manual PLMN Selection mode and network has downloaded a list of equivalent PLMNs during the Registration procedure }

**ensure that** {

**when** { Higher ranked cell is a cell of a PLMN in the downloaded equivalent PLMN list }

**then** { UE reselects to the equivalent PLMN cell , and attempts Registration with mobility on the selected cell. }

}

(2)

**with** { UE in NR RRC\_INACTIVE state on a cell and network has downloaded a list of equivalent PLMNs during Registration procedure for mobility }

**ensure that** {

**when** { Highest ranked cell is a cell of a PLMN not in the downloaded equivalent PLMN list }

**then** { UE does not reselect to the cell. }

}

6.4.1.2.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122 clauses 4.4.3.1.2 and TS 38.304, clauses 4.1 and clauses 4.2. Unless otherwise stated these are Rel-15 requirements.

[TS 23.122, clause 4.4.3.1.2]

The MS indicates whether there are any PLMNs, which are available using all supported access technologies. This includes PLMNs in the "forbidden PLMNs" list, "forbidden PLMNs for GPRS service" list and PLMNs which only offer services not supported by the MS. An MS which supports GSM COMPACT shall also indicate GSM COMPACT PLMNs (which use PBCCH).

If displayed, PLMNs meeting the criteria above are presented in the following order:

i)- either the HPLMN (if the EHPLMN list is not present or is empty) or, if one or more of the EHPLMNs are available then based on an optional data field on the SIM either only the highest priority available EHPLMN is to be presented to the user or all available EHPLMNs are presented to the user in priority order. If the data field is not present on the SIM, then only the highest priority available EHPLMN is presented;

ii)- PLMN/access technology combinations contained in the " User Controlled PLMN Selector with Access Technology " data file in the SIM (in priority order);

iii)- PLMN/access technology combinations contained in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iv)- other PLMN/access technology combinations with received high quality signal in random order;

v)- other PLMN/access technology combinations in order of decreasing signal quality.

In ii and iii, an MS using a SIM without access technology information storage (i.e. the "User Controlled PLMN Selector with Access Technology" and the "Operator Controlled PLMN Selector with Access Technology" data files are not present) shall instead present the PLMNs contained in the "PLMN Selector" data file in the SIM (in priority order).

In v, requirement h) in subclause 4.4.3.1.1 applies.

In i to v, requirements j), k) and l) in subclause 4.4.3.1.1 apply.

In GSM COMPACT, the non support of voice services shall be indicated to the user.

The HPLMN may provide on the SIM additional information on the available PLMNs. If this information is provided then the MS shall indicate it to the user. This information, provided as free text may include:

- preferred partner,

- roaming agreement status,

- supported services

Furthermore, the MS may indicate whether the available PLMNs are present on the EHPLMN list, the Forbidden list, the User Controlled PLMN List or the Operator Controlled PLMN List. The MS may also indicate that the PLMN is not present on any of these lists.

The user may select his desired PLMN and the MS then initiates registration on this PLMN using the access technology chosen by the user for that PLMN or using the highest priority available access technology for that PLMN, if the associated access technologies have a priority order. (This may take place at any time during the presentation of PLMNs). For such a registration, the MS shall ignore the contents of the "forbidden location areas for roaming", "forbidden tracking areas for roaming", "5GS forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service", "5GS forbidden tracking areas for regional provision of service", "forbidden PLMNs for GPRS service" and "forbidden PLMNs" lists.

NOTE 1: It is an MS implementation option whether to indicate access technologies to the user. If the MS does display access technologies, then the access technology selected by the user is only used for initial registration on the selected PLMN. If the MS does not display access technologies, then the access technology chosen for a particular PLMN should be the highest priority available access technology for that PLMN, if the associated access technologies have a priority order, and is only used for initial registration.

Once the MS has registered on a PLMN selected by the user, the MS shall not automatically register on a different PLMN unless:

i) the new PLMN is declared as an equivalent PLMN by the registered PLMN;

ii) the user selects automatic mode;

iii) the user initiates an emergency call while the MS is in limited service state and either the network does not broadcast the indication of support of emergency calls in limited service state, the registration request for emergency services is rejected by the network or the attach request for emergency bearer services is rejected by the network; or

iv) the user initiates access to RLOS, while the MS is in limited service state and either the network does not broadcast the indication of support of RLOS in limited service state, or the EPS attach request for access to RLOS is rejected by the network.

NOTE 2: If case iii) or iv) occurs, the MS can provide an indication to the upper layers that the MS has exited manual network selection mode.

If the user does not select a PLMN, the selected PLMN shall be the one that was selected before the PLMN selection procedure started. If no such PLMN was selected or that PLMN is no longer available, then the MS shall attempt to camp on any acceptable cell and enter the limited service state.

NOTE 3: High quality signal is defined in the appropriate AS specification.

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

When a UE is switched on, a public land mobile network (PLMN) is selected by NAS. For the selected PLMN, associated RAT(s) may be set, as specified in TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN then becomes the registered PLMN, as specified in TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

When the UE is in RRC\_IDLE state, upper layers may deactivate AS layer when MICO mode is activated as specified in TS 24.501 [14]. When MICO mode is activated, the AS configuration (e.g. priorities provided by dedicated signalling) is kept and all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while MICO mode is activated it is up to the UE implementation whether it performs the corresponding action immediately or the latest when MICO mode is deactivated. When MICO mode is deactivated, the UE shall perform all idle mode tasks.

[TS 38.304, clause 4.2]

Table 4.2-1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in RRC\_IDLE state and RRC\_INACTIVE states. The NAS part is specified in TS 23.122 [9] and the AS part in the present document.

Table 4.2-1: Functional division between AS and NAS in RRC\_IDLE state and RRC\_INACTIVE state

| RRC\_IDLE and RRC\_INACTIVE state Process | UE Non-Access Stratum | UE Access Stratum |
| --- | --- | --- |
| PLMN Selection | Maintain a list of PLMNs in priority order according to TS 23.122 [9]. Select a PLMN using automatic or manual mode as specified in TS 23.122 [9] and request AS to select a cell belonging to this PLMN. For each PLMN, associated RAT(s) may be set.  Evaluate reports of available PLMNs from AS for PLMN selection.  Maintain a list of equivalent PLMN identities. | Search for available PLMNs.  If associated RAT(s) is (are) set for the PLMN, search in this (these) RAT(s) and other RAT(s) for that PLMN as specified in TS 23.122 [9].  Perform measurements to support PLMN selection.  Synchronise to a broadcast channel to identify found PLMNs.  Report available PLMNs with associated RAT(s) to NAS on request from NAS or autonomously. |
| Cell  Selection | Control cell selection for example by indicating RAT(s) associated with the selected PLMN to be used initially in the search of a cell in the cell selection.  Maintain a list of "Forbidden Tracking Areas" and provide the list to AS. | Perform measurements needed to support cell selection.  Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.  Search for a suitable cell. The cells broadcast one or more 'PLMN identity' in the system information. Respond to NAS whether such cell is found or not.  If associated RATs is (are) set for the PLMN, perform the search in this (these) RAT(s) and other RATs for that PLMN as specified in TS 23.122 [9].  If a cell is found which satisfies cell selection criteria, camp on that cell. |
| Cell  Reselection | Maintain a list of equivalent PLMN identities and provide the list to AS.  Maintain a list of "Forbidden Tracking Areas" and provide the list to AS. | Perform measurements needed to support cell reselection.  Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.  Change cell if a more suitable cell is found. |
| Location registration | Register the UE as active after power on.  Register the UE's presence in a registration area, for instance regularly or when entering a new tracking area.  Deregister UE when shutting down.  Maintain a list of "Forbidden Tracking Areas". | Report registration area information to NAS. |
| RAN Notification Area Update | Not applicable. | Register the UE's presence in a RAN-based notification area (RNA), periodically or when entering a new RNA. |

6.4.1.2.3 Test description

6.4.1.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 12 and NR Cell 13 are configured according to TS 38.508-1, Table 4.4.2-3.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2-1 is used in NR cell 1 and NR cell 12.

- System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.2-1 is used in NR cell 13.

UE:

- The UE is in Manual PLMN selection mode.

Preamble:

- The UE is registered on NR Cell 1 except that the REGISTRATION ACCEPT message indicates the PLMN of NR Cell 12 in the Equivalent PLMN list as described in Table 6.4.1.2.3.3-4.

- The UE is in state 2N-A as defined in TS 38.508-1 [4], Table 4.4A.2-2 on NR Cell 1.

6.4.1.2.3.2 Test procedure sequence

Table 6.4.1.2.3.2-1 for FR1 and Table 6.4.1.2.3.2-2 for FR2 illustrates the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1", "T2" and "T3" are to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause.

Table 6.4.1.2.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 13 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -99 | -88 | -78 |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |

Table 6.4.1.2.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 12 | NR Cell 13 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -100 | -91 | -82 |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | “Off” | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.2-2 |

Table 6.4.1.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts cell levels according to row T0 of table 6.4.1.2.3.2-1/2. | - | - | - | - |
| 2 | Check: Does the UE transmit an *RRCResumeRequest* message on NR Cell 12? | --> | NR RRC: *RRCResumeRequest* | 1 | P |
| 3-6 | Steps 2 to 5 of the generic test procedure in TS 38.508-1 Table 4.9.5.2.2-1 with condition MOBILITY are performed. (Note 1) | - | - | - | - |
| 6A-6D | Steps 5 to 8 of the generic test procedure in TS 38.508-1 Table 4.5.4.2-3. (Note 3) | - | - | - | - |
| 7 | The SS transmits an *RRCRelease* message with suspend. | --> | NR RRC:RRCRelease | - | - |
| 8 | Check: Does the UE send an *RRCResumeRequest* on NR Cell 13 and NR Cell 1 within 60s? | --> | NR RRC: *RRCResumeRequest* | 2 | F |
| 9 | SS adjusts cell levels according to row T1 of table 6.4.1.2.3.2-1/2. | - | - | - | - |
| 10 | Set UE to Automatic PLMN selection mode. (Note 2) | - | - | - | - |
| Note 1: The REGISTRATION REQUEST is accepted with the PLMN of NR Cell 1 listed as an Equivalent PLMN.  Note 2: Steps 10 is to ensure UE is set back to automatic PLMN selection mode for the next test case.  Note 3: No SERVICE ACCEPT message should be included in step 6C (corresponding to step 7 of Table 4.5.4.2-3 in TS 38.508-1 [4]). | | | | | |

6.4.1.2.3.3 Specific message contents

Table 6.4.1.2.3.3-1: *SIB4* for NR Cell 1 (preamble and all steps, Table 6.4.1.2.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4] Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 12 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 13 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.1.2.3.3-2: *SIB4* for NR Cell 12 (preamble and all steps, Table 6.4.1.2.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4] Table 4.6.2-3 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink NR ARFCN as used for NR Cell 13 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.1.2.3.3-3: REGISTRATION ACCEPT for NR Cell 1 (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4] Table 4.7.1-7 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| Equivalent PLMNs | The PLMN of NR Cell 12 |  |  |

Table 6.4.1.2.3.3-3A: RRCResumeRequest (Step 2, Table 6.4.1.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCResumeRequest ::= SEQUENCE { | |  |  |  |
| rrcResumeRequest SEQUENCE { | |  |  |  |
| resumeCause | | mo-Signalling |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.4.1.2.3.3-4: REGISTRATION ACCEPT for NR Cell 12 (step 5, Table 6.4.1.2.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4] Table 4.7.1-7 | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| Equivalent PLMNs | The PLMN of NR Cell 1 |  |  |
| Allowed NSSAI |  |  |  |
| S-NSSAI |  |  |  |
| Length of S-NSSAI contents | ‘0000 0010’B |  |  |
| Mapped HPLMN SST | Same as SST |  |  |

Table 6.4.1.2.3.3-4A: RRCReconfiguration for NR Cell 12 (step 6C, Table 6.4.1.2.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4] Table 4.6.1-13 with condition NR | | | |
| **Information Element** | **Value/Remark** | **Comment** | **Condition** |
| dedicatedNAS-MessageList | Not Present |  |  |

Table 6.4.1.2.3.3-5: *RRCRelease* (step 7, Table 6.4.1.2.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-4B | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCRelease ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcRelease SEQUENCE { |  |  |  |
| suspendConfig SEQUENCE { |  |  | NR\_RRC\_INACTIVE |
| ran-NotificationAreaInfo CHOICE { |  |  |  |
| cellList SEQUENCE { |  |  |  |
| plmn-Identity |  | PLMN ID of NR Cell 12 |  |
| ran-AreaCells SEQUENCE { |  |  |  |
| cellIdentity | See Table 4.4.2-2 and 4.4.2-3 in TS 38.508-1 [4] | Cell Identity of NR Cell 12 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

### 6.4.2 Cell Selection/Qrxlevmin & Cell Reselection (Intra NR in RRC\_INACTIVE state)

#### 6.4.2.1 Cell Selection/Qrxlevmin & Cell Reselection (Intra NR in RRC\_INACTIVE state)

6.4.2.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** **that** {

**when** { serving cell fulfils all requirements for a suitable cell except the cell selection criteria which are not fulfilled (Srxlev<0) }

**then** { UE does not consider the cell as suitable , leaves RRC\_INACTIVE state and does not remain camped on that cell }

}

(2)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** **that** {

**when** { UE detects a cell ranked as the best cell }

**then** { UE reselects to the new cell and continues to remain in RRC\_INACTIVE state }

}

6.4.2.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.300, clause 9.2.1.1, and TS 38.304, clause 4.1, 4.5, 5.2.1, 5.2.3.1 and 5.2.3.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.300, clause 9.2.1.1]

The principles of PLMN selection in NR are based on the 3GPP PLMN selection principles. Cell selection is required on transition from RM-DEREGISTERED to RM-REGISTERED, from CM-IDLE to CM-CONNECTED and from CM-CONNECTED to CM-IDLE and is based on the following principles:

- The UE NAS layer identifies a selected PLMN and equivalent PLMNs;

- Cell selection is always based on CD-SSBs located on the synchronization raster (see subclause 5.2.4):

- The UE searches the NR frequency bands and for each carrier frequency identifies the strongest cell as per the CD-SSB. It then reads cell system information broadcast to identify its PLMN(s):

- The UE may search each carrier in turn ("initial cell selection") or make use of stored information to shorten the search ("stored information cell selection").

- The UE seeks to identify a suitable cell; if it is not able to identify a suitable cell it seeks to identify an acceptable cell. When a suitable cell is found or if only an acceptable cell is found it camps on that cell and commence the cell reselection procedure:

- A suitable cell is one for which the measured cell attributes satisfy the cell selection criteria; the cell PLMN is the selected PLMN, registered or an equivalent PLMN; the cell is not barred or reserved and the cell is not part of a tracking area which is in the list of "forbidden tracking areas for roaming";

- An acceptable cell is one for which the measured cell attributes satisfy the cell selection criteria and the cell is not barred.

Transition to RRC\_IDLE:

On transition from RRC\_CONNECTED or RRC\_INACTIVE to RRC\_IDLE, a UE should camp on a cell as result of cell selection according to the frequency be assigned by RRC in the state transition message if any.

Recovery from out of coverage:

The UE should attempt to find a suitable cell in the manner described for stored information or initial cell selection above. If no suitable cell is found on any frequency or RAT, the UE should attempt to find an acceptable cell.

In multi-beam operations, the cell quality is derived amongst the beams corresponding to the same cell (see subclause 9.2.4).

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

When a UE is switched on, a public land mobile network (PLMN) is selected by NAS. For the selected PLMN, associated RAT(s) may be set, as specified in TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN then becomes the registered PLMN, as specified in TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

…

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

When the UE is in RRC\_IDLE state, upper layers may deactivate AS layer when MICO mode is activated as specified in TS 24.501 [14]. When MICO mode is activated, the AS configuration (e.g. priorities provided by dedicated signalling) is kept and all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while MICO mode is activated it is up to the UE implementation whether it performs the corresponding action immediately or the latest when MICO mode is deactivated. When MICO mode is deactivated, the UE shall perform all idle mode tasks.

[TS 38.304, clause 4.5]

The cells are categorised according to which services they offer:

**acceptable cell:**

An "acceptable cell" is a cell on which the UE may camp to obtain limited service (originate emergency calls and receive ETWS and CMAS notifications). Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call and to receive ETWS and CMAS notification in an NR network:

- The cell is not barred, see subclause 5.3.1;

- The cell selection criteria are fulfilled, see subclause 5.2.3.2.

**suitable cell:**

A cell is considered as suitable if the following conditions are fulfilled:

- The cell is part of either the selected PLMN or the registered PLMN or PLMN of the Equivalent PLMN list and *trackingAreaCode* is provided for that PLMN;

- The cell selection criteria are fulfilled, see subclause 5.2.3.2.

According to the latest information provided by NAS:

- The cell is not barred, see subclause 5.3.1;

- The cell is part of at least one TA that is not part of the list of "Forbidden Tracking Areas" (TS 22.261 [12]), which belongs to a PLMN that fulfils the first bullet above.

**barred cell:**

A cell is barred if it is so indicated in the system information, as specified in TS 38.331 [3].

**reserved cell:**

A cell is reserved if it is so indicated in system information, as specified in TS 38.331 [3].

Following exception to these definitions are applicable for UEs:

- if a UE has an ongoing emergency call, all acceptable cells of that PLMN are treated as suitable for the duration of the emergency call.

- camped on a cell that belongs to a registration area that is forbidden for regional provision of service; a cell that belongs to a registration area that is forbidden for regional provision service (TS 23.122 [9], TS 24.501 [14]) is suitable but provides only limited service.

[TS 38.304, clause 5.2.1]

UE shall perform measurements for cell selection and reselection purposes as specified in TS 38.133 [8].

When evaluating Srxlev and Squal of non-serving cells for reselection evaluation purposes, the UE shall use parameters provided by the serving cell and for the final check on cell selection criterion, the UE shall use parameters provided by the target cell for cell reselection.

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on RRC\_IDLE or RRC\_INACTIVE state measurements and cell selection criteria.

In order to expedite the cell selection process, stored information for several RATs, if available, may be used by the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT. Details on performance requirements for cell reselection can be found in TS 38.133 [8].

The NAS is informed if the cell selection and reselection result in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, monitor control channel(s) of that cell so that the UE can:

- receive system information from the PLMN; and

- receive registration area information from the PLMN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN; and

- initiate transfer to Connected mode.

For cell selection in multi-beam operations, measurement quantity of a cell is up to UE implementation.

For cell reselection in multi-beam operations, the measurement quantity of this cell is derived amongst the beams corresponding to the same cell based on SS/PBCH block as follows:

- if *nrofSS-BlocksToAverage* is not configured in *SIB2/SIB4*; or

- if *absThreshSS-BlocksConsolidation* is not configured in *SIB2/SIB4*; or

- if the highest beam measurement quantity value is below or equal to *absThreshSS-BlocksConsolidation*:

- derive a cell measurement quantity as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [11].

- else:

- derive a cell measurement quantity as the linear average of the power values of up to *nrofSS-BlocksToAverage* of highest beam measurement quantity values above *absThreshSS-BlocksConsolidation*.

[TS 38.304, clause 5.2.3.1]

Cell selection is performed by one of the following two procedures:

a) Initial cell selection (no prior knowledge of which RF channels are NR frequencies):

1. The UE shall scan all RF channels in the NR bands according to its capabilities to find a suitable cell.

2. On each frequency, the UE need only search for the strongest cell.

3. Once a suitable cell is found, this cell shall be selected.

b) Cell selection by leveraging stored information:

1. This procedure requires stored information of frequencies and optionally also information on cell parameters from previously received measurement control information elements or from previously detected cells.

2. Once the UE has found a suitable cell, the UE shall select it.

3. If no suitable cell is found, the initial cell selection procedure in a) shall be started.

NOTE: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

[TS 38.304, clause 5.2.3.2]

The cell selection criterion S is fulfilled when:

Srxlev > 0 AND Squal > 0

where:

Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset )– Pcompensation - Qoffsettemp

Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm). If the UE supports SUL frequency for this cell, Qrxlevmin is obtained from *q-RxLevMinSUL*, if present,in *SIB1*, *SIB2* and *SIB4*, additionally, if QrxlevminoffsetcellSUL is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell;  else Qrxlevmin is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if Qrxlevminoffsetcell is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell. |
| Qqualmin | Minimum required quality level in the cell (dB). Additionally, if Qqualminoffsetcell is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned cell. |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9]. |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN, as specified in TS 23.122 [9]. |
| Pcompensation | If the UE supports the additionalPmax in the NR-NS-PmaxList, if present, in *SIB1, SIB2* and *SIB4:*  *max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);*  *else:*  *max(PEMAX1 –PPowerClass, 0) (dB)* |
| PEMAX1, PEMAX2 | Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 38.101 [15]. If UE supports SUL frequency for this cell, PEMAX1 and PEMAX2 are obtained from the *p-Max* for SUL in *SIB1* and *NR-NS-PmaxList* for SUL respectively in *SIB1, SIB2* and *SIB4* as specified in TS 38.331 [3], else PEMAX1 and PEMAX2 are obtained from the *p-Max* and *NR-NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* for normal UL as specified in TS 38.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101-1 [15]. |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN (TS 23.122 [9]). During this periodic search for higher priority PLMN, the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

6.4.2.1.3 Test description

6.4.2.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2.

- System information combination NR-3 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

UE:

None.

Preamble:

- The UE is in state 2N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-2.

6.4.2.1.3.2 Test procedure sequence

Table 6.4.2.1.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1" and "T2" are applied at the points indicated in the Main behaviour description in Table 6.4.2.1.3.2-3.

Table 6.4.2.1.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -115 | Off | The power level values are assigned to satisfy Srxlev NR Cell 1 < 0. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | The power level values are assigned to satisfy RNR Cell 2 > RNR Cell 1. |
| Note 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | |

Table 6.4.2.1.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | Off | Off | The power level values are assigned to satisfy Srxlev NR Cell 1 < 0. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | The power level values are assigned to satisfy RNR Cell 2 > RNR Cell 1. |
| Note 1: The downlink signal level uncertainty is specified in TS 38.508-1 [4] section 6.2.2.2. | | | | | |

Table 6.4.2.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The SS changes NR Cell 1 SSS level according to the row "T1" in table 6.4.2.1.3.2-1/2. | - | - | - | - |
| 2 | Void | - | - | - | - |
| 2A | Wait 15s. (Note 1) | - | - | - | - |
| 3 | The SS transmits a *Paging* message. | <-- | NR RRC: *Paging* | - | - |
| 4 | Check: Does the UE attempt to transmit an uplink message within the next 10s? | - | - | 1 | F |
| 5 | The UE is switched off. | - | - | - | - |
| 6 | Void | - | - | - | - |
| 6A | Void | - | - | - | - |
| 6B | The SS changes NR Cell 1 SSS levels according to the row "T0" in table 6.4.2.1.3.2-1/2. | - | - | - | - |
| 6C | The UE is switched on. | - | - | - | - |
| 7 | Generic procedure specified in TS 38.508-1 Table 4.5.3.2-1 are performed, in which the RRCRelease message includes the suspendConfig with NR\_RRC\_INACTIVE condition thereby moving the UE to RRC\_INACTIVE. | - | - | - | - |
| 8-15 | Void | - | - | - | - |
| 16 | The SS changes NR Cell 2 SSS level according to the row "T2" in table 6.4.2.1.3.2-1/2. | - | - | - | - |
| 17 | Void | - | - | - | - |
| 18 | Check: Does the UE transmit an *RRCResumeRequest* message on the NR Cell 2? | --> | NR RRC: *RRCResumeRequest* | 2 | P |
| 18A | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 18B | The UE transmit an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 19 | The SS transmits an *RRCRelease* message including *suspendConfig* with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |
| Note 1: As specified in TS 38.133 [30] clause 4.2.2.2, UE will wait DRXCycle \* 2 to evaluate serving cell. If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN.The wait time is selected to cover DRXCycle \* 2 = 1280ms \* 2 = 2.56s + 10s = 12.56s rounded up to 13s. Therefore, the actual wait time is selected to 15s, in order to be greater than 13s. | | | | | |

6.4.2.1.3.3 Specific message contents

Table 6.4.2.1.3.3-1: *SIB3* of NR Cell 1 (preamble and all steps, Table 6.4.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE (SIZE (1.. maxCellIntra)) OF IntraFreqNeighCellInfo { | 1 entry |  |  |
| IntraFreqNeighCellInfo[1] SEQUENCE{ |  | entry 1 |  |
| physCellId | Physical cell identity of NR Cell 2 |  |  |
| q-OffsetCell | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.2.1.3.3-1A: RRCResumeRequest (Step 18, Table 6.4.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCResumeRequest ::= SEQUENCE { | |  |  |  |
| rrcResumeRequest SEQUENCE { | |  |  |  |
| resumeCause | | rna-Update |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.4.2.1.3.3-2: RRCResume (step 18A, Table 6.4.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-17 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCResume ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcResume SEQUENCE { | |  |  |  |
| masterCellGroup := SEQUENCE { | | CellGroupConfig | Table 6.4.2.1.3.3-3 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.4.2.1.3.3-3: *CellGroupConfig* (Table 6.4.2.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-19 with condition RESUME | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfigDedicated | ServingCellConfig |  |  |
| } |  |  |  |

Table 6.4.2.1.3.3-4: *ServingCellConfig* (Table 6.4.2.1.3.3-3: *CellGroupConfig*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-167 with condition RESUME | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| initialDownlinkBWP | BWP-DownlinkDedicated |  |  |
| } |  |  |  |

Table 6.4.2.1.3.3-5: *BWP-DownlinkDedicated* (Table 6.4.2.1.3.3-4: *ServingCellConfig*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-11 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-DownlinkDedicated ::= SEQUENCE { |  |  |  |
| pdcch-Config | Not present |  |  |
| pdsch-Config CHOICE { |  |  |  |
| setup | PDSCH-Config |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.2.1.3.3-6: *PDSCH-Config* (Table 6.4.2.1.3.3-5: *BWP-DownlinkDedicated*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| dmrs-DownlinkForPDSCH-MappingTypeA | Not present |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 1 entry |  |  |
| TCI-State[1] SEQUENCE { |  | entry 1 |  |
| tci-StateId | 0 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB index #n | SSB index of NR Cell 2 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| prb-BundlingType | Not present |  |  |
| } |  |  |  |

#### 6.4.2.2 Inter-frequency cell reselection according to cell reselection priority provided by SIBs in RRC\_INACTIVE state

6.4.2.2.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** **that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the equal priority frequency }

**then** { UE reselects to the cell which belongs to the equal priority frequency and remains in RRC\_INACTIVE state }

}

(2)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** **that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the higher priority frequency }

**then** { UE reselects to the cell which belongs to the higher priority frequency and remains in RRC\_INACTIVE state }

}

(3)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** **that** {

**when** { UE detects the cell re-selection criteria are met for the cell which belongs to the lower priority frequency }

**then** { UE reselects to the cell which belongs to the lower priority frequency and remains in RRC\_INACTIVE state }

}

6.4.2.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 4.1, 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

…

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

When the UE is in RRC\_IDLE state, upper layers may deactivate AS layer when MICO mode is activated as specified in TS 24.501 [14]. When MICO mode is activated, the AS configuration (e.g. priorities provided by dedicated signalling) is kept and all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while MICO mode is activated it is up to the UE implementation whether it performs the corresponding action immediately or the latest when MICO mode is deactivated. When MICO mode is deactivated, the UE shall perform all idle mode tasks.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (3GPP TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (3GPP TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.2]

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to section 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

6.4.2.2.3 Test description

6.4.2.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- System information combination NR-4 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cells.

UE:

- None.

Preamble:

- The UE is in state 2N-A on NR Cell 1(serving cell) according to TS 38.508-1 [4] Table 4.4A.2-2.

6.4.2.2.3.2 Test procedure sequence

Table 6.4.2.2.3.2-1/2 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1", "T2" and "T3" are applied at the points indicated in the Main behaviour description in Table 6.4.2.2.3.2-3.

Table 6.4.2.2.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -78 | -78 | The power level values are assigned to satisfy SrxlevNR Cell 1 < 0 and SrxlevNR Cell 6 > ThreshNR Cell 6, highP. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -78 | -98 | The power level values are assigned to satisfy SrxlevNR Cell 6 < Threshserving, lowP and SrxlevNR Cell 3 > ThreshNR Cell 3, lowP, SrxlevNR Cell 1< 0. |
| Note 1: Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.4.2.2.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 | -82 | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -82 | -82 | The power level values are assigned to satisfy SrxlevNR Cell 1 < 0 and SrxlevNR Cell 6 > ThreshNR Cell 6, highP. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -82 | -100 | The power level values are assigned to satisfy SrxlevNR Cell 6 < Threshserving, lowP and SrxlevNR Cell 3 > ThreshNR Cell 3, lowP, SrxlevNR Cell 1< 0. |
| Note 1: The downlink signal level uncertainty is specified in TS 38.508-1 [4] section 6.2.2.2. | | | | | | |

Table 6.4.2.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes NR Cell 3 SSS level according to the row "T1" in table 6.4.2.2.3.2-1/2. | - | - | - | - |
| 2 | Void | - | - | - | - |
| 3 | Check: Does the UE transmit an *RRCResumeRequest* message on the cell 3? | --> | NR RRC: *RRCResumeRequest* | 1 | P |
| 4 | The SS transmits an *RRCRelease* message including *suspendConfig* with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |
| 5 | The SS changes NR Cell 1 and NR Cell 6 SSS levels according to the row "T2" in table 6.4.2.2.3.2-1/2. | - | - | - | - |
| 6 | Void | - | - | - | - |
| 7 | Check: Does the UE transmit an *RRCResumeRequest* message on the cell 6? | --> | NR RRC: *RRCResumeRequest* | 2 | P |
| 8 | The SS transmits an *RRCRelease* message including suspendConfig with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |
| 9 | The SS changes NR Cell 6 SSS level according to the row "T3" in table 6.4.2.2.3.2-1/2. | - | - | - | - |
| 10 | Void | - | - | - | - |
| 11 | Check: Does the UE transmit an *RRCResumeRequest* message on the cell 3? | --> | NR RRC: *RRCResumeRequest* | 3 | P |
| 12 | The SS transmits an *RRCRelease* message including suspendConfig with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |

6.4.2.2.3.3 Specific message contents

Table 6.4.2.2.3.3-1: Conditions for specific message contents in Tables below

|  |  |
| --- | --- |
| Condition | Explanation |
| NR Cell 1 | This condition applies to system information transmitted on NR Cell 1. |
| NR Cell 3 | This condition applies to system information transmitted on NR Cell 3. |
| NR Cell 6 | This condition applies to system information transmitted on NR Cell 6. |

Table 6.4.2.2.3.3-2: *SIB2* of NR Cell 6 (preamble and all steps, Table 6.4.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 10 | 20 dB | FR1 |
|  | 5 | 10 dB | FR2 |
| cellReselectionPriority | 5 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.2.2.3.3-3: *SIB4* of NR Cell 1, NR Cell 3 and NR Cell 6 (preamble and all steps, Table 6.4.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE SIZE (1..maxFreq) OF SEQUECNCE { | 2 entries |  | NR Cell 1 |
| 1 entry |  | NR Cell 3 and NR Cell 6 |
| dl-CarrierFreq[1] | Same downlink ARFCN as used for NR Cell 6 |  | NR Cell 1 |
| Same downlink ARFCN as used for NR Cell 6 |  | NR Cell 3 |
| Same downlink ARFCN as used for NR Cell 3 |  | NR Cell 6 |
| threshX-HighP[1] | 10 | 20 dB | NR Cell 3 |
| cellReselectionPriority[1] | 5 |  | NR Cell 1 |
| 5 |  | NR Cell 3 |
| 4 |  | NR Cell 6 |
| dl-CarrierFreq[2] | Same downlink ARFCN as used for NR Cell 3 |  | NR Cell 1 |
| cellReselectionPriority[2] | 4 |  | NR Cell 1 |
| } |  |  |  |
| } |  |  |  |

Table 6.4.2.1.3.3-5: RRCResumeRequest (Step 3, 7 and 11, Table 6.4.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCResumeRequest ::= SEQUENCE { | |  |  |  |
| rrcResumeRequest SEQUENCE { | |  |  |  |
| resumeCause | | rna-Update |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 6.4.2.3 Slice-based cell reselection in RRC\_INACTIVE state / Reselection priorities provided by SIB16

6.4.2.3.1 Test Purpose (TP)

(1)

**with** { UE supporting slice-based cell reselection and in NR RRC\_INACTIVE state }

**ensure that** {

**when** { UE detects the cell reselection criteria is met for two cells on different frequencies supporting different NAS-provided NSAG priorities }

**then** { UE reselects to the cell on the frequency which supports higher priority NSAG and remains in RRC\_INACTIVE state }

}

(2)

**with** { UE supporting slice-based cell reselection and in NR RRC\_INACTIVE state }

**ensure that** {

**when** { UE detects the cell reselection criteria is met for two cells on different frequencies supporting same NAS-provided NSAG priority }

**then** { UE reselects to the cell on the frequency which supports the NSAG having higher nsag-CellReselectionPriority and remains in RRC\_INACTIVE state }

}

6.4.2.3.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.304, clause 5.2.4.11. Unless otherwise stated these are Rel-17 requirements.

[TS 38.304, clause 5.2.4.11]

The UE derives reselection priorities for slice-based cell reselection by using:

- NSAGs and their priorities provided by NAS,

- *sliceInfoList* and or *sliceInfoListDedicated* per frequency with *nsag-CellReselectionPriority* per NSAG, if provided in system information and/or dedicated signalling,

- *cellReselectionPriority* per frequency provided in system information and/or dedicated signalling.

The UE considers an NR frequency to support all slices of an NSAG if

- the nsag-ID and TA of the NSAG as provided by NAS are indicated for the NR frequency (see TS 38.331).

The UE considers a cell on an NR frequency to support all slices of an NSAG if

*-* the nsag-ID and TA of the NSAG as provided by NAS are indicated for the NR frequency (see TS 38.331); and

- the cell is either listed in the *sliceAllowedCellListNR* (if provided in the used slice-based cell reselection information) or the cell is not listed in the *sliceExcludedCellListNR* (if provided in the used slice-based cell reselection information); or

- Neither *sliceAllowedCellListNR* nor *sliceExcludedCellListNR* is configured in the used slice-based cell reselection information

The UE shall derive reselection priorities for slice-based cell reselection according to the following rules:

- Frequencies that support at least one prioritized NSAG received from NAS have higher reselection priority than frequencies that support none of the NSAG(s) received from NAS.

- Frequencies that support at least one NSAG provided by NAS are prioritised in the order of the NAS-provided priority for the NSAG with highest priority supported on the frequency.

- Among the frequencies (one or multiple) that support the highest prioritised NSAG(s) with the same NAS-provided priorities, the frequencies are prioritized in the order of their highest *nsag-CellReselectionPriority* given for these NSAG(s). If no nsag-CellReselectionPriority is given for a NSAG at a frequency, the lowest priority value is used (i.e, lower than any of the network configured values for these frequencies).

- Frequencies that support none of the NSAG(s) provided by NAS are prioritized in the order of their *cellReselectionPriority*;

For a UE performing slice-based cell reselection, if the highest ranked cell or best cell in a frequency fulfils the inter- frequency cell reselection criteria (see clause 5.2.4.5) based on reselection priority for the frequency and NSAG derived according to this clause or fulfils intra-frequency and equal priority inter-frequency cell reselection criteria (see clause 5.2.4.6), but this cell does not support the NSAG according to this clause,

- if this cell supports any other NSAG(s) according to this clause, the UE shall re-derive a reselection priority for the frequency by considering the NSAG(s) supported by this cell (rather than those of the corresponding NR frequency)

- Otherwise, the UE shall re-derive a reselection priority for the frequency as if none of the NSAG(s) provided by NAS is supported.

This re-derived reselection priority is used for a maximum of 300 seconds, or until new information of NSAG(s) and their priorities are received from NAS. UE shall ensure the cell reselection criteria above are fulfilled based on the newly derived priorities.

6.4.2.3.3 Test description

6.4.2.3.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- System information combination NR-30 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None

Preamble:

- The UE is in state Switched OFF (state 0N-B) according to TS 38.508-1 [4].

6.4.2.3.3.2 Test procedure sequence

Table 6.4.2.3.3.2-1 for FR1 and Table 6.4.2.3.3.2-2 for FR2 illustrate the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1" and "T2" are applied at the points indicated in the Main behaviour description in Table 6.4.2.3.3.2-3.

Table 6.4.2.3.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -88 | -78 | The power level values are assigned to satisfy RNR Cell 3 < RNR Cell 6. |
| Note: Power level “Off” is defined in TS38.508-1 [4] Table 6.2.2.1-3. | | | | | | |

Table 6.4.2.3.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 6 | Remark |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | FFS | Off | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -91 | FFS | The power level values are assigned to satisfy RNR Cell 3 < RNR Cell 6. |

Table 6.4.2.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The UE is switched on. | - | - | - | - |
| 2-13 | Steps 2 to 13 of the generic procedure for NR RRC\_INACTIVE specified in TS 38.508-1 subclause 4.5.3 are performed. | - | - | - | - |
| 14 | The SS transmits a REGISTRATION ACCEPT message | <-- | REGISTRATION ACCEPT | - | - |
| 15-20 | Steps 15 to 20 of the generic procedure for NR RRC\_INACTIVE specified in TS 38.508-1 subclause 4.5.3 are performed. | - | - | - | - |
| 21 | The SS changes NR Cell 3 and NR Cell 6 SSS levels according to the row "T1" in table 6.4.2.3.3.2-1/2. | - | - | - | - |
| 22 | Void | - | - | - | - |
| 23 | Check: Does the UE transmit an *RRCResumeRequest* message on NR Cell 3? | --> | NR RRC: *RRCResumeRequest* | 1 | P |
| 23A | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 23B | The UE transmit an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 24 | The SS transmits an *RRCRelease* message including *suspendConfig* with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |
| 25 | The SS changes NR Cell 1 and NR Cell 6 SSS levels according to the row "T2" in table 6.4.2.3.3.2-1/2. | - | - | - | - |
| 26 | Void | - | - | - | - |
| 27 | Check: Does the UE transmit an *RRCResumeRequest* message on NR Cell 6? | --> | NR RRC: *RRCResumeRequest* | 2 | P |
| 27A | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 27B | The UE transmit an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 28 | The SS transmits an *RRCRelease* message including suspendConfig with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* |  |  |

6.4.2.3.3.3 Specific message contents

Table 6.4.2.3.3.3.3-1: REGISTRATION ACCEPT(step 14, Table 6.4.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 4.7.1-7 | | | |
| Information Element | | Value/remark | Comment | Condition |
| NSAG information | |  |  |  |
| NSAG information IEI | |  |  |  |
| Length of NSAG information contents | | 2 entities |  |  |
| NSAG 1 | |  |  |  |
| Length of NSAG | | 1 entity |  |  |
| NSAG identifier | | ‘00000001’B |  |  |
| S-NSSAI list of NSAG | |  |  |  |
| Length of S-NSSAI list of NSAG | |  |  |  |
| S-NSSAI value 1 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000001’B | SST value 1 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| S-NSSAI value 2 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000010’B | SST value 2 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| NSAG priority | | ‘00000011’B |  |  |
| TAI list | | Not checked |  |  |
| NSAG 2 | |  |  |  |
| Length of NSAG | | 1 entity |  |  |
| NSAG identifier | | ‘00000010’B |  |  |
| S-NSSAI list of NSAG | |  |  |  |
| Length of S-NSSAI list of NSAG | |  |  |  |
| S-NSSAI value 1 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000011’B | SST value 3 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| S-NSSAI value 2 | |  |  |  |
| S-NSSAI IEI | |  |  |  |
| Length of S-NSSAI contents | | ‘00000001’B | SST |  |
| SST | | ‘00000100’B | SST value 4 |  |
| SD | | Not Present |  |  |
| Mapped HPLMN SST | | Not Present |  |  |
| Mapped HPLMN SD | | Not Present |  |  |
| NSAG priority | | ‘00000010’B |  |  |
| TAI list | | Not checked |  |  |

Table 6.4.2.3.3.3.3-2: *SIB16* for NR Cell 1(preamble and all steps, Table 6.4.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 1 entry |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000001’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 5 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.4.2.3.3.3.3-3: *SIB16* for NR Cell 3(preamble and all steps, Table 6.4.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 1 entry |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000010’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 4 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 6.4.2.3.3.3.3-4: *SIB16* for NR Cell 6(preamble and all steps, Table 6.4.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB16-r17 ::= SEQUENCE { | |  |  |  |
| freqPriorityListSlicing-r17 SEQUENCE (SIZE (1..maxFreqPlus1)) OF FreqPrioritySlicing-r17 { | | 1 entity |  |  |
| FreqPrioritySlicing-r17 SEQUENCE{ | |  | entry 1 |  |
| dl-ImplicitCarrierFreq-r17 | | 1 |  |  |
| sliceInfoList-r17 SEQUENCE (SIZE (1..maxSliceInfo-r17)) OF SliceInfo-r17 { | | 1 entry |  |  |
| SliceInfo-r17 SEQUENCE { | |  | entry 1 |  |
| nsag-IdentityInfo-r17 SEQUENCE { | |  |  |  |
| nsag-ID-r17 | | ‘00000010’B |  |  |
| trackingAreaCode-r17 | | Not present |  |  |
| } | |  |  |  |
| nsag-CellReselectionPriority-r17 | | 6 |  |  |
| nsag-CellReselectionSubPriority-r17 | | Not present |  |  |
| sliceCellListNR-r17 | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

### 6.4.3 Inter-RAT Cell Reselection

#### 6.4.3.1 Inter-RAT cell reselection From NR RRC\_INACTIVE to E-UTRA RRC\_IDLE (lower priority & higher priority, Srxlev based)

6.4.3.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** **that** {

**when** { UE detects the cell re-selection criteria are met for the neighbour cell which belongs to the higher priority E-UTRA frequency }

**then** { UE reselects to the E-UTRA cell and transitions to E-UTRA RRC\_IDLE State }

}

(2)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** **that** {

**when** { UE detects the cell re-selection criteria are met for the neighbour cell which belongs to the lower priority E-UTRA frequency }

**then** { UE reselects to the E-UTRA cell and transitions to E-UTRA RRC\_IDLE State }

}

6.4.3.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.304: clause 4.1, 5.2.4.1, 5.2.4.2 and 5.2.4.5. Unless otherwise stated these are Rel-15 requirements.

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

…

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of available PLMNs is given to the user so that a manual selection can be performed (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

When the UE is in RRC\_IDLE state, upper layers may deactivate AS layer when MICO mode is activated as specified in TS 24.501 [14]. When MICO mode is activated, the AS configuration (e.g. priorities provided by dedicated signalling) is kept and all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while MICO mode is activated it is up to the UE implementation whether it performs the corresponding action immediately or the latest when MICO mode is deactivated. When MICO mode is deactivated, the UE shall perform all idle mode tasks.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS (3GPP TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- a PLMN selection is performed on request by NAS (3GPP TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

[TS 38.304, clause 5.2.4.2]

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 38.133 [8].

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in sub-clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to section 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

6.4.3.1.3 Test description

6.4.3.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1.

- NR Cell 1 is configured to operate in FR1 bands as defined in TS 38.508-1 [4] clause 6.2.3.

- System information combination NR-6 as defined in TS 38.508-1 [4] Table 4.4.3.1.2-1 is used in NR cell.

- E-UTRA Cell 1 and E-UTRA Cell 3.

- System information combination 31 as defined in TS 36.508 [7] Table 4.4.3.1.1-1 is used in E-UTRA cell 1 and E-UTRA cell 3.

UE:

- None.

Preamble:

- With E-UTRA Cell 1 "Serving cell" and NR Cell 1 "Non-suitable "Off" cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state RRC\_IDLE using generic procedure parameters Connectivity (E-UTRA/EPC) and Unrestricted nr PDN (*On*) in accordance with the procedure described in TS 38.508-1 [4], clause 4.5.2. 4G GUTI and eKSI are assigned and security context established

- the UE is switched-off

- With E-UTRA Cell 1 "Non-suitable "Off" cell" and NR Cell 1 "Serving cell" in accordance with TS 38.508-1 [4], Table 6.2.2.1-3, the UE is brought to state 2N-A, RRC\_INACTIVE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4], Table 4.5.3.2-1. 5G-GUTI and ngKSI are assigned and security context established.

6.4.3.1.3.2 Test procedure sequence

Table 6.4.3.1.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the NR cells at various time instants of the test execution. The exact instants on which these values shall be applied are described in the texts in this clause. The configuration "T0" indicates the initial conditions. Subsequent configurations marked "T1" and "T2" are applied at the points indicated in the Main behaviour description in Table 6.4.3.1.3.2-3.

Table 6.4.3.1.3.2-1: Time instances of cell power level and parameter changes for conducted test environment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR  Cell 1 | E-UTRA Cell 1 | E-UTRA Cell 3 | Remark |
| T0 | Cell-specific RS EPRE | dBm/15kHz | - | Off | Off | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| SS/PBCH  SSS EPRE | dBm/SCS | -88 | - | - |
| T1 | Cell-specific RS EPRE | dBm/15kHz | - | -78 | Off | The power level values are assigned to satisfy SrxlevE-UTRA Cell 1 > ThreshE-UTRA Cell 1, HighP. |
| SS/PBCH  SSS EPRE | dBm/SCS | -88 | - | - |
| T2 | Cell-specific RS EPRE | dBm/15kHz | - | Off | -76 | The power level values are assigned to satisfy SrxlevNR Cell 1 < Threshserving, LowP, SrxlevE-UTRA Cell 3 > ThreshE-UTRA Cell 3, lowP, and SrxlevE-UTRA Cell 1 < 0. |
| SS/PBCH  SSS EPRE | dBm/SCS | -98 | - | - |
| Note 1: Power level “Off” of NR cell is defined in TS 38.508-1 [4] Table 6.2.2.1-3.  Note 2: Power level “Off” of E-UTRA cell is defined in TS 36.508 [7] Table 6.2.2.1-3. | | | | | | |

Table 6.4.3.1.3.2-2: Void

Table 6.4.3.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes E-UTRA Cell 1 SSS level according to the row "T1" in table 6.4.3.1.3.2-1. | - | - | - | - |
| 2 | Void | - | - | - | - |
| 3 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRA Cell 1? | - | - | 1 | P |
| 4 | The SS changes NR Cell 1 SSS levels according to the row "T0" in table 6.4.3.1.3.2-1. | - | - | - | - |
| 5 | Void | - | - | - | - |
| 6 | Steps of the generic test procedure in TS 38.508-1 [4] Table 4.9.9.2.2-1 are performed on NR Cell 1. | - | - | - | - |
| 7 | The SS transmits an *RRCRelease* message. | <-- | NR RRC: *RRCRelease* | - | - |
| 7A-7H | Steps 1-8 as defined in TS 38.508-1 [4] Table 4.5.4.2-3 | - | - | - | - |
| 7I | The SS transmits an *RRCRelease* message including *suspendConfig* with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |
| 8 | The SS changes NR Cell 1, E-UTRA Cell 1 and E-UTRA Cell 3 SSS level according to the row "T2" in table 6.4.3.1.3.2-1. | - | - | - | - |
| 9 | Void | - | - | - | - |
| 10 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.7.2.2-1 indicate that the UE is camped on E-UTRA Cell 3 with condition '*connected without release*'? | - | - | 2 | P |
| 11 | At the end of this test procedure sequence, the UE is in end state E-UTRA connected  (E2\_T3440) according to TS 36.508 [7]. | - | - | - | - |

6.4.3.1.3.3 Specific message contents

Table 6.4.3.1.3.3-1: *SIB2* of NR Cell 1 (preamble and all steps, Table 6.4.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 10 | 20 dB |  |
| cellReselectionPriority | 5 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.3.1.3.3-2: *SIB5* of NR Cell 1 (preamble and all steps, Table 6.4.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB5 ::= SEQUENCE { |  |  |  |
| carrierFreqListEUTRA SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA { | 2 entries |  |  |
| CarrierFreqEUTRA[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq | Same downlink ARFCN as used for E-UTRA Cell 1 |  |  |
| cellReselectionPriority | 6 |  |  |
| } |  |  |  |
| CarrierFreqEUTRA[2] SEQUENCE { |  | entry 2 |  |
| carrierFreq | Same downlink ARFCN as used for E-UTRA Cell 3 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.3.1.3.3-3: *SystemInformationBlockType24* for E-UTRA Cell 1 (preamble and all steps, Table 6.4.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 36.508 [7] table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink ARFCN as used for NR Cell 1 |  |  |
| cellReselectionPriority-r15 | 5 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.4.3.1.3.3-4: TRACKING AREA UPDATE REQUEST (Step 3, Table 6.4.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.7.2.3-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS update type |  |  |  |
| EPS update type Value | '010'B | Combined TA/LA updating with IMSI attach | combined\_TA\_LA |
| '000'B | TA updating | TA\_only |
| NOTE: The message shall be integrity protected using the 5GS security context available in the UE. | | | |

Table 6.4.3.1.3.3-5: TRACKING AREA UPDATE REQUEST (Step 10, Table 6.4.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.7.2.3-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS update type |  |  |  |
| EPS update type Value | '001'B | Combined TA/LA updating | combined\_TA\_LA |
| '000'B | TA updating | TA\_only |
| UE radio capability information update needed | Not Check | UE radio capability information update needed |  |
| NOTE: The message shall be integrity protected using the 5GS security context available in the UE. | | | |

|  |  |
| --- | --- |
| Condition | Explanation |
| TA\_only | This condition applies if the UE is configured to initiate EPS attach or if explicitly specified. |
| combined\_TA\_LA | This condition applies if the UE is configured to initiate combined EPS/IMSI attach or if explicitly specified. |

Table 6.4.3.1.3.3-6: REGISTRATION REQUEST (Step 6, Table 6.4.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-6. | | | |
| Information Element | Value/remark | Comment | Condition |
| EPS NAS message container | TRACKING AREA UPDATE REQUEST message | See Table 6.4.3.1.3.3-7 |  |

Table 6.4.3.1.3.3-7: TRACKING AREA UPDATE REQUEST (Table 6.4.3.1.3.3-6)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.9.9.2.3-2 with condition Mapped EPS security context |

Table 6.4.3.1.3.3-8: *SystemInformationBlockType24* for E-UTRA Cell 3 (preamble and all steps, Table 6.4.3.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 36.508 [7] table 4.4.3.3-20 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SystemInformationBlockType24-r15 ::= SEQUENCE { |  |  |  |
| carrierFreqListNR-r15 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreqNR-r15 { | 1 entry |  |  |
| CarrierFreqNR-r15[1] SEQUENCE { |  | entry 1 |  |
| carrierFreq-r15 | Same downlink ARFCN as used for NR Cell 1 |  |  |
| threshX-High-r15 | 10 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

## 6.5 SNPN and CAG Selection

### 6.5.1 SNPN Only Selection

#### 6.5.1.1 SNPN Selection in Manual Mode

6.5.1.1.1 Test Purpose (TP)

(1)

**with** { UE in Manual network/SNPN selection mode and an SNPN cell is available for which an entry does not exist in the "list of subscriber data" }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE does not indicate to the user any available SNPNs }

}

(2)

**with** { UE in Manual network/SNPN selection mode }

**ensure that** {

**when** { an SNPN cell is available for which an entry exists in the "list of subscriber data" }

**then** { UE indicates to the user that an SNPN is available and user selects the SNPN }

}

(3)

**with** { UE in Manual network/SNPN selection mode and has registered on an SNPN selected by the user }

**ensure that** {

**when** { an SNPN cell is available for which an entry exists in the "list of subscriber data" }

**then** { UE does not automatically register on the SNPN cell until the user selects automatic SNPN selection mode }

}

6.5.1.1.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122 clauses 4.9.3.1.0 and 4.9.3.1.2. Unless otherwise stated these are Rel-16 requirements.

[TS 23.122, clause 4.9.3.1.0]

At switch on, or following recovery from lack of coverage, the MS selects the registered SNPN (if it is available) using NG-RAN access technology and if necessary (in the case of recovery from lack of coverage, see subclause 4.5.2) attempts to perform an LR.

NOTE 1: The MS in automatic SNPN selection mode can end the SNPN search procedure once the registered SNPN is found on NG-RAN access technology.

NOTE 2: An MS in automatic SNPN selection mode can use location information to determine which SNPNs can be available in its present location.

If successful registration is achieved, the MS indicates the selected SNPN.

If there is no registered SNPN, or registration is not possible due to the SNPN being unavailable or registration failure, the MS follows the procedure in subclause 4.9.3.1.1 or subclause 4.9.3.1.2 depending on its SNPN selection mode. At switch on, the MS shall use the SNPN selection mode that was used before switching off.

NOTE 3: If successful registration is achieved, then the current serving SNPN becomes the registered SNPN and the MS does not store the previous registered SNPN for later use.

If registration is not possible on recovery from lack of coverage due to the registered SNPN being unavailable, an MS may, optionally, continue looking for the registered SNPN for an implementation dependent time.

NOTE 4: An MS registered to an SNPN should behave as described above only if one or more PDU sessions are currently active.

[TS 23.122, clause 4.9.3.1.2]

The MS indicates to the user one or more SNPNs, which are available and each of them is identified by an SNPN identity in an entry of the "list of subscriber data" in the ME. This includes SNPNs in the list of "permanently forbidden SNPNs", and the list of "temporarily forbidden SNPNs". The MS may indicate to the user whether the available SNPNs are present in the list of "temporarily forbidden SNPNs" or the list of "permanently forbidden SNPNs". The order in which those SNPNs are indicated is MS implementation specific.

For each of the SNPNs indicated to the user, the UE shall forward a human-readable network name along with the SNPN identity to the upper layers if the system information broadcasted for the SNPN includes the human-readable network name for the SNPN.

The MS shall limit its search for the SNPN to the NG-RAN access technology.

The user may select his desired SNPN and the MS then initiates registration on this SNPN using the NG-RAN access technology, the subscriber identifier and the credentials from an entry of the "list of subscriber data", with the SNPN identity matching the selected SNPN (this may take place at any time during the presentation of SNPNs).

Once the MS has registered on an SNPN selected by the user, the MS shall not automatically register on a different SNPN unless the user selects automatic SNPN selection mode.

NOTE: Emergency services are not supported in SNPN access mode.

If the user does not select an SNPN, the selected SNPN shall be the one that was selected either automatically or manually before the SNPN selection procedure started. If no such SNPN was selected or that SNPN is no longer available, then the MS shall attempt to camp on any acceptable cell and enter the limited service state.

6.5.1.1.3 Test description

6.5.1.1.3.1 Pre-test conditions

System Simulator:

- 3 SNPN cells: NR Cell 1, NR Cell 2, and NR Cell 4 are configured broadcasting default SNPN IDs as indicated in TS 38.508-1 [4] Table 4.4.2-4.

- System information combination NR-12 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- The UE is in Manual SNPN selection mode.

- The UE is provisioned with a “list of subscriber data” to allow access to SNPN identified by NR Cell 2 and NR Cell 4.

Preamble:

- Ensure that the UE has cleared the Registered SNPN and the UE is in state Switched OFF (state 0-A).

6.5.1.1.3.2 Test procedure sequence

Table 6.5.1.1.3.2-1/2 shows the cell configurations used during the test. Subsequent configurations marked “T1”, “T2” “T3” “T4”etc are applied at the points indicated in the Main behaviour description in Table 6.5.1.1.3.2-3. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.5.1.1.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **NR Cell 4** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | “Off” | “Off” |  |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | “Off” |  |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | -78 |  |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | “Off” | -78 |  |

Table 6.5.1.1.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **NR Cell 4** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -91 | “Off” |  |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -91 | ”Off” |  |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -91 | -82 |  |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | ”Off” | -82 |  |

Table 6.5.1.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts cell levels according to row T1 of table 6.5.1.1.3.2-1/2. | - | - | - | - |
| 2 | The UE is Switched ON. | - | - | - | - |
| 3 | Manual selection of SNPN identified by NR Cell 1 is performed (NOTE 1). | - | - | - | - |
| 4 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 1 within the next 60 s? | --> | *RRCSetupRequest* | 1 | F |
| 5 | SS adjusts cell levels according to row T2 of table 6.5.1.1.3.2-1/2. | - | - | - | - |
| 6 | Manual selection of SNPN identified by NR Cell 2 is performed (NOTE 1). | - | - | - | - |
| 7 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 2? | --> | *RRCSetupRequest* | 2 | P |
| 8-25 | Steps 3 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 are performed on NR Cell 2. | - | - | - | - |
| 26 | SS adjusts cell levels according to row T3 of table 6.5.1.1.3.2-1/2. | - | - | - | - |
| 27 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 4 within the next 60 s? | --> | *RRCSetupRequest* | 3 | F |
| 28 | SS adjusts cell levels according to row T4 of table 6.5.1.1.3.2-1/2 | - | - | - | - |
| 29 | The user sets the UE in Automatic SNPN/Network selection mode (NOTE 1). | - | - | - | - |
| 30 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 4? | --> | *RRCSetupRequest* | 3 | P |
| 31-47 | Steps 3 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 are performed on NR Cell 4. | - | - | - | - |
| NOTE 1: This is performed via MMI or AT command. | | | | | |

6.5.1.1.3.3 Specific message contents

Table 6.5.1.1.3.3-1: REGISTRATION REQUEST (step 9, 32 Table 6.5.1.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 Table 4.7.1-6 | | | |
| Information Element | | Value/remark | Comment | Condition |
| 5GS registration type value | | ‘001’B | Initial registration |  |

#### 6.5.1.2 SNPN Selection in Automatic Mode

6.5.1.2.1 Test Purpose (TP)

(1)

**with** { UE in Automatic SNPN selection mode and SNPN cell is available for which an entry does not exist in the "list of subscriber data" }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE does not select the SNPN cell and continues searching for an allowable SNPN Cell }

}

(2)

**with** { UE in Automatic SNPN selection mode and a Registered SNPN cell along with another better ranked allowable SNPN cell becomes available }

**ensure that** {

**when** { UE is switched on or return to coverage }

**then** { UE selects the Registered SNPN cell and UE attempts a Registration on the selected cell }

}

(3)

**with** { UE in Automatic SNPN selection mode and Registration on a SNPN cell is unsuccessful}

ensure that {

**when** { UE continues searching for an allowable SNPN Cell and a new allowable SNPN cell becomes available }

**then** { the UE registers on the new SNPN cell }

}

6.5.1.2.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122 clauses 4.9.3.1.0 and 4.9.3.1.1. Unless otherwise stated these are Rel-16 requirements.

[TS 23.122, clause 4.9.3.1.0]

At switch on, or following recovery from lack of coverage, the MS selects the registered SNPN (if it is available) using NG-RAN access technology and if necessary (in the case of recovery from lack of coverage, see subclause 4.5.2) attempts to perform an LR.

NOTE 1: The MS in automatic SNPN selection mode can end the SNPN search procedure once the registered SNPN is found on NG-RAN access technology.

NOTE 2: An MS in automatic SNPN selection mode can use location information to determine which SNPNs can be available in its present location.

If successful registration is achieved, the MS indicates the selected SNPN.

If there is no registered SNPN, or registration is not possible due to the SNPN being unavailable or registration failure, the MS follows the procedure in subclause 4.9.3.1.1 or subclause 4.9.3.1.2 depending on its SNPN selection mode. At switch on, the MS shall use the SNPN selection mode that was used before switching off.

NOTE 3: If successful registration is achieved, then the current serving SNPN becomes the registered SNPN and the MS does not store the previous registered SNPN for later use.

If registration is not possible on recovery from lack of coverage due to the registered SNPN being unavailable, an MS may, optionally, continue looking for the registered SNPN for an implementation dependent time.

NOTE 4: An MS registered to an SNPN should behave as described above only if one or more PDU sessions are currently active.

[TS 23.122, clause 4.9.3.1.0]

The MS selects another SNPN, if available, allowable, and identified by an SNPN identity in an entry of the "list of subscriber data" in the ME. If more than one SNPN are available, allowable, and each of them is identified by an SNPN identity in an entry of the "list of subscriber data" in the ME, how the MS selects one of those SNPNs is MS implementation specific.

The MS shall limit its search for the SNPN to the NG-RAN access technology.

Once the MS selects the SNPN, the MS attempts registrations on the selected SNPN using the NG-RAN access technology, the subscriber identifier and the credentials from an entry of the "list of subscriber data" with the SNPN identity matching the selected SNPN.

If successful registration is achieved, the MS indicates the selected SNPN.

If registration cannot be achieved because no SNPNs are available, allowable, and identified by an SNPN identity in an entry of the "list of subscriber data" in the ME, the MS indicates "no service" to the user, waits until a new SNPN is available, allowable, and identified by an SNPN identity in an entry of the "list of subscriber data" in the ME and then repeats the procedure.

If there were one or more SNPNs which were available, allowable, and identified by an SNPN identity in an entry of the "list of subscriber data" in the ME but an LR failure made registration on those SNPNs unsuccessful, the MS selects one of those SNPNs again and enters a limited service state.

6.5.1.2.3 Test description

6.5.1.2.3.1 Pre-test conditions

System Simulator:

- 3 SNPN cells NR Cell 1, NR cell 2, NR Cell 3 are configured broadcasting default SNPN IDs as indicated in TS 38.508-1 [4] Table 4.4.2-4.

- System information combination NR-12 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- The UE is in Automatic SNPN selection mode.

- The UE is provisioned with a “list of subscriber data” to allow access to SNPN identified by NR cell 1 and NR cell 3.

Preamble:

- Ensure that the UE has cleared the Registered SNPN. And the UE is in state Switched OFF (state 0-A).

6.5.1.2.3.2 Test procedure sequence

Table 6.5.1.2.3.2-1/2 shows the cell configurations used during the test. Subsequent configurations marked “T1”, “T2” and “T3” are applied at the points indicated in the Main behaviour description in Table 6.5.1.2.3.2-3. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.5.1.2.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **NR Cell 3** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -88 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | “Off” | -78 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |

Table 6.5.1.2.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **NR Cell 3** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | “Off” | -91 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -91 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | -91 | “Off” | -82 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |

Table 6.5.1.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts cell levels according to row T1 of table 6.5.1.2.3.2-1/2. | - | - | - | - |
| 2 | Power on the UE. | - | - | - | - |
| 3 | Check: Does the UE transmit an *RRCSetupRequest* on NR Cell 2 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 4 | SS adjusts cell levels according to row T2 of table 6.5.1.2.3.2-1/2. | - | - | - | - |
| 5 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 6-23 | Steps 3 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 1 with ‘*connected without release’*. | - | - | - | - |
| 24 | The UE is switched off by executing generic procedure in Table 4.9.6.3-1 in TS 38.508-1 [4] | - | - | - | - |
| 25 | SS adjusts cell levels according to row T3 of table 6.5.1.2.3.2-1/2. | - | - | - | - |
| 26 | The UE is Switched ON. | - | - | - | - |
| 27 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 28-34 | Steps 3-9 of Table 4.5.2.2-2 in TS38.508-1 [4] are performed on NR Cell 1. | - | - | - | - |
| 35 | The SS transmits a REGISTRATION REJECT with cause #75 (Permanently not authorized for this SNPN). | <-- | NR RRC: *DLInformationTransfer*  5GMM: REGISTRATION REJECT | - | - |
| 36 | The SS releases the RRC connection | - | - | - | - |
| 37 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 3? | --> | NR RRC: *RRCSetupRequest* | 3 | P |
| 38-55 | Steps 3 to 20a1 of Table 4.5.2.2-2 of the generic procedure inTS 38.508-1 [4] are performed on NR Cell 3. | - | - | - | - |
| 56 | The generic test procedure in TS 38.508-1 Table 4.9.6.1-1 of Switch off procedure in RRC\_IDLE are performed. | - | - | - | - |
| 57 | The SS configures:  - NR Cell 1 as the "Serving cell"  - NR Cell 3 as a "Non-Suitable "off" cell ". |  |  |  |  |
| 58 | The UE is brought back to operation or the USIM is inserted. The UE is powered on or switched on. | - | - | - | - |
| 59 | The UE is made to perform manual SNPN search and select SNPN identified by NR Cell 1 (Note 1, Note 2). | - | - | - | - |
| 60-78a1 | Steps 2 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2 are performed on NR Cell 1. | - | - | - | - |
| 79 | The user sets the UE in Automatic SNPN/Network selection mode (Note 1). | - | - | - | - |
| Note 1: This is performed via MMI or AT command.  Note 2: Step 59 is to ensure that UE clears NR Cell 1 from the "permanently forbidden SNPNs" list for the next test case. | | | | | |

6.5.1.2.3.3 Specific message contents

Table 6.5.1.2.3.3-1: REGISTRATION REJECT for NR Cell 1 (step 35 Table 6.5.1.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.7.1-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| 5GMM cause | ‘01001011’B | #75 (Permanently not authorized for this SNPN). |  |

Table 6.5.1.2.3.3-2: REGISTRATION REQUEST (step 39, Table 6.5.1.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 Table 4.7.1-6 | | | |
| Information Element | | Value/remark | Comment | Condition |
| 5GS registration type value | | ‘001’B | Initial registration |  |

#### 6.5.1.3 SNPN / User Reselection in Automatic Mode

6.5.1.3.1 Test Purpose (TP)

(1)

**with** { UE in Automatic SNPN selection mode and registered on an SNPN cell for which an entry exists in the "list of subscriber data" and another SNPN cell is made available for which an entry exists in the "list of subscriber data" }

**ensure that** {

**when** { UE is requested to initiate reselection and registration onto an available SNPN }

**then** { UE reselects to the SNPN cell }

}

6.5.1.3.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 23.122 clauses 4.9.3.2.0 and 4.9.3.2.1. Unless otherwise stated these are Rel-16 requirements.

[TS 23.122, clause 4.9.3.2.0]

At any time the user may request the MS to initiate reselection and registration onto an available SNPN, according to the following procedures, dependent upon the SNPN selection mode of the UE.

[TS 23.122, clause 4.9.3.2.1]

The MS selects an SNPN, if available, allowable, and identified by an SNPN identity in an entry of the "list of subscriber data" in the ME in accordance with the following order:

i) an SNPN, which is available and identified by an SNPN identity in an entry of the "list of subscriber data" in the ME, excluding the previously selected SNPN. If more than one SNPN different from the previously selected SNPN are available, allowable, and each of them is identified by an SNPN identity in an entry of the "list of subscriber data" in the ME, how the MS selects one of those SNPNs is MS implementation specific.

ii) the previously selected SNPN.

The MS shall limit its search for the SNPN to the NG-RAN access technology.

The previously selected SNPN is the SNPN which the MS has selected prior to the start of the user reselection procedure.

Once the MS selects an SNPN, if the selected SNPN is other than the previously selected SNPN, the MS attempts registrations on the selected SNPN using the NG-RAN access technology, the subscriber identifier and the credentials from an entry of the "list of subscriber data" with the SNPN identity matching the selected SNPN.

NOTE: If the previously selected SNPN is selected, and registration has not been attempted on any other SNPNs, then the MS is already registered on the SNPN, and so registration is not necessary.

6.5.1.3.3 Test description

6.5.1.3.3.1 Pre-test conditions

System Simulator:

- 2 SNPN cells NR Cell 1, NR Cell 2 are configured broadcasting default SNPN IDs as indicated in TS 38.508-1 [4] Table 4.4.2-4.

- System information combination NR-12 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- The UE is in Automatic SNPN selection mode.

- The UE is provisioned with a “list of subscriber data” to allow access to SNPN identified by NR cell 1 and NR cell 2.

Preamble:

- Ensure that the UE has cleared the Registered SNPN. And the UE is in state Switched OFF (state 0-B).

6.5.1.3.3.2 Test procedure sequence

Table 6.5.1.3.3.2-1/2 shows the cell configurations used during the test. Subsequent configurations marked “T1” and “T2” are applied at the points indicated in the Main behaviour description in Table 6.5.1.3.3.2-3. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.5.1.3.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |

Table 6.5.1.3.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remarks** |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | -82 | “Off” | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -82 | Power level “Off” is defined in TS 38.508-1 [4] Table 6.2.2.1-3. |

Table 6.5.1.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS adjusts cell levels according to row T1 of table 6.5.1.3.3.2-1/2. | - | - | - | - |
| 2 | Power on the UE. | - | - | - | - |
| 3-22 | Steps 1 to 20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 1 with ‘*connected without release’*. | - | - | - | - |
| 23 | SS adjusts cell levels according to row T2 of table 6.5.1.3.3.2-1/2. | - | - | - | - |
| 24 | Cause the UE in Automatic network selection mode to initiate user reselection and registration onto an available SNPN identified by NR cell 2. (Note 1) | - | - | - | - |
| 25 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 2? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 26-43a1 | Steps 3 to 20a1 of the generic test procedure in TS 38.508-1 Table 4.5.2.2-2 are performed on NR Cell 2. (Note 2) | - | - | - | - |
| Note 1: MMI command “TRIGGER\_USER\_RESELECTION” to be used. AT command AT+COPS is not suitable to achieve the test purpose.  Note 2: The 5GS registration type shall be only set as ‘Initial Registration’ according to TS 24.501 subclause 5.2.3.2.5 specified in Release 16. | | | | | |

6.5.1.3.3.3 Specific message contents

Table 6.5.1.3.3.3-1: REGISTRATION REQUEST (step 27, Table 6.5.1.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 Table 4.7.1-6 | | | |
| Information Element | | Value/remark | Comment | Condition |
| 5GS registration type value | | ‘001’B | Initial registration |  |

### 6.5.2 CAG (Closed Access Group)

#### 6.5.2.1 CAG Selection in Manual Mode

6.5.2.1.1 Test Purpose (TP)

(1)

**with** { UE in Manual network selection mode and provided with CAG information list }

**ensure that** {

**when** { there exists an entry with the PLMN ID of the PLMN in the "CAG information list" and the CAG-ID is included in the "Allowed CAG list" }

**then** { UE manually selects the CAG cell }

}

(2)

**with** { UE in Manual network selection mode and PLMN ID of the PLMN in the "CAG information list" and the CAG-ID are not included in the "Allowed CAG list" }

**ensure that** {

**when** { the available CAG cell broadcasts that the PLMN allows a user to manually select the CAG-ID }

**then** { UE manually selects the CAG cell that is outside the UE's Allowed CAG list }

}

(3)

**with** { UE in Manual network selection mode }

**ensure** that {

**when** { there exists an entry for the presented PLMN in the "CAG information list" and the entry includes an "indication that the MS is only allowed to access 5GS via CAG cells" }

**then** { UE manually selects the CAG cell }

}

6.5.2.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122, clause 4.4.3.1.2. Unless otherwise stated these are Rel-16 requirements.

[TS 23.122, clause 4.4.3.1.2]

The MS indicates whether there are any PLMNs, which are available using all supported access technologies. This includes PLMNs in the "forbidden PLMNs" list, "forbidden PLMNs for GPRS service" list and PLMNs which only offer services not supported by the MS. An MS which supports GSM COMPACT shall also indicate GSM COMPACT PLMNs (which use PBCCH).

If displayed, PLMNs meeting the criteria above are presented in the following order:

i)- either the HPLMN (if the EHPLMN list is not present or is empty) or, if one or more of the EHPLMNs are available then based on an optional data field on the SIM either only the highest priority available EHPLMN is to be presented to the user or all available EHPLMNs are presented to the user in priority order. If the data field is not present on the SIM, then only the highest priority available EHPLMN is presented;

ii)- PLMN/access technology combinations contained in the " User Controlled PLMN Selector with Access Technology " data file in the SIM (in priority order);

iii)- PLMN/access technology combinations contained in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order) or stored in the ME (in priority order);

iv)- other PLMN/access technology combinations with received high quality signal in random order;

v)- other PLMN/access technology combinations in order of decreasing signal quality.

…

In i to v, if the MS supports CAG, for each PLMN/access technology combination of NG-RAN access technology, the MS shall present to the user:

a) the PLMN/access technology combination and a list of CAG-IDs composed of one or more CAG-IDs such that for each CAG-ID:

1) there is an available CAG cell which broadcasts the CAG-ID for the PLMN; and

2) the following is true:

i) there exists an entry with the PLMN ID of the PLMN in the "CAG information list" and the CAG-ID is included in the "Allowed CAG list" of the entry; or

ii) the available CAG cell broadcasting the CAG-ID for the PLMN also broadcasts that the PLMN allows a user to manually select the CAG-ID.

For each of the presented CAG-ID, the MS may indicate to the user whether the CAG-ID is present in the "Allowed CAG list" stored in the UE; and

b) the PLMN/access technology combination without a list of CAG-IDs, if there is an available NG-RAN cell which is not a CAG cell for the PLMN. If there exists an entry for the presented PLMN in the "CAG information list" and the entry includes an "indication that the MS is only allowed to access 5GS via CAG cells", the MS may indicate to the user that the MS is only allowed to access the PLMN via CAG cells.

6.5.2.1.3 Test description

6.5.2.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 4.

- NR Cell 2 and NR Cell 4 are CAG cells.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used for NR Cell 1, NR Cell 2 and NR Cell 4.

- The PLMNs are identified in the test by the identifiers in Table 6.5.2.1.3.1-1 and the PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.5.2.1.3.1–1: PLMN and CAG identifiers

|  |  |  |
| --- | --- | --- |
| NR Cell | PLMN name | CAG IDs |
| 1 | PLMN 1 | - |
| 2 | PLMN 3 | 1 |
| 4 | PLMN 2 | 2 |

UE:

None.

Preamble:

- The UE is registered on NR Cell 1 using the procedure described in TS 38.508-1 [4] clause 4.5.2.2 except that the REGISTRATION ACCEPT message includes CAG information list with CAG-ID 1.

- The UE is set to Manual PLMN selection mode before it is in state Switched OFF (State 0N-B) as per TS 38.508-1 [4] Table 4.4A.2-0.

6.5.2.1.3.2 Test procedure sequence

Table 6.5.2.1.3.2-1 for FR1 and Table 6.5.2.1.3.2-2 for FR2 illustrate the downlink power to be applied for the cells at various time instants of the test execution. The configuration T0 indicates the initial conditions for preamble. Configurations marked "T1", "T2" and "T3"are applied at the points indicated in the Main behaviour description in Table 6.5.2.1.3.2-3.

Table 6.5.2.1.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **NR Cell 4** | **Remarks** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | "Off" | Power level "Off" is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | "Off" | Power level "Off" is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | -88 | Power level "Off" is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | ”Off” | -88 | "Off" | Power level "Off" is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -115 | "Off" | Power level "Off" is defined in TS 38.508-1 [4] Table 6.2.2.1-3 |

Table 6.5.2.1.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **NR Cell 4** | **Remarks** |
| **T0** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS |  |
| **T1** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS |  |
| **T2** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS |  |
| **T3** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS |  |
| **T4** | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | FFS |  |

Table 6.5.2.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes cell power levels according to row "T1" in Table 6.5.2.1.3.2-1 for FR1 and Table 6.5.2.1.3.2-2 for FR2. | - | - | - | - |
| 2 | The UE is switched on. | - | - | - | - |
| 3 | The UE is made to perform manual CAG selection and selects NR Cell 2. | - | - | - | - |
| 4 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 2? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 5-22 | Steps 3-20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 2.  Note: The UE performs initial registration procedure with REGISTRATION ACCEPT message including CAG information list with PLMN ID 2 and CAG only indication and the RRC connection is released. | - | - | - | - |
| 23 | The SS changes cell power levels according to row "T2" in Table 6.5.2.1.3.2-1 for FR1 and Table 6.5.2.1.3.2-2 for FR2. | - | - | - | - |
| 24 | The UE is made to perform manual CAG selection and select NR Cell 4. | - | *-* | - | - |
| 25 | Void | - | - | - | - |
| 26-27A | Steps 1 to 3 of the test procedure to check that UE is camped on a new cell belonging to a new TA as specified in TS 38.508-1 [4] subclause 4.9.5 are performed on NR Cell 4. | - | - | 2 | P |
| 28-36 | Void | - | - | - | - |
| 37 | The SS transmits a *DLInformationTransfer* message and a REGISTRATION ACCEPT message. | <-- | NR RRC: *DLInformationTransfer*  5GMM: REGISTRATION ACCEPT | - | - |
| 38-39 | Steps 5 to 6a1 of the test procedure to check that UE is camped on a new cell belonging to a new TA as specified in TS 38.508-1 [4] subclause 4.9.5 are performed on NR Cell 4. | - | - | - | - |
| 40-43 | Void | - | - | - | - |
| 44 | Void | - | - | - | - |
| 45 | Void | - | - | - | - |
| 46 | Void | - | - | - | - |
| 46A | The SS changes cell power levels according to row "T3" in Table 6.5.2.1.3.2-1 for FR1 and Table 6.5.2.1.3.2-2 for FR2. | - | - | - | - |
| 47 | The UE is made to perform manual CAG selection and select NR Cell 2. | - | - | - | - |
| 48 | Void | - | - | - | - |
| 49-53A | Steps 1-6a1 of the test procedure to check that UE is camped on a new cell belonging to a new TA as specified in TS 38.508-1 [4] subclause 4.9.5 are performed on NR Cell 2. | - | *-* | 3 | P |
| 54 | The SS changes cell power levels according to row "T4" in Table 6.5.2.1.3.2-1 for FR1 and Table 6.5.2.1.3.2-2 for FR2. | - | *-* | - | - |
| 55 | The user sets the UE in Automatic PLMN selection mode. | - | *-* | - | - |
| 56 | The UE performs the Registration procedure for mobility registration update as specified in TS 38.508-1 [4] subclause 4.9.5 on NR Cell 1. | - | *-* | - | - |

6.5.2.1.3.3 Specific message contents

Table 6.5.2.1.3.3-1: REGISTRATION REQUEST (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.7.1-6 | | | |
| Information Element | Value/Remark | Comment | Condition |
| 5GS registration type |  |  |  |
| 5GS registration type value | '001'B | Initial registration |  |
| 5GMM capability |  |  |  |
| CAG | ‘1’B | CAG supported |  |

Table 6.5.2.1.3.3-2: REGISTRATION ACCEPT (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  | MCC : 003; MNC : 21; CAG only : 0;  CAG-ID 1 : 1 |  |
| Length of CAG information list contents | ‘0000 0000 0000 1001’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1000’B |  |  |
| MCC | MCC of NR Cell 2 | See Table 6.5.2.1.3.1–1 |  |
| MNC | MNC of NR Cell 2 | See Table 6.5.2.1.3.1–1 |  |
| CAG only | ‘0’B |  |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |

Table 6.5.2.1.3.3-3: REGISTRATION ACCEPT (Step 16, Table 6.5.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  | MCC : 003; MNC : 21; CAG only : 1;  CAG-ID 1 : 1 |  |
| Length of CAG information list contents | ‘0000 0000 0000 1001’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1000’B |  |  |
| MCC | MCC of NR Cell 2 | See Table 6.5.2.1.3.1–1 |  |
| MNC | MNC of NR Cell 2 | See Table 6.5.2.1.3.1–1 |  |
| CAG only | ‘1’B |  |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |

Table 6.5.2.1.3.3-4: SIB1 for NR Cell 4 (all steps in T2, Table 6.5.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 002 | PLMN2 MCC |  |
| mnc | 11 | PLMN2 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entr 1 |  |
| cag-Identity-r16 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| manualCAGselectionAllowed-r16 | true |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 4 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 4 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.1.3.3-5: SIB1 for NR Cell 2 (all steps in Table 6.5.2.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 003 | PLMN3 MCC |  |
| mnc | 21 | PLMN3 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-Identity-r16 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| manualCAGselectionAllowed-r16 | true |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 2 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 2 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.5.2.2 CAG Selection in Automatic Mode

6.5.2.2.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode and provisioned with an empty "CAG information list” }

**ensure that** {

**when** { UE is switched on or returned to coverage, and a cell which is not a CAG cell becomes available }

**then** { UE selects the cell }

}

(2)

**with** { UE in Automatic network selection mode provisioned with a "CAG information list” }

**ensure that** {

**when** { UE is switched on or returned to coverage, and a CAG cell with a CAG-ID present in the "Allowed CAG list" becomes available }

**then** { UE selects the CAG cell }

}

(3)

**with** { UE in Automatic network selection mode provisioned with a "CAG information list” }

**ensure that** {

**when** { UE is switched on and a cell which is not a CAG cell becomes available, and there is an entry with the PLMN ID of the PLMN in the "CAG information list" but the "indication that the MS is only allowed to access 5GS via CAG cells" is not included in the entry }

**then** { UE selects the cell }

}

6.5.2.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clauses 3.8, and 4.4.3.1.1. Unless otherwise stated these are Rel-16 requirements.

[TS 23.122, clause 3.8]

The MS may support CAG.

If the MS supports CAG, the MS can be provisioned with a "CAG information list", consisting of zero or more entries, each containing:

a) a PLMN ID;

b) an "Allowed CAG list". The "Allowed CAG list" contains zero or more CAG-IDs; and

c) an optional "indication that the MS is only allowed to access 5GS via CAG cells".

The "CAG information list" is stored in the ME.

NOTE: When the UE is registering or registered to a PLMN other than the HPLMN or EHPLMN, then the HPLMN will send a "CAG information list" consisting of CAG subscription information related to the serving PLMN only. When the UE is registering or registered to the HPLMN or EHPLMN then the HPLMN or EHPLMN can send CAG subscription information related to any PLMN in the "CAG information list".

If the MS supports CAG and a PLMN is selected as described in subclause 4.4.3.1.1, the automatic CAG selection is performed as part of subclause 4.4.3.1.1.

If the MS supports CAG and a PLMN is selected as described in subclause 4.4.3.1.2, the manual CAG selection is performed as part of subclause 4.4.3.1.2.

The NAS shall provide the AS with a "CAG information list", if available. If the contents of the "CAG information list" have changed, the NAS shall provide an updated "CAG information list" to the AS.

[TS 23.122, clause 4.4.3.1.1]

The MS selects and attempts registration on other PLMN/access technology combinations, if available and allowable, in the following order:

i) either the HPLMN (if the EHPLMN list is not present or is empty) or the highest priority EHPLMN that is available (if the EHPLMN list is present) ;

ii) each PLMN/access technology combination in the "User Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order);

iii) each PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" data file in the SIM (in priority order) or stored in the ME (in priority order);

iv) other PLMN/access technology combinations with received high quality signal in random order;

v) other PLMN/access technology combinations in order of decreasing signal quality.

When following the above procedure the following requirements apply:

…

m) In i to v, if the MS supports CAG and:

1) is provisioned with a non-empty "CAG information list", the MS shall consider a PLMN indicated by an NG-RAN cell only if:

A) the cell is a CAG cell and broadcasts a CAG-ID for the PLMN such that there exists an entry with the PLMN ID of the PLMN in the "CAG information list" and the CAG-ID is included in the "Allowed CAG list" of the entry; or

B) the cell is not a CAG cell and:

- there is no entry with the PLMN ID of the PLMN in the "CAG information list"; or

- there exists an entry with the PLMN ID of the PLMN in the "CAG information list" but the "indication that the MS is only allowed to access 5GS via CAG cells" is not included in the entry; or

2) is provisioned with an empty "CAG information list" or is not provisioned with a "CAG information list", the MS shall consider a PLMN indicated by an NG-RAN cell only if the cell is not a CAG cell.

n) In i to v, if the MS only supports control plane CIoT 5GS optimization (see 3GPP TS 23.501 [62]) and the MS camps on an E-UTRA cell connected to 5GCN, which is not NB-IoT cell (see 3GPP TS 36.304 [43], 3GPP TS 36.331 [22]), the MS shall not consider PLMNs which do not advertise support of 5GS services with control plane CIoT 5GS optimization.

o) In i to v, if the MS supports CIoT 5GS optimizations, the MS shall not consider the PLMN/access technology combinations for which the MS preferred CIoT network behaviour is not advertised as supported by the PLMN/access technology combination (see 3GPP TS 24.501 [64]).

NOTE 7: As an implementation option, the MS supporting CIoT 5GS optimizations that was not able to select any PLMN according to o) can perform a second iteration of i to v with no restriction.

p) In iii, the MS shall use the PLMN/access technology combination in the "Operator Controlled PLMN Selector with Access Technology" stored in the ME, if the last received steering of roaming information contains the "list of preferred PLMN/access technology combinations"(see annex C) and is stored in the ME. Otherwise, the MS shall use the "Operator Controlled PLMN Selector with Access Technology" list retrieved from the SIM.

If successful registration is achieved, the MS indicates the selected PLMN.

If registration cannot be achieved because no PLMNs are available and allowable, and the MS does not support access to RLOS, the MS indicates "no service" to the user, waits until a new PLMN is available and allowable and then repeats the procedure.

If there were one or more PLMNs which were available and allowable, but an LR failure made registration on those PLMNs unsuccessful or an entry in any of the lists "forbidden location areas for roaming", "forbidden tracking areas for roaming", "5GS forbidden tracking areas for roaming", "forbidden location areas for regional provision of service", "forbidden tracking areas for regional provision of service", "5GS forbidden tracking areas for regional provision of service", or "CAG information list" prevented a registration attempt, the MS selects the first such PLMN again and enters a limited service state.

…

6.5.2.2.3 Test description

6.5.2.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2, NR Cell 4 and NR Cell 11.

- NR Cell 2 and NR Cell 4 are CAG cells.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used for NR Cell 1, NR Cell 2, NR Cell 4 and NR Cell 11.

- The PLMNs are identified in the test by the identifiers in Table 6.5.2.2.3.1-1 and the PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.5.2.2.3.1-1: PLMN identifiers

|  |  |  |
| --- | --- | --- |
| NR Cell | PLMN name | CAG IDs |
| 1 | PLMN1 | - |
| 2 | PLMN2 | 1 |
| 4 | PLMN3 | 2 |
| 11 | PLMN2 | - |

UE:

- The UE is in Automatic PLMN selection mode.

- There is an empty “CAG information list” provisioned in the UE.

Preamble:

- The UE is registered on NR Cell 1 using the procedure described in TS 38.508-1 [4] clause 4.5.2.2 except that the REGISTRATION ACCEPT message includes an empty CAG information list before it is in state Switched OFF (State 0N-B).

6.5.2.2.3.2 Test procedure sequence

Table 6.5.2.2.3.2-1 for FR1 and 6.5.2.2.3.2-2 for FR2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1", "T2" and "T3" are to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.5.2.2.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | "Off" | "Off" |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | -88 | "Off" |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | "Off" | "Off" |  |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | "Off" | -88 |  |

Table 6.5.2.2.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | "Off" | FFS | "Off" |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | FFS | "Off" |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | FFS | FFS | "Off" |  |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | "Off" | FFS |  |

Table 6.5.2.2.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE. | - | - | - | - |
| 2 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 3-13 | Steps 3 to 13 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 1.  NOTE: The UE starts registration. | - | - | - | - |
| 14 | The SS transmits a *DLInformationTransfer* message and a REGISTRATION ACCEPT message containing the CAG information list with the CAG ID of NR Cell 2. | <-- | NR RRC: *DLInformationTransfer*  5G MM: REGISTRATION ACCEPT | - | - |
| 15-20a1 | Steps 15 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 1.  NOTE: The UE completes registration and the RRC connection is released. | - | - | - | - |
| 21 | The UE is switched off by executing generic procedure in Table 4.9.6.1-1 in TS 38.508-1 [4]. | - | - | - | - |
| 22 | SS adjusts cell levels according to row T1 of table 6.5.2.2.3.2-1 for FR1 and table 6.5.2.2.3.2-2 for FR2. | - | - | - | - |
| 23 | Power on the UE. | - | - | - | - |
| 24 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 4 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| 25 | SS adjusts cell levels according to row T2 of table 6.5.2.2.3.2-1 for FR1 and table 6.5.2.2.3.2-2 for FR2. | - | - | - | - |
| 26 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 2? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 27-44a1 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 2.  NOTE: The UE completes registration and the RRC connection is released. | - | - | - | - |
| 45 | The UE is switched off by executing generic procedure in Table 4.9.6.1-1 in TS 38.508-1 [4]. | - | - | - | - |
| 46 | SS adjusts cell levels according to row T3 of table 6.5.2.2.3.2-1 for FR1 and table 6.5.2.2.3.2-2 for FR2. | - | - | - | - |
| 47 | Power on the UE. | - | - | - | - |
| 48 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 11? | --> | NR RRC: *RRCSetupRequest* | 3 | P |
| 49-66a1 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 11.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |

6.5.2.2.3.3 Specific message contents

Table 6.5.2.2.3.3-1: REGISTRATION ACCEPT (step 14, Table 6.5.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list | 2 entries |  |  |
| Length of CAG information list contents | ‘0000 0000 0001 0010’B |  |  |
| Entry 1 |  | MCC: 002; MNC: 11; CAG only: 0; CAG-ID 1: 1 |  |
| Length of entry contents | ‘0000 1000’B |  |  |
| MCC | MCC of NR Cell 2 | See Table 6.5.2.2.3.1-1 |  |
| MNC | MNC of NR Cell 2 | See Table 6.5.2.2.3.1-1 |  |
| CAG only | ‘0’B |  |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| Entry 2 |  | MCC: 003; MNC: 21; CAG only: 1; CAG-ID 1: 4 |  |
| Length of entry contents | ‘0000 1000’B |  |  |
| MCC | MCC of NR Cell 4 | See Table 6.5.2.2.3.1-1 |  |
| MNC | MNC of NR Cell 4 | See Table 6.5.2.2.3.1-1 |  |
| CAG only | ‘1’B |  |  |
| CAG-ID 1 | 4 | CAG ID is coded as a 32 bit BITSTRING |  |
| Equivalent PLMNs | PLMN2 |  |  |

Table 6.5.2.2.3.3-2: REGISTRATION ACCEPT (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  |  |  |
| Length of CAG information list contents | ‘0000 0000 0000 0000’B |  |  |
| Entry 1 | Not present |  |  |

Table 6.5.2.2.3.3-3: SIB1 for NR Cell 2 (all steps in Table 6.5.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 002 | PLMN2 MCC |  |
| mnc | 11 | PLMN2 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-Identity-r16 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 2 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 2 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.2.3.3-4: SIB1 for NR Cell 4 (all steps in Table 6.5.2.2.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 003 | PLMN3 MCC |  |
| mnc | 21 | PLMN3 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-Identity-r16 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 4 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 4 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.5.2.3 CAG / Limited Service / No Suitable cell

6.5.2.3.1 Test Purpose (TP)

(1)

**with** { UE in Automatic network selection mode provisioned with a "CAG information list” }

**ensure that** {

**when** { UE is switched on or returned to coverage, and a CAG cell with a CAG-ID not present in the "Allowed CAG list" becomes available }

**then** { UE does not select the CAG cell }

}

(2)

**with** { UE in Automatic network selection mode configured with "indication that the MS is only allowed to access 5GS via CAG cells" }

**ensure that** {

**when** { UE is switched on and a cell which is not a CAG cell becomes available, and there is an entry with the PLMN ID of the PLMN in the "CAG information list" but the "indication that the MS is only allowed to access 5GS via CAG cells" is included in the entry }

**then** { UE does not select the CAG cell }

}

(3)

**with** { UE in Automatic network selection mode provisioned with an empty "CAG information list” }

**ensure that** {

**when** { UE is switched on or returned to coverage, and a CAG cell with a PLMN ID becomes available }

**then** { UE does not select the CAG cell }

}

6.5.2.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 23.122 clause 3.5. Unless otherwise stated these are Rel-16 requirements.

[TS 23.122, clause 3.5]

There are a number of situations in which the MS is unable to obtain normal service from a PLMN or SNPN. These include:

…

i) MS supporting CAG is camped on a CAG cell belonging to a PLMN, the CAG-ID of the CAG cell is not manually selected by the user and none of the CAG-ID(s) of the CAG cell are present in the "Allowed CAG list" associated with that PLMN in the "CAG information list";

j) MS supporting CAG is camped on a non-CAG cell belonging to a PLMN, the PLMN ID of the non-CAG cell without a CAG-ID is not manually selected by the user and the UE is configured with "indication that the MS is only allowed to access 5GS via CAG cells" for that PLMN in the "CAG information list"; and

k) MS supporting CAG is camped on a CAG cell belonging to a PLMN, the CAG-ID of the CAG cell is not manually selected by the user and the "CAG information list" does not contain an entry for the PLMN (e.g. because the UE is not (pre-)configured with a "CAG information list").

6.5.2.3.3 Test description

6.5.2.3.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2, NR Cell 4 and NR Cell 11.

- NR Cell 2 and NR Cell 4 are CAG cells.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used for NR Cell 1, NR Cell 2, NR Cell 4 and NR Cell 11.

- The PLMNs are identified in the test by the identifiers in Table 6.5.2.3.3.1-1 and the PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.5.2.3.3.1-1: PLMN identifiers

|  |  |  |
| --- | --- | --- |
| NR Cell | PLMN name | CAG IDs |
| 1 | PLMN1 | - |
| 2 | PLMN1 | 1 |
| 4 | PLMN1 | 2 |
| 11 | PLMN1 | - |

UE:

- The UE is in Automatic PLMN selection mode.

- There is an empty “CAG information list” provisioned in the UE.

Preamble:

- The UE is registered on NR Cell 1 using the procedure described in TS 38.508-1 [4] clause 4.5.2.2 except that the REGISTRATION ACCEPT message includes an empty CAG information list before it is in state Switched OFF (State 0N-B).

6.5.2.3.3.2 Test procedure sequence

Table 6.5.2.3.3.2-1 for FR1 and 6.5.2.3.3.2-2 for FR2 illustrate the downlink power levels to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble, while columns marked "T1", "T2", "T3", "T3" and "T5" are to be applied subsequently in the Main behaviour. The exact instants on which these values shall be applied are described in the texts in this clause. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.5.2.3.3.2-1: Cell configuration changes over time for FR1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | -88 | "Off" |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | "Off" | "Off" |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | -88 | "Off" |  |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | "Off" | "Off" |  |
| T4 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | "Off" | -88 |  |
| T5 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | "Off" | "Off" |  |

Table 6.5.2.3.3.2-2: Cell configuration changes over time for FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 4 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | FFS | "Off" |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | "Off" | "Off" | "Off" |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | FFS | "Off" |  |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | FFS | "Off" | "Off" |  |
| T4 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | "Off" | "Off" | FFS |  |
| T5 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | FFS | "Off" | "Off" |  |

Table 6.5.2.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE. | - | - | - | - |
| 2 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 4 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 3 | F |
| 3 | SS adjusts cell levels according to row T1 of table 6.5.2.3.3.2-1 for FR1 and table 6.5.2.3.3.2-2 for FR2. | - | - | - | - |
| 4-16 | Steps 1 to 13 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 1.  NOTE: The UE starts registration. | - | - | - | - |
| 17 | The SS transmits a *DLInformationTransfer* message and a REGISTRATION ACCEPT message containing the CAG information list with the CAG ID of NR Cell 2. | <-- | NR RRC: *DLInformationTransfer*  5G MM: REGISTRATION ACCEPT | - | - |
| 18-23a1 | Steps 15 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 1.  NOTE: The UE completes registration and the RRC connection is released. | - | - | - | - |
| 24 | The UE is switched off by executing generic procedure in Table 4.9.6.1-1 in TS 38.508-1 [4]. | - | - | - | - |
| 25 | SS adjusts cell levels according to row T2 of table 6.5.2.3.3.2-1 for FR1 and table 6.5.2.3.3.2-2 for FR2. | - | - | - | - |
| 26 | Power on the UE. | - | - | - | - |
| 27 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 4 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 28 | SS adjusts cell levels according to row T3 of table 6.5.2.3.3.2-1 for FR1 and table 6.5.2.3.3.2-2 for FR2. | - | - | - | - |
| 29-47a1 | Steps 1 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 2.  NOTE: The UE completes registration and the RRC connection is released. | - | - | - | - |
| 48 | The UE is switched off by executing generic procedure in Table 4.9.6.1-1 in TS 38.508-1 [4]. | - | - | - | - |
| 49 | SS adjusts cell levels according to row T4 of table 6.5.2.3.3.2-1 for FR1 and table 6.5.2.3.3.2-2 for FR2. | - | - | - | - |
| 50 | Power on the UE. | - | - | - | - |
| 51 | Check: Does the UE send a *RRCSetupRequest* on NR Cell 11 within the next 60 s? | --> | NR RRC: *RRCSetupRequest* | 2 | F |
| 52 | SS adjusts cell levels according to row T5 of table 6.5.2.3.3.2-1 for FR1 and table 6.5.2.3.3.2-2 for FR2. | - | - | - | - |
| 53-72a1 | Steps 1 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2 are performed on NR Cell 2.  NOTE: The UE completes registration and the RRC connection is released. | - | - | - | - |

6.5.2.3.3.3 Specific message contents

Table 6.5.2.3.3.3-1: REGISTRATION REQUEST (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.7.1-6 | | | |
| Information Element | Value/Remark | Comment | Condition |
| 5GS registration type |  |  |  |
| 5GS registration type value | '001'B | Initial registration |  |
| 5GMM capability |  |  |  |
| CAG | ‘1’B | CAG supported |  |

Table 6.5.2.3.3.3-2: REGISTRATION ACCEPT (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  |  |  |
| Length of CAG information list contents | ‘0000 0000 0000 0000’B |  |  |
| Entry 1 | Not present |  |  |

Table 6.5.2.3.3.3-3: REGISTRATION ACCEPT (step 17, Table 6.5.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  | MCC : 001; MNC : 01; CAG only : 0; CAG-ID 1 : 1 |  |
| Length of CAG information list contents | ‘0000 0000 0000 1001’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1000’B |  |  |
| MCC | MCC of NR Cell 2 | See Table 6.5.2.3.3.1-1 |  |
| MNC | MNC of NR Cell 2 | See Table 6.5.2.3.3.1-1 |  |
| CAG only | ‘0’B |  |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |

Table 6.5.2.3.3.3-4: REGISTRATION ACCEPT (step 42, Table 6.5.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  | MCC : 001; MNC : 01; CAG only : 1; CAG-ID 1 : 1 |  |
| Length of CAG information list contents | ‘0000 0000 0000 1001’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1000’B |  |  |
| MCC | MCC of NR Cell 11 | See Table 6.5.2.3.3.1-1 |  |
| MNC | MNC of NR Cell 11 | See Table 6.5.2.3.3.1-1 |  |
| CAG only | ‘1’B | Indication that the UE is only allowed to access 5GS via CAG cells (CAGonly) |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |

Table 6.5.2.3.3.3-5: SIB1 for NR Cell 4 (all steps in Table 6.5.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 001 | PLMN1 MCC |  |
| mnc | 01 | PLMN1 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-Identity-r16 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 4 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 4 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.3.3.3-6: SIB1 for NR Cell 2 (all steps in Table 6.5.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 001 | PLMN1 MCC |  |
| mnc | 01 | PLMN1 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-Identity-r16 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 2 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 2 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.3.3.3-7: REGISTRATION ACCEPT (step 66, Table 6.5.2.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  |  |  |
| Length of CAG information list contents | ‘0000 0000 0000 1001’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1000’B |  |  |
| MCC | MCC of NR Cell 2 | See Table 6.5.2.3.3.1-1 |  |
| MNC | MNC of NR Cell 2 | See Table 6.5.2.3.3.1-1 |  |
| CAG only | ‘0’B |  |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |

#### 6.5.2.4 CAG / cell reselection / Within allowed CAG / non-CAG cell to CAG cell

6.5.2.4.1 Test Purpose (TP)

(1)

with { UE in NR RRC\_IDLE state on a non-CAG cell **and** UE’s Allowed CAG list is not empty }

ensure that {

when { UE detects an allowed CAG cell which becomes highest ranked cell }

then { UE reselects to the CAG cell }

}

(2)

with { UE in NR RRC\_IDLE state }

ensure that {

when { UE detects the cell re-selection criteria are met for the CAG cell which belongs to the higher priority frequency }

then { UE reselects the cell which belongs to the higher priority frequency }

}

6.5.2.4.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304: clauses 5.2.4.2, 5.2.4.5, 5.2.4.6 and 5.2.4.10. Unless otherwise stated these are Rel-16 requirements.

[TS 38.304, clause 5.2.4.2]

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE may choose not to perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority according to TS 38.133 [8].

- If the UE supports relaxed measurement and *relaxedMeasurement* is present in *SIB2*, the UE may further relax the needed measurements, as specified in clause 5.2.4.9.

[TS 38.304, clause 5.2.4.5]

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

NOTE: If *rangeToBestCell* is configured but *absThreshSS-BlocksConsolidation* is not configured on an NR frequency, the UE considers that there is one beam above the threshold for each cell on that frequency.

[TS 38.304, clause 5.2.4.10]

In addition to normal cell reselection, a UE may optionally use an autonomous search function to detect CAG cells on serving and non-serving frequencies. However UE shall follow the cell reselection criteria based on dedicated frequency priorities and only follow the autonomous cell search result if the result fulfils also the existing cell reselection criteria based on dedicated frequency priorities.

6.5.2.4.3 Test description

6.5.2.4.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- NR Cell 3 and NR Cell 6 are CAG cells.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used for NR Cell 1, NR Cell 3 and NR Cell 6.

- The PLMNs are identified in the test by the identifiers in Table 6.5.2.4.3.1-1 and the PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

Table 6.5.2.4.3.1–1: PLMN and CAG identifiers

|  |  |  |
| --- | --- | --- |
| NR Cell | PLMN name | CAG IDs |
| 1 | PLMN 1 | - |
| 3 | PLMN 2 | 1 |
| 6 | PLMN 2 | 2 |

UE:

- None.

Preamble:

- The UE is registered on NR Cell 1 and is brought to state 1N-A, RRC\_IDLE Connectivity (NR), in accordance with the procedure described in TS 38.508-1 [4] Table 4.5.2.2-2, except that the REGISTRATION ACCEPT message includes CAG information list with CAG-ID 1 and CAG-ID 2, and that the REGISTRATION ACCEPT message indicates PLMN2 in the Equivalent PLMN list as described in Table 6.5.2.4.3.3-1.

6.5.2.4.3.2 Test procedure sequence

Table 6.5.2.4.3.2-1/2 shows the cell configurations used during the test. The configuration T0 indicates the initial conditions for preamble. Subsequent configurations marked “T1” and “T2” are applied at the points indicated in the Main behaviour description in Table 6.5.2.4.3.2-3. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.5.2.4.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 3** | **NR Cell 6** | **Remarks** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | "Off" | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -78 | "Off" | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -78 | -78 | The power level values are assigned to satisfy SrxlevNR Cell 1 < 0 and SrxlevNR Cell 6 > ThreshNR Cell 6, high. |

Table 6.5.2.4.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 3** | **NR Cell 6** | **Remarks** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | "Off" | "Off" | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | "Off" | The power level values are assigned to satisfy RNR Cell 1 < RNR Cell 3. |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | FFS | FFS | The power level values are assigned to satisfy SrxlevNR Cell 1 < 0 and SrxlevNR Cell 6 > ThreshNR Cell 6, high. |

Table 6.5.2.4.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The SS changes cell power levels according to row "T1" in Table 6.5.2.4.3.2-1 for FR1 and Table 6.5.2.4.3.2-2 for FR2. | - | - | - | - |
| 2 | Check: Does the UE transmit an *RRCSetupRequest* message on NR Cell 3? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 3-7a1 | Steps 2 to 6a1 of the mobility registration updating procedure described in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 3. | - | - | - | - |
| 8 | SS adjusts cell levels according to row T2 of table 6.5.2.4.3.2-1/2. | - | - | - | - |
| 9 | Wait for 34(FR1)/130(FR2) seconds to allow UE to recognise the change. | - | - | - | - |
| 10 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.4.2.2-1 indicate that the UE is camped on NR Cell 6? | - | - | 2 | - |
| Note: The wait time at step 9 is Kcarrier\*Tdetect,NR\_Inter (as per TS 38.133 [30], clause 4.2.2.4). | | | | | |

6.5.2.4.3.3 Specific message contents

Table 6.5.2.4.3.3-1: REGISTRATION ACCEPT for NR Cell 1 (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  | MCC: 002; MNC: 11; CAG only: 0; CAG-ID 1: 1; CAG-ID 2: 2 |  |
| Length of CAG information list contents | ‘0000 0000 0000 1101’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1100’B |  |  |
| MCC | MCC of PLMN 2 | See Table 6.5.2.4.3.1–1 |  |
| MNC | MNC of PLMN 2 | See Table 6.5.2.4.3.1–1 |  |
| CAG only | ‘0’B |  |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| CAG-ID 2 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| Equivalent PLMNs | PLMN2 |  |  |

Table 6.5.2.4.3.3-2: SIB2 of NR Cell 6 (preamble and all steps, Table 6.5.2.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB2 ::= SEQUENCE { |  |  |  |
| cellReselectionServingFreqInfo SEQUENCE { |  |  |  |
| threshServingLowP | 10 | 20 dB |  |
| cellReselectionPriority | 5 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.4.3.3-3: SIB4 of NR Cell 3 (preamble and all steps, Table 6.5.2.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 6 |  |  |
| threshX-HighP | 10 | 20 dB | FR1 |
| 9 | 18 dB | FR2 |
| cellReselectionPriority | 5 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.4.3.3-4: SIB4 of NR Cell 1 (preamble and all steps, Table 6.5.2.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 2 entries |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  | entry 1 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 6 |  |  |
| cellReselectionPriority | 5 |  |  |
| } |  |  |  |
| InterFreqCarrierFreqInfo[2] SEQUENCE { |  | entry 2 |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  |  |
| cellReselectionPriority | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.4.3.3-5: SIB1 for NR Cell 3 (preamble and all steps, Table 6.5.2.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 002 | PLMN2 MCC |  |
| mnc | 11 | PLMN2 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-identity-r16 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 3 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 3 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.4.3.3-6: SIB1 for NR Cell 6 (preamble and all steps, Table 6.5.2.4.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 002 | PLMN2 MCC |  |
| mnc | 11 | PLMN2 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-identity-r16 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 6 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 6 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.5.2.5 Void

#### 6.5.2.6 CAG / cell reservation

6.5.2.6.1 Test Purpose (TP)

(1)

with { UE in Automatic network selection mode and provisioned with "CAG information list" }

ensure that {

when { UE is switched on or returns to coverage, and a cell which is not a CAG cell with cell status “true” for other use becomes available }

then { UE does not attempt to reselect to the higher ranked cell }

}

(2)

with { UE camped normally in state NR RRC\_IDLE on a CAG cell and UE’s Allowed CAG list is not empty }

ensure that {

when { a higher ranked CAG cell is found with cell status as “not barred” and “not reserved” for operator use and “true” for other use, and not “true” for future use }

then { UE does reselect to the higher ranked cell }

}

6.5.2.6.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304: clauses 5.2.4.4, 5.2.4.6 and 5.3.1. Unless otherwise stated these are Rel-16 requirements.

[TS 38.304, clause 5.2.4.4]

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in clause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in clause 5.2.4.5, the UE shall check if the access is restricted according to the rules in clause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in clause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to one or more of the following reasons:

- this cell belongs to a PLMN which is not indicated as being equivalent to the registered PLMN, or

- this cell is a CAG cell that belongs to a PLMN which is equivalent to the registered PLMN but with no CAG-ID that is present in the UE's allowed CAG list being broadcasted, or

- this cell is not a CAG cell and the CAG-only indication in the UE is set, or

- this cell does not belong to a SNPN that is equal to the registered or selected SNPN of the UE in SNPN access mode,

the UE shall not consider this cell and, for operation in licensed spectrum, other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

For operation with shared spectrum channel access, when the highest ranked cell or best cell is not a candidate for reselection per the previous paragraph, the UE should continue to consider other cells on the same frequency for cell reselection, however if the second highest ranked cell on this frequency is also not suitable due to one or more of the above reasons, the UE may consider this frequency to be the lowest priority for a maximum of 300 seconds.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to being part of the "list of 5GS forbidden TAs for roaming", the UE shall not consider this cell and other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

If the highest ranked cell or best cell according to absolute priority reselection rules is an inter-RAT cell which is not suitable due to being part of the "list of forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for a maximum of 300 seconds.

If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under NR control to a frequency for which the timer is running, the limitation(s) on that frequency shall be removed.

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to subclause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

[TS 38.304, clause 5.3.1]

Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of following fields:

- *cellBarred* (IE type: "barred" or "not barred")   
Indicated in *MIB* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")   
Indicated in *SIB1* message*.* In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is specified per PLMN or per SNPN.

- *cellReservedForOtherUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

*- cellReservedForFutureUse* (IE type: "true")   
Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs.

NOTE 0: IAB-MT ignores the *cellBarred*, *cellReservedForOperatorUse, cellReservedForFutureUse* and *intraFreqReselection* (i.e. treats *intraFreqReselection* as if it was set to *allowed*) as defined in TS 38.331 [3]. IAB-MT also ignores *cellReservedForOtherUse* for cell barring determination (i.e. NPN capable IAB-MT considers *cellReservedForOtherUse* for determination of an NPN-only cell) as defined in TS 38.331 [3].

- *iab-Support* (IE type: "true")  
Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is specified per PLMN or per SNPN.

When cell status is indicated as "not barred" and "not reserved" for operator use and not "true" for other use and not "true" for future use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell broadcasts any CAG-IDs or NIDs and the cell status is indicated as "not barred" and "not reserved" for operator use and "true" for other use, and not "true" for future use:

- All NPN-capable UEs shall treat this cell as candidate during the cell selection and cell reselection procedures, other UEs shall treat this cell as if cell status is "barred".

When cell status is indicated as "true" for other use, and either cell does not broadcast any CAG-IDs or NIDs or does not broadcast any CAG-IDs and the UE is not operating in SNPN Access Mode,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "true" for future use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN/SNPN and not "true" for other use and not "true" for future use,

- UEs assigned to Access Identity 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to Access Identity 11 or 15 shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for selected/registered SNPN is set to "reserved".

- UEs assigned to an Access Identity 0, 1, 2 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN/SNPN or the selected PLMN/SNPN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in TS 22.261 [12].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

- If the field *intraFreqReselection* in *MIB* message is set to "allowed":

- the UE may select another cell on the same frequency if re-selection criteria are fulfilled;

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds;

- else:

- the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed":

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds;

- If the cell operates in licensed spectrum:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds;

- else:

- the UE may select to another cell on the same frequency if the reselection criteria are fulfilled.

- else:

- If the cell operates in licensed spectrum, or if this cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or the selected PLMN of the UE, or if this cell belongs to the registered SNPN or the selected SNPN of the UE:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds;

- else:

- the UE may select to another cell on the same frequency if the reselection criteria are fulfilled.

- the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT.

NOTE 2: If barring of a cell is triggered by the condition of *trackingAreaCode* not being provided, as specified in TS 38.331 [3], the barring only applies to this PLMN and the UE can re-evaluate the barring condition again due to selection of another PLMN.

6.5.2.6.3 Test description

6.5.2.6.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 6.

- NR Cell 3 and NR Cell 6 are CAG cells.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used for NR Cell 1, NR Cell 3 and NR Cell 6.

- The PLMNs are identified in the test by the identifiers in Table 6.5.2.6.3.1-1 and the PLMN settings are defined in TS 36.523-1 [13] table 6.0.1-1.

- NR Cell 6 TAC is set to TAC=2.

Table 6.5.2.6.3.1–1: PLMN and CAG identifiers

|  |  |  |
| --- | --- | --- |
| NR Cell | PLMN name | CAG IDs |
| 1 | PLMN 1 | - |
| 3 | PLMN 2 | 1 |
| 6 | PLMN 2 | 2 |

UE:

- The UE is in Automatic PLMN selection mode.

Preamble:

- The UE is registered on NR Cell 1 using the procedure described in TS 38.508-1 [4] Table 4.5.2.2-2, except that the REGISTRATION ACCEPT message includes CAG information list with CAG-ID 1 and CAG-ID 2 before it is in state Switched OFF (State 0N-B).

6.5.2.6.3.2 Test procedure sequence

Table 6.5.2.6.3.2-1/2 shows the cell configurations used during the test. The configuration T0 indicates the initial conditions for preamble. Subsequent configurations marked “T1”, “T2” and “T3” are applied at the points indicated in the Main behaviour description in Table 6.5.2.6.3.2-3. Cell powers are chosen for a serving cell and a non-suitable “Off” cell as defined in TS 38.508-1 [4] Table 6.2.2.1-3 for FR1 and Table 6.2.2.2-2 for FR2.

Table 6.5.2.6.3.2-1: Time instances of cell power level and parameter changes for FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 3** | **NR Cell 6** | **Remarks** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | "Off" | "Off" | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 | "Off" |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | -78 | The power level values are assigned to satisfy RNR Cell 3 < RNR Cell 6. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | -88 | "Off" |  |

Table 6.5.2.6.3.2-2: Time instances of cell power level and parameter changes for FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 3** | **NR Cell 6** | **Remarks** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | "Off" | "Off" | The power level values are assigned to ensure the UE registered on NR Cell 1. |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | FFS | FFS | "Off" |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | FFS | FFS | The power level values are assigned to satisfy RNR Cell 3 < RNR Cell 6. |
| T3 | SS/PBCH  SSS EPRE | dBm/SCS | "Off" | FFS | "Off" |  |

Table 6.5.2.6.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The SIB1 for NR cell 1 is updated according to Table 6.5.2.6.3.3-2. | - | - | - | - |
| 1A | Wait for 2.1\* modification period second for the SS to transmit modified system information.  (Note 1) | - | - | - | - |
| 2 | The UE is switched on. | - | - | - | - |
| 3 | Check: Does the UE transmit a *RRCSetupRequest* message on NR Cell 1 within 60s ? | --> | NR RRC: *RRCSetupRequest* | 1 | F |
| 4 | The SS changes cell power levels according to row "T1" in Table 6.5.2.6.3.2-1 for FR1 and Table 6.5.2.6.3.2-2 for FR2. | - | - | - | - |
| 5-22a1 | Steps 2-20a1 of Table 4.5.2.2-2 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 3. | - | - | - | - |
| 23 | SS adjusts cell levels according to row T2 of table 6.5.2.6.3.2-1/2. | - | - | - | - |
| 24 | Check: Does the UE transmit a *RRCSetupRequest* message on NR Cell 6. | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 25-29 | Steps 2-6a1 of Table 4.9.5.2.2-1 of the generic procedure in TS 38.508-1 [4] are performed on NR Cell 6. | - | - | - | - |
| 30 | Void | - | - | - | - |
| 31 | SS adjusts cell levels according to row T3 of table 6.5.2.6.3.2-1/2. | - | - | - | - |
| 32-36 | Steps 1 to 5 of the generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 are performed on NR Cell 3. | - | - | - | - |
| Note 1: The modification period, expressed in number of radio frames = modificationPeriodCoeff \* defaultPagingCycle. | | | | | |

6.5.2.6.3.3 Specific message contents

Table 6.5.2.6.3.3-1: REGISTRATION ACCEPT for NR Cell 1 (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  | MCC : 002; MNC : 11; CAG only : 0;CAG-ID 1 : 1, CAG-ID 2 : 2 |  |
| Length of CAG information list contents | ‘0000 0000 0000 1101’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1100’B |  |  |
| MCC | MCC of NR Cell 3 | See Table 6.5.2.6.3.1–1 |  |
| MNC | MNC of NR Cell 3 | See Table 6.5.2.6.3.1–1 |  |
| CAG only | ‘0’B |  |  |
| CAG-ID 1 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| CAG-ID 2 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| Equivalent PLMNs | PLMN2 |  |  |

Table 6.5.2.6.3.3-2: SIB1 for NR Cell 1 (Step 1, Table 6.5.2.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.6.3.3-3: Void

Table 6.5.2.6.3.3-4: SIB1 for NR Cell 6 (preamble and all steps, Table 6.5.2.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 002 | PLMN2 MCC |  |
| mnc | 11 | PLMN2 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-identity-r16 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | 000000000000000000000010 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 6 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.6.3.3-5: SIB1 for NR Cell 3 (preamble and all steps, Table 6.5.2.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-28 with condition CAG | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| cellAccessRelatedInfo SEQUENCE { |  |  |  |
| cellReservedForOtherUse | true |  |  |
| npn-IdentityInfoList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-IdentityInfo-r16 { | 1 entry |  |  |
| NPN-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| npn-IdentityList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF NPN-Identity-r16 { | 1 entry |  |  |
| NPN-Identity-r16[1] CHOICE { |  | entry 1 |  |
| pni-npn-r16 SEQUENCE { |  |  |  |
| plmn-Identity-r16 SEQUENCE { |  |  |  |
| mcc | 002 | PLMN2 MCC |  |
| mnc | 11 | PLMN2 MNC |  |
| } |  |  |  |
| cag-IdentityList-r16 SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16 { | 1 entry |  |  |
| CAG-IdentityInfo-r16[1] SEQUENCE { |  | entry 1 |  |
| cag-identity-r16 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| trackingAreaCode-r16 | TAC of NR Cell 3 |  |  |
| cellIdentity-r16 | Cell Identity of NR Cell 3 |  |  |
| cellReservedForOperatorUse-r16 | notReserved |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.5.2.6.3.3-6: REGISTRATION ACCEPT (Step 17, Table 6.5.2.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  | MCC : 002; MNC : 11; CAG only : 1;  CAG-ID 1 : 2, CAG ID 2: 1 |  |
| Length of CAG information list contents | ‘0000 0000 0000 1101’B |  |  |
| Entry 1 |  |  |  |
| Length of entry contents | ‘0000 1100’B |  |  |
| MCC | MCC of NR Cell 6 | See Table 6.5.2.6.3.1-1 |  |
| MNC | MNC of NR Cell 6 | See Table 6.5.2.6.3.1-1 |  |
| CAG only | ‘1’B |  |  |
| CAG-ID 1 | 2 | CAG ID is coded as a 32 bit BITSTRING |  |
| CAG-ID 2 | 1 | CAG ID is coded as a 32 bit BITSTRING |  |

Table 6.5.2.6.3.3-7: REGISTRATION ACCEPT (Step 35, Table 6.5.2.6.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], table 4.7.1-7 | | | |
| Information Element | Value/Remark | Comment | Condition |
| CAG information list |  |  |  |
| Length of CAG information list contents | ‘0000 0000 0000 0000’B |  |  |
| Entry 1 | Not present |  |  |

## 6.6 NR unlicensed idle mode operations

### 6.6.1 NR unlicensed cell selection

#### 6.6.1.1 Cell selection / next strongest cell / Intra frequency reselection not allowed

6.6.1.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure** that {

**when** { a cell fulfilling all requirements for a suitable cell is not the strongest cell on that frequency }

**then** { the UE searches for the next strongest cell on that frequency and camps on it }

}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure** that {

**when** { a cell broadcasting *intraFreqReselection* in MIB message is set to "not allowed" }

**then** { the UE selects another cell on same frequency and camps on it }

}

6.6.1.1.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304, clause 5.1.1.2, 5.2.3.1 and 5.3.1. Unless otherwise stated these are Rel-16 requirements.

[TS 38.304, clause 5.1.1.2]

The UE shall scan all RF channels in the NR bands according to its capabilities to find available PLMNs and available CAGs. On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which PLMN(s) the cell belongs to and any associated CAG(s). For operation with shared spectrum channel access, the UE may also read the system information of multiple strongest cell(s). If the UE can read one or several PLMN identities in the strongest cell or the multiple strongest cell(s) in case of operation with shared spectrum channel access, each found PLMN (see the PLMN reading in TS 38.331 [3]) shall be reported to the NAS as a high quality PLMN (but without the RSRP value) and any associated CAG-ID, provided that the following high-quality criterion is fulfilled:

1. For an NR cell, the measured RSRP value shall be greater than or equal to -110 dBm.

Found PLMNs that do not satisfy the high-quality criterion but for which the UE has been able to read the PLMN identities are reported to the NAS together with their corresponding RSRP values and any associated CAG-ID. The quality measure reported by the UE to NAS shall be the same for each PLMN found in one cell.

[TS 38.304, clause 5.2.3.1]

Cell selection is performed by one of the following two procedures:

a) Initial cell selection (no prior knowledge of which RF channels are NR frequencies):

1. The UE shall scan all RF channels in the NR bands according to its capabilities to find a suitable cell.

2. On each frequency, the UE need only search for the strongest cell, except for operation with shared spectrum channel access where the UE may search for the next strongest cell(s).

3. Once a suitable cell is found, this cell shall be selected.

[TS 38.304, clause 5.3.1]

…

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MIB*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- else:

…

- If the UE is not a RedCap UE, or if the UE is a RedCap UE and *intraFreqReselectionRedCap* in SIB1 is available:

…

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed":

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds;

- If the cell operates in licensed spectrum:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds;

- else:

- the UE may select to another cell on the same frequency if the reselection criteria are fulfilled.

- else:

- If the cell operates in licensed spectrum, or if this cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or the selected PLMN of the UE, or if this cell belongs to the registered SNPN or the selected SNPN of the UE:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds;

- else:

- the UE may select to another cell on the same frequency if the reselection criteria are fulfilled.

- the UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

6.6.1.1.3 Test description

6.6.1.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 and NR Cell 11 as specified in TS 38.508-1 [4] table 4.4.2-3 with exception that PLMN of NR Cell 11 is set to 002-101.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None.

Preamble:

- The UE is in state Switched OFF (state 0-A) according to TS 38.508-1 [4].

6.6.1.1.3.2 Test procedure sequence

Table 6.6.1.1.3.2-1 illustrates the downlink power levels to be applied for NR Cell 1 and NR Cell 11 at various time instants of the test execution. Row marked "T0" denotes the conditions after the preamble, while the configuration marked "T1", are applied at the point indicated in the Main behaviour description in Table 6.6.1.1.3.2-2.

Table 6.6.1.1.3.2-1: Time instances of cell power level and parameter changes for NR Cell 1 and NR Cell 11 in conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 11** | **Remark** |
| **T0** | SS/PBCH SSS EPRE | dBm/SCS | -99 | -88 | The power level values are assigned to ensure the shared spectrum UE searches for next strongest cell. |

Table 6.6.1.1.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T0" in table 6.6.1.1.3.2-1. | - | - | - | - |
| 2 | The UE is switched on. | - | - | - | - |
| 3 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 4-21 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |
| 22 | The UE is switched off by executing generic procedure in Table 4.9.6.1-1 in TS 38.508-1 [4]. | - | - | - | - |
| 23 | The SS changes the MIB of NR Cell 11 to set the *intraFreqReselection* to notAllowed. | - | - | - | - |
| 24 | The UE is switched on. | - | - | - | - |
| 25 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 1? | --> | NR RRC: *RRCSetupRequest* | 2 | P |
| 26-43a1 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] Table 4.5.2.2-2 are performed on NR Cell 1.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |

6.6.1.1.3.3 Specific message contents

Table 6.6.1.1.3.3-1: MIB for NR Cell 11 (step 23, Table 6.6.1.1.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.6.1-6 | | | |
| Information Element | | Value/remark | Comment | Condition |
| MIB ::= SEQUENCE { | |  |  |  |
| intraFreqReselection | | notAllowed |  |  |
| } | |  |  |  |

### 6.6.2 NR unlicensed cell reselection

#### 6.6.2.1 Cell reselection / next best cell / Intra frequency

6.6.2.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure** that {

**when** { UE detects the cell re-selection criteria are met for the next best cell on the same frequency }

**then** { the UE reselects the new cell }

}

6.6.2.1.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304, clauses 5.2.4.1, 5.2.4.4 and TS 38.331, clause 6.3.1. Unless otherwise stated these are Rel-16 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If any fields with *cellReselectionPriority* or *nsag-CellReselectionPriority* are provided in dedicated signalling, the UE shall ignore any fields with *cellReselectionPriority* and *nsag-CellReselectionPriority* provided in system information.

When UE is in camped normally state, if it supports slice-based cell reselection and has received the network slice(s) and NSAG information from NAS to be used for cell reselection, UE shall derive reselection priorities according to clause 5.2.4.11.

If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

…

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

…

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall consider only the allow-listed cells, if configured, as candidates for cell reselection.

The UE in RRC\_IDLE state shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

…

[TS 38.304, clause 5.2.4.4]

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in clause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in clause 5.2.4.5, the UE shall check if the access is restricted according to the rules in clause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in clause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to one or more of the following reasons:

- this cell belongs to a PLMN which is not indicated as being equivalent to the registered PLMN, or

- this cell is a CAG cell that belongs to a PLMN which is equivalent to the registered PLMN but with no CAG-ID that is present in the UE's allowed CAG list being broadcasted, or

- this cell is not a CAG cell and the CAG-only indication in the UE is set, or

- this cell does not belong to a SNPN that is equal to the registered or selected SNPN of the UE in SNPN access mode,

the UE shall not consider this cell and, for operation in licensed spectrum, other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

For operation with shared spectrum channel access, when the highest ranked cell or best cell is not a candidate for reselection per the previous paragraph, the UE should continue to consider other cells on the same frequency for cell reselection, however if the second highest ranked cell on this frequency is also not suitable due to one or more of the above reasons, the UE may consider this frequency to be the lowest priority for a maximum of 300 seconds.

…

[TS 38.331, clause 6.3.1]

…

|  |
| --- |
| ***intraFreqAllowedCellList***  List of allow-listed intra-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4. |

6.6.2.1.3 Test description

6.6.2.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 11 as specified in TS 38.508-1 [4] table 4.4.2-3 with exceptions that PLMN of NR Cell 11 is set to 002-101 and NR Cell 2 TAC is set to 2.

- System information combination NR-3 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None.

Preamble:

- The UE is in state Registered, Idle mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-1.

6.6.2.1.3.2 Test procedure sequence

Table 6.6.2.1.3.2-1 illustrates the downlink power levels to be applied for NR Cell 1, NR Cell 2 and NR Cell 11 at various time instants of the test execution. Row marked "T0" denotes the initial conditions after the preamble, while the configuration marked "T1", are applied at the point indicated in the Main behaviour description in Table 6.6.2.1.3.2-2.

Table 6.6.2.1.3.2-1: Time instances of cell power level and parameter changes for NR Cell 1, NR Cell 2 and NR Cell 11

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -94 | -78 | The power level values are assigned to satisfy RNRCell 1 < RNRCell 2 < RNRCell 11 |

Table 6.6.2.1.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.6.2.1.3.2-1. | - | - | - | - |
| 2 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.5 indicate that the UE is camped on NR Cell 2?  NOTE: The UE performs a registration for mobility procedure and the RRC connection is released. | - | - | 1 | - |

6.6.2.1.3.3 Specific message contents

Table 6.6.2.1.3.3-1: SIB3 for NR Cell 1 (preamble and all steps, Table 6.6.2.1.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE (SIZE (1.. maxCellIntra)) OF IntraFreqNeighCellInfo { | 1 entry |  |  |
| IntraFreqNeighCellInfo[1] SEQUENCE { |  |  |  |
| physCellId | PhysicalCellID of NR Cell 2 |  |  |
| q-OffsetCell | dB0 |  |  |
| } |  |  |  |
| } |  |  |  |
| IntraFreqAllowedCellList-r16::=SEQUENCE (SIZE (1.. maxCellWhite)) OF PCI-Range { | 1 entry |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 2 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.6.2.1.3.3-2: SIB3 for NR Cell 2 (all steps, Table 6.6.2.1.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE (SIZE (1.. maxCellIntra)) OF IntraFreqNeighCellInfo { | 1 entry |  |  |
| IntraFreqNeighCellInfo[1] SEQUENCE { |  |  |  |
| physCellId | PhysicalCellID of NR Cell 1 |  |  |
| q-OffsetCell | dB0 |  |  |
| } |  |  |  |
| } |  |  |  |
| IntraFreqAllowedCellList-r16::=SEQUENCE (SIZE (1.. maxCellWhite)) OF PCI-Range { | 1 entry |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 1 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.6.2.2 Cell reselection / next best cell not suitable / inter frequency

6.6.2.2.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_IDLE state }

**ensure** that {

**when** { UE detects next best cell on the same frequency as not suitable for reselection }

**then** { the UE does not reselect to the cell on the same frequency }

}

(2)

**with** { UE in NR RRC\_IDLE state }

**ensure** that {

**when** { UE detects the cell re-selection criteria are met for the cell on the different frequency }

**then** { the UE reselects the new cell }

}

6.6.2.2.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304, clauses 5.2.4.1, 5.2.4.4, 5.2.4.6 and TS 38.331, clause 6.3.1. Unless otherwise stated these are Rel-16 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If any fields with *cellReselectionPriority* or *nsag-CellReselectionPriority* are provided in dedicated signalling, the UE shall ignore any fields with *cellReselectionPriority* and *nsag-CellReselectionPriority* provided in system information.

When UE is in camped normally state, if it supports slice-based cell reselection and has received the network slice(s) and NSAG information from NAS to be used for cell reselection, UE shall derive reselection priorities according to clause 5.2.4.11.

If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

…

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

…

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall consider only the allow-listed cells, if configured, as candidates for cell reselection.

The UE in RRC\_IDLE state shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

…

[TS 38.304, clause 5.2.4.4]

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in clause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in clause 5.2.4.5, the UE shall check if the access is restricted according to the rules in clause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in clause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to one or more of the following reasons:

- this cell belongs to a PLMN which is not indicated as being equivalent to the registered PLMN, or

- this cell is a CAG cell that belongs to a PLMN which is equivalent to the registered PLMN but with no CAG-ID that is present in the UE's allowed CAG list being broadcasted, or

- this cell is not a CAG cell and the CAG-only indication in the UE is set, or

- this cell does not belong to a SNPN that is equal to the registered or selected SNPN of the UE in SNPN access mode,

the UE shall not consider this cell and, for operation in licensed spectrum, other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

For operation with shared spectrum channel access, when the highest ranked cell or best cell is not a candidate for reselection per the previous paragraph, the UE should continue to consider other cells on the same frequency for cell reselection, however if the second highest ranked cell on this frequency is also not suitable due to one or more of the above reasons, the UE may consider this frequency to be the lowest priority for a maximum of 300 seconds.

…

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

NOTE: If *rangeToBestCell* is configured but *absThreshSS-BlocksConsolidation* is not configured on an NR frequency, the UE considers that there is one beam above the threshold for each cell on that frequency.

[TS 38.331, clause 6.3.1]

…

|  |
| --- |
| ***interFreqAllowedCellList***  List of allow-listed inter-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4. |

6.6.2.2.3 Test description

6.6.2.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 11 as specified in TS 38.508-1 [4] table 4.4.2-3 with exceptions that PLMN of NR Cell 11 is set to 002-101 and NR Cell 3 TAC is set to 2.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cell 1 and NR cell 3.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cell 11.

UE:

- None.

Preamble:

- The UE is in state Registered, Idle mode (state 1N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-1.

6.6.2.2.3.2 Test procedure sequence

Table 6.6.2.2.3.2-1 illustrates the downlink power levels to be applied for NR Cell 1, NR Cell 3 and NR Cell 11 at various time instants of the test execution. Row marked "T0" denotes the initial conditions after the preamble, while the configuration marked "T1", are applied at the point indicated in the Main behaviour description in Table 6.6.2.2.3.2-2.

Table 6.6.2.2.3.2-1: Time instances of cell power level and parameter changes for NR Cell 1, NR Cell 3 and NR Cell 11

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | Off | -78 | The power level values are assigned to satisfy R NRCell 1 < R NRCell 11 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -94 | -78 | The power level values are assigned to satisfy R NRCell 1 < R NRCell 3 < R NRCell 11 |

Table 6.6.2.2.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.6.2.2.3.2-1. | - | - | - | - |
| 2 | Check: Does the UE send an *RRCSetupRequest* on NR Cell 11 within 60s? | - | NR RRC: *RRCSetupRequest* | 1 | F |
| 3 | The SS adjusts the SS/PBCH EPRE levels according to row "T2" in table 6.6.2.2.3.2-1. | - | - | - | - |
| 4 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] clause 4.9.5 indicate that the UE is camped on NR Cell 3?  NOTE: The UE performs a registration for mobility procedure and the RRC connection is released. | - | - | 2 | - |

6.6.2.2.3.3 Specific message contents

Table 6.6.2.2.3.3-1: SIB4 for NR Cell 1 (preamble and all steps, Table 6.6.2.2.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  |  |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  |  |
| } |  |  |  |
| } |  |  |  |
| InterFreqCarrierFreqList-v1610 SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-v1610 { | 1 entry |  |  |
| InterFreqCarrierFreqInfo-v1610[1] { |  |  |  |
| InterFreqAllowedCellList-r16 ::= SEQUENCE (SIZE (1..maxCellAllowed)) OF PCI-Range { |  |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 3 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.6.2.2.3.3-2: SIB4 for NR Cell 3 (step 3, Table 6.6.2.2.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  |  |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| InterFreqCarrierFreqList-v1610 SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-v1610 { | 1 entry |  |  |
| InterFreqCarrierFreqInfo-v1610[1] { |  |  |  |
| InterFreqAllowedCellList-r16 ::= SEQUENCE (SIZE (1..maxCellAllowed)) OF PCI-Range { |  |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 1 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 6.6.2.3 Cell reselection / next best cell / intra frequency / RRC Inactive

6.6.2.3.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** that {

**when** { UE detects the cell re-selection criteria are met for the next best cell on the same frequency }

**then** { the UE reselects the new cell }

}

6.6.2.3.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304, clauses 4.1, 5.2.4.1, 5.2.4.4 and TS 38.331, clause 6.3.1. Unless otherwise stated these are Rel-16 requirements.

[TS 38.304, clause 4.1]

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection (for UE not operating in SNPN access mode) or SNPN selection (for UE operating in SNPN access mode);

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, SNPN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN or SNPN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

…

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

…

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is as follows:

a) It enables the UE to receive system information from the PLMN or the SNPN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

e) It enables the UE to receive MBS broadcast services.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If any fields with *cellReselectionPriority* or *nsag-CellReselectionPriority* are provided in dedicated signalling, the UE shall ignore any fields with *cellReselectionPriority* and *nsag-CellReselectionPriority* provided in system information.

When UE is in camped normally state, if it supports slice-based cell reselection and has received the network slice(s) and NSAG information from NAS to be used for cell reselection, UE shall derive reselection priorities according to clause 5.2.4.11.

If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

…

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

…

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall consider only the allow-listed cells, if configured, as candidates for cell reselection.

The UE in RRC\_IDLE state shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

…

[TS 38.304, clause 5.2.4.4]

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in clause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in clause 5.2.4.5, the UE shall check if the access is restricted according to the rules in clause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in clause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to one or more of the following reasons:

- this cell belongs to a PLMN which is not indicated as being equivalent to the registered PLMN, or

- this cell is a CAG cell that belongs to a PLMN which is equivalent to the registered PLMN but with no CAG-ID that is present in the UE's allowed CAG list being broadcasted, or

- this cell is not a CAG cell and the CAG-only indication in the UE is set, or

- this cell does not belong to a SNPN that is equal to the registered or selected SNPN of the UE in SNPN access mode,

the UE shall not consider this cell and, for operation in licensed spectrum, other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

For operation with shared spectrum channel access, when the highest ranked cell or best cell is not a candidate for reselection per the previous paragraph, the UE should continue to consider other cells on the same frequency for cell reselection, however if the second highest ranked cell on this frequency is also not suitable due to one or more of the above reasons, the UE may consider this frequency to be the lowest priority for a maximum of 300 seconds.

…

[TS 38.331, clause 6.3.1]

|  |
| --- |
| ***intraFreqAllowedCellList***  List of allow-listed intra-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4. |

6.6.2.3.3 Test description

6.6.2.3.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 2 and NR Cell 11 as specified in TS 38.508-1 [4] table 4.4.2-3 with exceptions that PLMN of NR Cell 11 is set to 002-101 and NR Cell 2 TAC is set to 2.

- System information combination NR-3 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

UE:

- None.

Preamble:

- The UE is in state Registered, Inactive mode (state 2N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-2.

6.6.2.3.3.2 Test procedure sequence

Table 6.6.2.3.3.2-1 illustrates the downlink power levels to be applied for NR Cell 1, NR Cell 2 and NR Cell 11 at various time instants of the test execution. Row marked "T0" denotes the initial conditions after the preamble, while the configuration marked "T1", are applied at the point indicated in the Main behaviour description in Table 6.6.2.3.3.2-2.

Table 6.6.2.3.3.2-1: Time instances of cell power level and parameter changes for NR Cell 1, NR Cell 2 and NR Cell 11

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 2 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -94 | -78 | The power level values are assigned to satisfy RNRCell 1 < RNRCell 2 < RNRCell 11 |

Table 6.6.2.3.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.6.2.3.3.2-1. | - | - | - | - |
| 2 | Check: Does the UE transmit an *RRCResumeRequest* message on NR Cell 2? | --> | NR RRC: *RRCResumeRequest* | 1 | P |
| 3 | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 4 | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 5 | The SS transmits an RRCRelease message including suspendConfig with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |

6.6.2.3.3.3 Specific message contents

Table 6.6.2.3.3.3-1: SIB3 for NR Cell 1 (preamble and all steps, Table 6.6.2.3.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE (SIZE (1.. maxCellIntra)) OF IntraFreqNeighCellInfo { | 1 entry |  |  |
| IntraFreqNeighCellInfo[1] SEQUENCE { |  |  |  |
| physCellId | PhysicalCellID of NR Cell 2 |  |  |
| q-OffsetCell | dB0 |  |  |
| } |  |  |  |
| } |  |  |  |
| IntraFreqAllowedCellList-r16::=SEQUENCE (SIZE (1.. maxCellWhite)) OF PCI-Range { | 1 entry |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 2 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.6.2.3.3.3-2: SIB3 for NR Cell 2 (all steps, Table 6.6.2.3.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-2 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB3 ::= SEQUENCE { |  |  |  |
| intraFreqNeighCellList SEQUENCE (SIZE (1.. maxCellIntra)) OF IntraFreqNeighCellInfo { | 1 entry |  |  |
| IntraFreqNeighCellInfo[1] SEQUENCE { |  |  |  |
| physCellId | PhysicalCellID of NR Cell 1 |  |  |
| q-OffsetCell | dB0 |  |  |
| } |  |  |  |
| } |  |  |  |
| IntraFreqAllowedCellList-r16::=SEQUENCE (SIZE (1.. maxCellWhite)) OF PCI-Range { | 1 entry |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 1 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.6.2.3.3.3-3: *RRCResumeRequest* (step 2, Table 6.6.2.3.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCResumeRequest ::= SEQUENCE { |  |  |  |
| rrcResumeRequest SEQUENCE { |  |  |  |
| resumeCause | rna-Update |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.6.2.3.3.3-4: RRCRelease (step 5, Table 6.6.2.3.3.2-2)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-16 with condition NR\_RRC\_INACTIVE |

#### 6.6.2.4 Cell reselection / next best cell not suitable / inter frequency / RRC Inactive

6.6.2.4.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** that {

**when** { UE detects next best cell on the same frequency as not suitable for reselection }

**then** { the UE does not reselect to the cell on the same frequency }

}

(2)

**with** { UE in NR RRC\_INACTIVE state }

**ensure** that {

**when** { UE detects the cell re-selection criteria are met for the cell on the different frequency }

**then** { the UE reselects the new cell }

}

6.6.2.4.2 Conformance requirements

References: The conformance requirements covered in the current TC are specified in: TS 38.304, clauses 5.2.4.1, 5.2.4.4, 5.2.4.6 and TS 38.331, clause 6.3.1. Unless otherwise stated these are Rel-16 requirements.

[TS 38.304, clause 5.2.4.1]

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If any fields with *cellReselectionPriority* or *nsag-CellReselectionPriority* are provided in dedicated signalling, the UE shall ignore any fields with *cellReselectionPriority* and *nsag-CellReselectionPriority* provided in system information.

When UE is in camped normally state, if it supports slice-based cell reselection and has received the network slice(s) and NSAG information from NAS to be used for cell reselection, UE shall derive reselection priorities according to clause 5.2.4.11.

If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values).

…

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

…

The UE shall not consider any exclude-listed cells as candidate for cell reselection.

The UE shall consider only the allow-listed cells, if configured, as candidates for cell reselection.

The UE in RRC\_IDLE state shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

…

[TS 38.304, clause 5.2.4.4]

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in clause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in clause 5.2.4.5, the UE shall check if the access is restricted according to the rules in clause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in clause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable due to one or more of the following reasons:

- this cell belongs to a PLMN which is not indicated as being equivalent to the registered PLMN, or

- this cell is a CAG cell that belongs to a PLMN which is equivalent to the registered PLMN but with no CAG-ID that is present in the UE's allowed CAG list being broadcasted, or

- this cell is not a CAG cell and the CAG-only indication in the UE is set, or

- this cell does not belong to a SNPN that is equal to the registered or selected SNPN of the UE in SNPN access mode,

the UE shall not consider this cell and, for operation in licensed spectrum, other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

For operation with shared spectrum channel access, when the highest ranked cell or best cell is not a candidate for reselection per the previous paragraph, the UE should continue to consider other cells on the same frequency for cell reselection, however if the second highest ranked cell on this frequency is also not suitable due to one or more of the above reasons, the UE may consider this frequency to be the lowest priority for a maximum of 300 seconds.

…

[TS 38.304, clause 5.2.4.6]

The cell-ranking criterion Rs for serving cell and Rn for neighbouring cells is defined by:

|  |
| --- |
| Rs = Qmeas,s +Qhyst - Qoffsettemp  Rn = Qmeas,n -Qoffset - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Qmeas | RSRP measurement quantity used in cell reselections. |
| Qoffset | For intra-frequency: Equals to Qoffsets,n, if Qoffsets,n is valid, otherwise this equals to zero.  For inter-frequency: Equals to Qoffsets,n plus Qoffsetfrequency, if Qoffsets,n is valid, otherwise this equals to Qoffsetfrequency. |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 38.331 [3]. |

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

The cells shall be ranked according to the R criteria specified above by deriving Qmeas,n and Qmeas,s and calculating the R values using averaged RSRP results.

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured*,* then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better than the serving cell according to the cell reselection criteria specified above during a time interval TreselectionRAT;

- more than 1 second has elapsed since the UE camped on the current serving cell.

NOTE: If *rangeToBestCell* is configured but *absThreshSS-BlocksConsolidation* is not configured on an NR frequency, the UE considers that there is one beam above the threshold for each cell on that frequency.

[TS 38.331, clause 6.3.1]

…

|  |
| --- |
| ***interFreqAllowedCellList***  List of allow-listed inter-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4. |

6.6.2.4.3 Test description

6.6.2.4.3.1 Pre-test conditions

System Simulator:

- NR Cell 1, NR Cell 3 and NR Cell 11 as specified in TS 38.508-1 [4] table 4.4.2-3 with exceptions that PLMN of NR Cell 11 is set to 002-101 and NR Cell 3 TAC is set to 2.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cell 1 and NR cell 3.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cell 11.

UE:

- None.

Preamble:

- The UE is in state Registered, Inactive mode (state 2N-A) on NR Cell 1 according to TS 38.508-1 [4] Table 4.4A.2-2.

6.6.2.4.3.2 Test procedure sequence

Table 6.6.2.4.3.2-1 illustrates the downlink power levels to be applied for NR Cell 1, NR Cell 3 and NR Cell 11 at various time instants of the test execution. Row marked "T0" denotes the initial conditions after the preamble, while the configuration marked "T1", are applied at the point indicated in the Main behaviour description in Table 6.6.2.4.3.2-2.

Table 6.6.2.4.3.2-1: Time instances of cell power level and parameter changes for NR Cell 1, NR Cell 3 and NR Cell 11

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | NR Cell 11 | Remarks |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | Off | -78 | The power level values are assigned to satisfy R NRCell 1 < R NRCell 11 |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -115 | -94 | -78 | The power level values are assigned to satisfy R NRCell 1 < R NRCell 3 < R NRCell 11 |

Table 6.6.2.4.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS adjusts the SS/PBCH EPRE levels according to row "T1" in table 6.6.2.4.3.2-1. | - | - | - | - |
| 2 | Check: Does the UE send an *RRCResumeRequest* on NR Cell 11 within 60s? | - | NR RRC: *RRCResumeRequest* | 1 | F |
| 3 | The SS adjusts the SS/PBCH EPRE levels according to row "T2" in table 6.6.2.4.3.2-1. | - | - | - | - |
| 4 | Check: Does the UE transmit an *RRCResumeRequest* message on NR Cell 3? | --> | NR RRC: *RRCResumeRequest* | 2 | P |
| 5 | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 6 | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 7 | The SS transmits an RRCRelease message including suspendConfig with NR\_RRC\_INACTIVE condition. | <-- | NR RRC: *RRCRelease* | - | - |

6.6.2.4.3.3 Specific message contents

Table 6.6.2.4.3.3-1: SIB4 for NR Cell 1 (preamble and all steps, Table 6.6.2.4.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  |  |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 3 |  |  |
| } |  |  |  |
| } |  |  |  |
| InterFreqCarrierFreqList-v1610 SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-v1610 { | 1 entry |  |  |
| InterFreqCarrierFreqInfo-v1610[1] { |  |  |  |
| InterFreqAllowedCellList-r16 ::= SEQUENCE (SIZE (1..maxCellAllowed)) OF PCI-Range { |  |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 3 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.6.2.4.3.3-2: SIB4 for NR Cell 3 (step 3, Table 6.6.2.4.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB4 ::= SEQUENCE { |  |  |  |
| interFreqCarrierFreqList SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo { | 1 entry |  |  |
| InterFreqCarrierFreqInfo[1] SEQUENCE { |  |  |  |
| dl-CarrierFreq | Same downlink ARFCN as used for NR Cell 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| InterFreqCarrierFreqList-v1610 SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-v1610 { | 1 entry |  |  |
| InterFreqCarrierFreqInfo-v1610[1] { |  |  |  |
| InterFreqAllowedCellList-r16 ::= SEQUENCE (SIZE (1..maxCellAllowed)) OF PCI-Range { |  |  |  |
| PCI-Range[1] SEQUENCE { |  |  |  |
| start | PhysicalCellID of NR Cell 1 |  |  |
| range | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |