**3GPP TSG-RAN WG4 Meeting #94-eR4-2002744**

**E-meeting, 24th Feb, 2020 - 6th Mar, 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.141** | **CR** | **0922** | **rev** | **1** | **Current version:** | **16.4.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of NB-IoT into TS37.141 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | ZTE Corporation | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NB\_IOTenh3 | | | | |  | ***Date:*** | | | 2020-02-24 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | NB-IoT operation in NR in-band is missing in the existing 37.141 spec, therefore propose to add this feature. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Update the CS 16/18/19/17 to include NB-IoT operation in NR in-band; 2. Update the TC21, NTC21, TC22 to include NB-IoT operation in NR in-band; 3. Update the applicability table in section 5 to include NB-IoT operation in NR in-band; 4. Update the TX and RX requirements; | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | NB-IoT operation in NR in-band is missing. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1,3.2,4.6,1,4.6.7,4.7.1,4.8.21,4.8.22,4.8.23,5,6,7.1,7.2.5,7.3.5,7.4.5,7.5.5,7.7.5,7.8,C.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

**<Start of change>**

# 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] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**Band category:** group of operating bands for which the same MSR scenarios apply.

**Base Station RF Bandwidth:** RF bandwidth in which a base station transmits and/or receives single or multiple carrier(s) and/or RATs simultaneously within a supported operating band.

NOTE: In single carrier operation, the Base Station RF Bandwidth is equal to the channel bandwidth.

**Base Station RF Bandwidth edge:** frequency of one of the edges of the Base Station RF Bandwidth.

**Carrier:** modulated waveform conveying the NR, E-UTRA, UTRA or GSM/EDGE physical channels.

**Carrier aggregation:** aggregation of two or more NR or E-UTRA component carriers in order to support wider transmission bandwidths.

**Carrier aggregation band:** set of one or more operating bands across which multiple NR or E-UTRA carriers are aggregated with a specific set of technical requirements.

NOTE: Carrier aggregation band(s) for an E-UTRA BS is declared by the manufacturer.

**Channel bandwidth:** RF bandwidth supporting a single NR, E-UTRA, UTRA or GSM/EDGE RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell.

NOTE: The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

NOTE: The term channel bandwidth is referred to as BS channel bandwidth in the NR specifications, since for NR the BS and UE may operate with differing bandwidths.

**Contiguous carriers:** set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block.

**Carrier power:** power at the antenna connector in the channel bandwidth of the carrier averaged over at least one subframe for NR or E-UTRA, at least one slot for UTRA and the useful part of the burst for GSM/EDGE.

**Contiguous spectrum:** spectrum consisting of a contiguous block of spectrum with no sub-block gap(s).

**Downlink operating band:** part of the operating band designated for downlink.

**Highest Carrier:** carrier with the highest carrier centre frequency transmitted/received in the specified operating band(s).

**Inter RF Bandwidth gap:** frequency gap between two consecutive Base Station RF Bandwidths that are placed within two supported operating bands.

**Inter-band carrier aggregation:** carrier aggregation of NR or E-UTRA component carriers in different operating bands**.**

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

**Inter-band gap:** The frequency gap between two supported consecutive operating bands.

**Intra-band contiguous carrier aggregation:** contiguousNR orE-UTRAcarriers aggregated in the same operating band.

**Intra-band non-contiguous carrier aggregation:** non-contiguousNR orE-UTRAcarriers aggregated in the same operating band.

**Lowest Carrier:** carrier with the lowest carrier centre frequency transmitted/received in the specified operating band(s).

**Lower Base Station RF Bandwidth edge:** frequency of the lower Base Station RF Bandwidth edge, used as a frequency reference point for transmitter and receiver requirements.

**Lower sub-block edge:** frequency at the lower edge of one sub-block.

NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

**Maximum Base Station RF Bandwidth:** maximum RF bandwidth supported by a BS within each supported operating band.

NOTE: The maximum Base Station RF Bandwidth for BS configured for contiguous and non-contiguous operation within each supported operating band is declared separately.

**Maximum carrier output power:** carrier power available at the antenna connector for a specified reference condition.

**Maximum Radio Bandwidth:** maximum frequency difference between the upper edge of the highest used carrier and the lower edge of the lowest used carrier.

**Maximum RAT output power:** sum of the power of all carriers of the same RAT available at the antenna connector for a specified reference condition.

**Maximum throughput:** maximum achievable throughput for a reference measurement channel.

**Maximum total output power:** sum of the power of all carriers available at the antenna connector for a specified reference condition.

**MB-MSR Base Station:** MSR base station characterized by the ability of its transmitter and/or receiver to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different operating band (which is not a sub-band or superseding-band of another supported operating band) than the other carrier(s).

**Mean power:** power measured in the bandwidth and period of measurement applicable for each RAT

NOTE: Mean power for an E-UTRA carrier is defined in TS 36.141 [9] and mean power for a UTRA carrier is defined in TS 25.141 [10]. In case of multiple carriers, the mean power is the sum of the mean power of all carriers.

**Measurement bandwidth**: RF bandwidth in which an emission level is specified.

**MSR Base Station:** base station characterized by the ability of its receiver and transmitter to process two or more carriers in common active RF components simultaneously in a declared Base Station RF Bandwidth, where at least one carrier is of a different RAT than the other carrier(s).

**Multi-band connector**: *antenna* connector of the *BS type 1-C* associated with a transmitter or receiver that is characterized by the ability to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different *operating band* than the other carrier(s) and where this different *operating band* is not a sub-band or superseding-band of another supported operating band.

**Multi-band transmitter:** transmitter characterized by the ability to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different operating band (which is not a sub-band or superseding-band of another supported operating band) than the other carrier(s).

**Multi-band receiver:** receiver characterized by the ability to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different operating band (which is not a sub-band or superseding-band of another supported operating band) than the other carrier(s).

**Non-contiguous spectrum:** spectrum consisting of two or more sub-blocks separated by sub-block gap(s).

**NB-IoT In-band operation:** NB-IoT is operating in-band when it utilizes the resource block(s) within a normal E-UTRA carrier.

**NB-IoT guard band operation:** NB-IoT is operating in guard band when it utilizes the unused resource block(s) within a E-UTRA carrier’s guard-band.

**NB-IoT standalone operation:** NB-IoT is operating standalone when it utilizes its own spectrum, for example the spectrum currently being used by GERAN systems as a replacement of one or more GSM carriers, as well as scattered spectrum for potential IoT deployment.

**NB-IoT operation in NR in-band:** NB-IoT is operating in-band when it is located within a NR transmission bandwidth configuration plus 15 kHz at each edge but not within the NR minimum guard band GBChannel.

**NB-IoT operation in NR guard band:** NB-IoT is operating in guard band when it is located within a NR BS channel bandwidth but is not NB-IoT operation in NR in-band

**Occupied bandwidth:** width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage β/2 of the total mean power of a given emission.

**Operating band:** A frequency range in which NR, E-UTRA, UTRA or GSM/EDGE operates (paired or unpaired), that is defined with a specific set of technical requirements**.**

NOTE: The operating band(s) for a base station is declared by the manufacturer.

**Sub-band:** A sub-band of an operating band contains a part of the uplink and downlink frequency range of the operating band.

**Sub-block:** one contiguous allocated block of spectrum for use by the same base station.

NOTE: There may be multiple instances of sub-blocks within an RF bandwidth.

**Sub-block bandwidth:** RF bandwidth of one sub-block.

**Sub-block gap:** frequency gap between two consecutive sub-blocks within an Base Station RF Bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

**Superseding-band:** A superseding-band of an operating band includes the whole of the uplink and downlink frequency range of the operating band.

**Single-RAT operation:** operation of a base station in an operating band with only one RAT configured in that operating band.

**Synchronized operation:** operation of TDD in two different systems, where no simultaneous uplink and downlink occur.

**RAT power:** sum of all carrier powers for all carriers of the same type.

**Rated carrier output power:** mean power level per carrier that the manufacturer has declared to be available at the antenna connector.

**Rated RAT output power:** mean power level per RAT that the manufacturer has declared to be available at the antenna connector.

**Rated total output power:** total mean power level that the manufacturer has declared to be available at the antenna connector.

**RRC filtered mean power:** mean power of a UTRA carrier as measured through a root raised cosine filter with roll-off factor  and a bandwidth equal to the chip rate of the radio access mode.

NOTE: The RRC filtered mean power of a perfectly modulated UTRA signal is 0.246 dB lower than the mean power of the same signal.

**Throughput:** number of payload bits successfully received per second for a reference measurement channel in a specified reference condition.

**Total output power:** sum of all carrier powers for all carriers transmitted by the BS.

**Total RF Bandwidth**: maximum sum of Base Station RF Bandwidths in all supported operating bands.

**Transmission bandwidth:** bandwidth of an instantaneous NR or E-UTRA transmission from a UE or BS, measured in resource block units.

**Transmission bandwidth configuration:** highest NR or E-UTRA transmission bandwidth allowed for uplink or downlink in a given channel bandwidth, measured in resource block units.

**Transmitter ON period:** time period during which the base station transmitter is transmitting data and/or reference symbols.

**Transmitter OFF period:** time period during which the base station transmitter is not allowed to transmit.

**Transmitter transient period:** time period during which the transmitter is changing from the OFF period to the ON period or vice versa.

**Unsynchronized operation:** peration of TDD in two different systems, where the conditions for synchronized operation are not met.

**Uplink operating band:** part of the operating band designated for uplink.

**Upper Base Station RF Bandwidth edge:** frequency of the upper Base Station RF Bandwidth edge, used as a frequency reference point for transmitter and receiver requirements.

**Upper sub-block edge:** frequency at the upper edge of one sub-block.

NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

 Roll-off factor

 Percentage of the mean transmitted power emitted outside the occupied bandwidth on the assigned channel

BWChannel Channel bandwidth (for E-UTRA and NR)

BWConfig Transmission bandwidth configuration (for E-UTRA), expressed in MHz, where BWConfig = *N*RB x 180 kHz in the uplink and BWConfig = 15 kHz + *N*RB x 180 kHz in the downlink. Transmission bandwidth configuration (for NR), where BWConfig = *N*RB x SCS x 12.

BWRF Base Station RF Bandwidth, where BWRF = FBW RF,high – FBW RF,low

BWRF,max Maximum Base Station RF Bandwidth

DwPTS Downlink part of the special subframe (for E-UTRA TDD operation

f Frequency

Δf Separation between the Base Station RF Bandwidth edge frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency

Δfmax The largest value of Δf used for defining the requirement

ΔfOBUE Maximum offset of the *operating band* unwanted emissions mask from the downlink *operating band* edge

ΔfOOB Maximum offset of the out-of-band boundary from the uplink *operating band* edge

FC Carrier centre frequency

Ffilter Filter centre frequency

f\_offset Separation between the Base Station RF Bandwidth edge frequency and the centre of the measuring filter

f\_offsetmax The maximum value of f\_offset used for defining the requirement

Fblock,high Upper sub-blockedge, where Fblock,high = FC,block,high + Foffset, RAT

Fblock,low Lower sub-blockedge, where Fblock,low = FC,block,low - Foffset, RAT

FBW RF,high Upper Base Station RF Bandwidth edge, where FBW RF,high = FC,high + Foffset, RAT

FBW RF,low Lower Base Station RF Bandwidth edge, where FBW RF,low = FC,low - Foffset, RAT

FC band, high Center frequency of the highest transmitted/received carrier in a band.

FC band, low Center frequency of the lowest transmitted/received carrier in a band.

FC,block, high Centre frequency of the highest transmitted/received carrier in a sub-block.

FC,block, low Centre frequency of the lowest transmitted/received carrier in a sub-block.

FC,high Centre frequency of the highest transmitted/received carrier.

FC,low Centre frequency of the lowest transmitted/received carrier.

Foffset, RAT Frequency offset from the centre frequency of the *highest* transmitted/received carrier to the *upper* Base StationRF Bandwidth edge, sub-block edge or Inter RF Bandwidth edge, or from the centre frequency of the *lowest* transmitted/received carrier to the *lower* Base StationRF Bandwidth edge, sub-block edge or Inter RF Bandwidth edge for a specific RAT.

FDL\_low The lowest frequency of the downlink operating band

FDL\_high The highest frequency of the downlink operating band

FUL\_low The lowest frequency of the uplink operating band

FUL\_high The highest frequency of the uplink operating band

GBChannel Minimum guard band defined in TS 38.104 [27] clause 5.3.3

NRB Transmission bandwidth configuration, expressed in units of resource blocks (for E-UTRA)

PEM,B32,B75,B76,ind Declared emission level in Band 32, Band 75 and Band 76, ind=a, b, c

PEM,B32,ind Declared emission level in Band 32, ind= d, e

PEM,B50,B74,B75,ind Declared emission level for Band 50, Band 74 and Band 75, ind=a,b

Pmax Maximum total output power

Pmax,c Maximum carrier output power

Pmax,RAT Maximum RAT output power

PRated,c Rated carrier output power

PREFSENS Reference Sensitivity power level

Wgap Sub-block gap size or Inter RF Bandwidth gap size

**<NEXT of change>**

## 4.6 Manufacturer's declarations of regional and optional requirements

### 4.6.1 Operating band and frequency range

The manufacturer shall declare which operating band(s) specified in clause 4.4 that is supported by the BS under test and if applicable, which frequency ranges within the operating band(s) that the Base Station can operate in. Requirements for other operating bands and frequency ranges need not be tested.

The manufacturer shall declare which operating band(s) specified in clause 4.4 are supported by the BS under test for carrier aggregation.

The manufacturer shall declare which NB-IoT operating mode (standalone, NB-IoT operation in E-UTRA in-band and/or guard band, NB-IoT operation in NR in-band) the BS supports for the declared supported band.

For each supported E-UTRA channel bandwidth, manufacturer shall declare if BS supports NB-IoT in-band and/or guard band operation and the number of supported NB-IoT PRBs.

For each supported NR channel bandwidth, manufacturer shall declare if BS supports NB-IoT operation in NR in-band and the number of supported NB-IoT PRBs.

**<NEXT of change>**

### 4.6.7 NB-IoT power dynamic range

If the BS supports E-UTRA with NB-IoT operating in-band and/or in guard band, manufacturer shall declare the maximum power dynamic range it could support with a minimum of +6dB as mentioned in TS 36.104 [5] clause 6.3.3.

If the BS supports 5 MHZ E-UTRA with NB-IoT operating in guard band, manufacturer shall also declare the maximum power that could be allocated to this NB-IoT PRB.

If the BS supports NB-IoT operation in NR in-band, manufacturer shall declare the maximum power dynamic range it could support with a minimum requirement as defined in TS 38.104 [27] clause 6.3.4.

**<NEXT of change>**

## 4.7 Capability set definition and manufacturer's declarations of supported RF configurations

### 4.7.1 Definition of Capability Sets (CS)

Capability set is defined as the BS capability to support certain RAT combinations in an operating band.

The manufacturer shall declare the supported capability set(s) according to Table 4.7.1-1 and Table 4.7.1.-2 for each supported operating band.

Table 4.7.1-1: Capability sets

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Capability Set supported by the BS | CS1 | CS2 | CS3 | CS4 | CS5 | CS6 | CS7 |
| Supported RATs | UTRA  (MC) | E-UTRA  (MC)3 | UTRA,  E-UTRA3 | GSM, UTRA | GSM, E-UTRA3 | GSM, UTRA, E-UTRA | GSM, UTRA, E-UTRA3 |
| Supported configurations | SR UTRA (SC, MC) | SR  E-UTRA3 (SC, MC, CA) | MR UTRA + E-UTRA3  SR UTRA (SC, MC)  SR E-UTRA3 (SC, MC, CA) | MR GSM + UTRA  SR GSM (MCBTS)  SR UTRA (SC, MC) | MR GSM + E-UTRA3  SR GSM (MCBTS)  SR E-UTRA3 (SC, MC, CA) | MR GSM + UTRA +  E-UTRA  MR GSM + UTRA  MR GSM + E-UTRA  MR UTRA + E-UTRA  SR GSM (MCBTS)  SR UTRA (SC, MC)  SR E-UTRA (SC, MC, CA) | MR GSM + UTRA2  MR GSM +  E-UTRA3  MR E-UTRA3 + UTRA2  SR UTRA (SC, MC)2  SR E-UTRA3 (SC, MC) |
| Applicable BC | BC1, BC2 or BC3 | BC1, BC2 or BC3 | BC1, BC2 or BC3 | BC2 | BC2 | BC2 | BC2 |
| NOTE 1: MC denotes multi-carrier in single RAT; SC denotes single carrier; MR denotes multi-RAT; SR denotes single-RAT.  NOTE 2: For this configuration related to BC2 bands, the support of UTRA in band 3 is declared by the manufacturer.  NOTE 3: Includes optional (declared by the manufacturer) support of NB-IoT in-band and/or NB-IoT guard band operation within E-UTRA carrier(s)  NOTE 4: Void  NOTE 5: Void | | | | | | | |

Table 4.7.1-1A: Capability sets

|  |  |  |  |
| --- | --- | --- | --- |
| Capability Set supported by the BS | CS16 | CS18 | CS19 |
| Supported RATs | NR4, E-UTRA3 | GSM, E-UTRA3, NR4 | UTRA, E-UTRA3, NR4 |
| Supported configurations | MR E-UTRA3 + NR4  SR NR4  (SC, MC, CA)  SR E-UTRA3 (SC, MC, CA) | SR E-UTRA3 (SC, MC, CA)  SR NR4 (SC, MC, CA)  MR GSM + E-UTRA3  MR GSM + NR4  MR E-UTRA3 + NR4  MR GSM+ E-UTRA3 + NR4 | SR UTRA (SC, MC)  SR E-UTRA3 (SC, MC, CA)  SR NR4 (SC, MC, CA)  MR UTRA + E-UTRA3  MR UTRA + NR4  MR E-UTRA3 + NR4  MR UTRA + E-UTRA3 + NR4 |
| Applicable BC | BC1, BC2 or BC3 | BC2 | BC1, BC2 |
| NOTE 1: MC denotes multi-carrier in single RAT; SC denotes single carrier; MR denotes multi-RAT; SR denotes single-RAT.  NOTE 2: For this configuration related to BC2 bands, the support of UTRA in band 3 is declared by the manufacturer.  NOTE 3: Includes optional (declared by the manufacturer) support of NB-IoT in-band and/or NB-IoT guard band operation within E-UTRA carrier(s)  NOTE 4: Includes optional (declared by the manufacturer) support of NB-IoT operation in NR in-band within NR carrier(s). | | | |

Table 4.7.1-2 Capability sets with NB-IoT standalone operation

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Capability Set supported by the BS | CS8 | CS9 | CS10 | CS11 | CS12 | CS13 | CS14 | CS15 | CS17 |
| Supported RATs | NB-IoT standalone | GSM,  NB-IoT standalone | UTRA,  NB-IoT standalone | E-UTRA,  NB-IoT standalone | GSM, UTRA,  NB-IoT standalone | GSM, E‑UTRA,  NB-IoT standalone | UTRA, E‑UTRA,  NB-IoT standalone | GSM, UTRA, E-UTRA,  NB-IoT standalone | NR6, E-UTRA3, NB-IoT standalone |
| Supported configurations | SR NB-IoT standalone (SC, MC) | MR GSM + NB-IoT standalone  SR GSM (MCBTS)  SR NB-IoT standalone (SC, MC) | MR UTRA +  NB-IoT standalone  SR UTRA (SC, MC)  SR NB-IoT standalone (SC, MC) | MR E-UTRA + NB-IoT standalone  SR E-UTRA (SC, MC, CA)  SR NB-IoT standalone (SC, MC) | MR GSM + UTRA + NB‑IoT standalone  SR GSM (MCBTS)  SR UTRA (SC, MC)  SR NB-IoT standalone (SC, MC)  MR GSM +  NB-IoT standalone  MR UTRA +  NB-IoT standalone  MR GSM +  UTRA | MR GSM + E‑UTRA + NB-IoT standalone  SR GSM (MCBTS)  SR E-UTRA (SC, MC, CA)  SR NB-IoT standalone (SC, MC)  MR GSM +  NB-IoT standalone  MR E-UTRA + NB-IoT standalone  MR GSM +  E-UTRA | MR UTRA + E-UTRA + NB-IoT standalone  SR UTRA (SC, MC)  SR E-UTRA (SC, MC, CA)  SR NB-IoT standalone (SC, MC)  MR UTRA +  NB-IoT standalone  MR E-UTRA + NB-IoT standalone  MR UTRA +  E-UTRA | MR GSM + UTRA2 + NB‑IoT standalone  MR GSM + E‑UTRA + NB-IoT standalone  MR UTRA2 + E-UTRA + NB-IoT standalone  MR GSM +  NB-IoT standalone  MR UTRA2 +  NB-IoT standalone  MR E-UTRA + NB-IoT standalone  MR GSM + UTRA2  MR GSM +  E-UTRA  MR E-UTRA + UTRA2  SR UTRA (SC, MC)2  SR E-UTRA (SC, MC)  SR NB-IoT standalone (SC, MC) | MR E-UTRA3 + NR  SR NR  (SC, MC, CA)  SR E-UTRA3 (SC, MC, CA)  SR NB-IoT standalone  (SC, MC)  MR E-UTRA3 + NB-IoT standalone  MR NR + NB‑IoT standalone  MR NR + E‑UTRA3 + NB‑IoT standalone |
| Applicable BC | BC1, BC2 or BC3 | BC2 | BC1, BC2 or BC3 | BC1, BC2 or BC3 | BC2 | BC2 | BC1, BC2 or BC3 | BC2 | BC1, BC2 or BC3 |
| NOTE 1: MC denotes multi-carrier in single RAT; SC denotes single carrier; MR denotes multi-RAT; SR denotes single-RAT.  NOTE 2: For this configuration related to BC2 bands, the support of UTRA in band 3 is declared by the manufacturer.  NOTE 3: Includes optional (declared by the manufacturer) support of NB-IoT in-band and/or NB-IoT guard band operation within E-UTRA carrier(s).  NOTE 4: Void  NOTE 5: Void  NOTE 6: Includes optional (declared by the manufacturer) support of NB-IoT operation in NR in-band within NR carrier(s). | | | | | | | | | |

The applicable test configurations for each RF requirement are defined in sub-clause 5.1 and 5.2 for the declared capability set(s). For a BS declared to be capable of multi-band operation, the applicable test configurations for each RF requirement are defined in sub-clause 5.3 for the declared capability set(s).

NOTE: Not every supported configuration within a CS is tested, but the tables in sub-clause 5.1, 5.2 and 5.3 provide a judicious choice among the supported configurations and test configurations to ensure proper test coverage.

**<NEXT of change>**

### 4.8.21 TC21: Contiguous operation in CS16, 18, 19

#### 4.8.21.0 General

The purpose of TC21, TC21a and TC21b is to test multi-RAT operations with NR.

Unless otherwise stated, for all test configurations in this clause, the narrowest supported NR channel bandwidth and lowest SCS for that bandwidth for the operating band shall be used in the test configuration.

Unless otherwise stated, the E-UTRA bandwidth shall be 5 MHz unless the BS does not support 5 MHz E-UTRA, in which case the E-UTRA bandwidth shall be the lowest supported bandwidth for the operating band.

#### 4.8.21.1 TC21 generation

TC21 is only applicable for a BS that supports E-UTRA and NR. TC21 is constructed using the following method:

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band adjacent to the lower Base Station RF Bandwidth edge. Place the power boosted NB-IoT RB at the lower outermost eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier adjacent to the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

* If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.
* If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.
* If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place an E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- For transmitter tests, alternately add NR carriers at the low end and E-UTRA carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

#### 4.8.21.1A TC21a generation

TC21a is only applicable for a BS that supports GSM, E-UTRA and NR. TC21a is constructed using the following method:

For transmitter tests, if the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of TC21a shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use TC21a shall be performed using both instances 1) and 2) of TC21a except tests for modulation accuracy in which only TC21a according to 2) shall be used.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- Place a GSM carrier at the lower Base Station RF Bandwidth edge and:

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT RB at the upper outermost RB eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported:

* If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.
  + If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.
  + If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a GSM carrier adjacent to the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply. Place one E-UTRA carrier adjacent to the already placed GSM carrier. The specified FOffset-RAT shall apply.

- Place one NR carrier adjacent to the already placed carrier at the upper Base Station RF bandwidth edge.

- For transmitter tests, add GSM carriers at the lower edge using 600 kHz spacing until no more GSM carriers are supported or no more GSM carriers fit. Add alternately NR carriers and E-UTRA carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

#### 4.8.21.1B TC21b generation

TC21b is only applicable for a BS that supports UTRA, E-UTRA and NR. TC21b is constructed using the following method:

For transmitter tests, if the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of TC21b shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use TC21b shall be performed using both instances 1) and 2) of TC21b.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band adjacent to the lower Base Station RF Bandwidth edge. Place the power boosted NB-IoT RB at the lower outermost RB eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier adjacent to the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

* + If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.
  + If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.
  + If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- Place UTRA carrier adjacent to the already placed E-UTRA carrier. The UTRA FDD may be shifted maximum 100 kHz towards lower frequencies to align with the channel raster.

- For transmitter tests, alternately add NR carriers at the low end and E-UTRA carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

#### 4.8.21.2 TC21 power allocation

a) Unless otherwise stated, set each carrier to the same power so that the sum of the carrier powers equals the rated total output power as appropriate for the test configuration according to manufacturer’s declarations in subclause 4.7.2

b) In case that TC21 is configured for testing modulation quality, the power allocated per carrier for the RAT on which modulation quality is measured shall be the highest possible for the given modulation configuration according to the manufacturer’s declarations in subclause 4.7.2, unless that power is higher than the level defined by case a). The power of the remaining carriers from other RAT(s) shall be set to the same level as in case a).

If in the case of b) the power of one RAT needs to be reduced in order to meet the manufacture’s declaration the power in the other RAT(s) does not need to be increased.

### 4.8.22 NTC21: Non-contiguous operation in CS16, 18, 19

#### 4.8.22.0 General

The purpose of NTC21, NTC21a and NTC21b is to test multi-RAT operations with NR.

Unless otherwise stated, for all test configurations in this clause, the narrowest supported NR channel bandwidth and lowest SCS for that bandwidth shall be used in the test configuration.

Unless otherwise stated, the E-UTRA bandwidth shall be 5 MHz unless the BS does not support 5 MHz E-UTRA, in which case the E-UTRA bandwidth shall be the lowest supported bandwidth.

#### 4.8.22.1 NTC21 generation

NTC21 is only applicable for a BS that supports E-UTRA and NR. NTC21 is constructed using the following method:

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth for non-contiguous operation. The Base Station RF Bandwidth consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum Base Station RF Bandwidth.

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band adjacent to the lower Base Station RF Bandwidth edge. Place the power boosted NB-IoT RB at the lower outermost RB eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier adjacent to the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

* + If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.
  + If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.
  + If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place an E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- The sub-block edges adjacent to the sub-block gap shall be determined using the specified FOffset-RAT for the carrier adjacent to the sub-block gap.

#### 4.8.22.1A NTC21a generation

NTC21a is only applicable for a BS that supports GSM, E-UTRA and NR. NTC21a is constructed using the following method:

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of NTC21a shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use NTC21a shall be performed using both instances 1) and 2) of NTC21a except:

1) Tests for modulation accuracy in which only NTC21a according to 2) shall be used.

2) If the reduced number of supported carriers is 6 or more, only instance 1) of NTC21a shall be used.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth for non-contiguous operation. The Base Station RF Bandwidth consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum Base Station RF Bandwidth.

- Place a GSM carrier at the lower RF Bandwidth edge. The specified FOffset-RAT shall apply. Place one GSM carrier adjacent to the upper sub-block edge of the lower sub-block.

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band in the middle of the lower sub-block bandwidth and place the power boosted NB-IoT RB at the lower outermost RB eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band.

- If NB-IoT operation in NR in-band is not supported, place NR carrier in the middle of the lower sub-block bandwidth.

* + If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.
  + If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.
  + If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a GSM carrier adjacent to the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- Place a GSM carrier adjacent to the lower sub-block edge of the upper sub-block. Place an E-UTRA carrier in the middle of the upper sub-block bandwidth.

- The nominal carrier spacing defined in subclause 4.5.1 shall apply. The sub-block edges adjacent to the sub-block gap shall be determined using the specified FOffset-RAT for the carrier adjacent to the sub-block gap.

#### 4.8.22.1B NTC21b generation

NTC21b is only applicable for a BS that supports UTRA, E-UTRA and NR. NTC21b is constructed using the following method:

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, two instances of NTC21b shall be generated using the following values for rated total output power and the total number of supported carriers:

1) The rated total output power and the reduced number of supported carriers at the rated total output power in Multi-RAT operations

2) The reduced rated total output power at the total number of supported carriers in Multi-RAT operations and the total number of supported carriers.

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, tests that use NTC21b shall be performed using both instances 1) and 2) of NTC21b except if the reduced number of supported carriers is 4 or more, only instance 1) of NTC21b shall be used.

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth for non-contiguous operation. The Base Station RF Bandwidth consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum Base Station RF Bandwidth.

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band adjacent to the lower Base Station RF Bandwidth edge. Place the power boosted NB-IoT RB at the lower outermost RB eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- If NB-IoT operation in NR in-band is not supported, place an NR carrier adjacent to the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

* + If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the upper Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply.
  + If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. Place the power boosted NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.
  + If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place an E-UTRA carrier adjacent to the upper Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply.

- Place a UTRA carrier adjacent to the lower sub-block edge of the upper sub-block.

- For transmitter tests, place one UTRA adjacent to the upper sub-block edge of the lower sub-block. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

- The sub-block edges adjacent to the sub-block gap shall be determined using the specified FOffset-RAT for the carrier adjacent to the sub-block gap. The carrier(s) may be shifted maximum 100 kHz towards higher frequencies to align with the channel raster.

#### 4.8.22.2 NTC21 power allocation

a) Unless otherwise stated, set each carrier to the same power so that the sum of the carrier powers equals the rated total output power appropriate for the test configuration according to manufacturer’s declarations in subclause 4.7.2.

b) In case that NTC21 is configured for testing modulation quality, the power allocated per carrier for the RAT on which modulation quality is measured shall be the highest possible for the given modulation configuration according to the manufacturer’s declarations in subclause 4.7.2, unless that power is higher than the level defined by case a). The power of the remaining carriers from other RAT(s) shall be set to the same level as in case a).

If in the case of b) the power of one RAT needs to be reduced in order to meet the manufacture’s declaration the power in the other RAT(s) does not need to be increased.

### 4.8.23 TC22: Contiguous operation in CS17

#### 4.8.23.1 TC22 generation

TC22 is constructed using the following method:

- The Base Station RF Bandwidth shall be the declared maximum Base Station RF Bandwidth.

- Place a standalone NB-IoT carrier at the upper Base Station RF Bandwidth edge.

- If NB-IoT operation in NR in-band is supported, place an NR carrier with NB-IoT operation in NR in-band adjacent to the lower Base Station RF Bandwidth edge. Place the power boosted NB-IoT RB at the lower outermost RB eligible (according to clause 5.7.3 of TS 36.104 [5] and the definition in clause 3.1) in-band position closest to NR minimum guard band for NB-IoT operation in NR in-band at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply. Place a 5MHz / 15kHz SCS E-UTRA carrier adjacent to the 5MHz NR carrier.

- If NB-IoT operation in NR in-band is not supported and:

* + If NB-IoT guard band operation is supported, place a 10 MHz E-UTRA carrier adjacent to the lower Base Station RF Bandwidth edge. Place the NB-IoT PRB at the outermost guard-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the lower Base Station RF Bandwidth edge and adjacent to the E-UTRA PRB edge as close as possible (i.e., away from the lower Base Station RF Bandwidth edge). The specified FOffset-RAT shall apply. Place a 5MHz / 15kHz SCS NR carrier adjacent to the 10 MHz E-UTRA carrier.
  + If NB-IoT guard-band operation is not supported and NB-IoT in-band operation is supported, place a 5 MHz E-UTRA carrier adjacent to the lower Base Station RF Bandwidth edge. Place the NB-IoT PRB at the outermost in-band position eligible for NB-IoT PRB (according to subclause 4.5.3) at the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply. Place a 5MHz / 15kHz SCS NR carrier adjacent to the 5 MHz E-UTRA carrier.
  + If neither NB-IoT guard-band nor NB-IoT in-band operation is supported, place a 5MHz/15kHz SCS NR carrier adjacent to the lower Base Station RF Bandwidth edge. The specified FOffset-RAT shall apply. Place a 5 MHz E-UTRA carrier adjacent to the 5MHz / 15kHz SCS NR carrier.

- For transmitter tests, alternately add 5MHz E-UTRA carriers at the low end and NB-IoT standalone carriers at the high end adjacent to the already placed carriers until the Base Station RF Bandwidth is filled or the total number of supported carriers is reached. The nominal carrier spacing defined in subclause 4.5.1 shall apply.

- If NR 5MHz and/or E-UTRA 5/10 MHz channel bandwidth is not supported, the narrowest carrier shall be selected. If 15kHz SCS is not supported for particular NR operating band, the smallest supported SCS declared per operating band shall be selected.

#### 4.8.23.2 TC22 power allocation

Set the power of each carrier to the same power so that the sum of the carrier powers equals the rated total output power according to the manufacturer’s declaration in subclause 4.7.2.

**<NEXT of change>**

# 6 Transmitter characteristics

## 6.1 General

General test conditions for transmitter tests are given in clause 4, including interpretation of measurement results and configurations for testing. BS configurations for the tests are defined in subclause 4.10.

Unless otherwise stated, a BS declared to be capable of E-UTRA with NB-IoT in-band or guard band operations (or any combination with GSM and/or UTRA or NR) is only required to pass the transmitter tests for E-UTRA with NB-IoT in-band or guard band (or any combination with GSM and/or UTRA or NR); it is not required to perform the transmitter tests again for E-UTRA only (or any combination with GSM and/or UTRA or NR).

Unless otherwise stated, a BS declared to be capable of E-UTRA with NB-IoT in-band and guard band operations (or any combination with GSM and/or UTRA or NR) needs only to pass the transmitter tests for E-UTRA with guard band operation (or any combination with GSM and/or UTRA or NR).

Unless otherwise stated, a BS declared to be capable of NB-IoT operation in NR in-band (or any combination with GSM and/or UTRA or E-UTRA) is only required to pass the transmitter tests for NB-IoT operation in NR in-band (or any combination with GSM and/or UTRA or E-UTRA); it is not required to perform the transmitter tests again for NR only (or any combination with GSM and/or UTRA or E-UTRA).

**<NEXT of change>**

## 6.3 Output power dynamics

### 6.3.1 Definition and applicability

Output power dynamics is defined by the MSR BS transmitter’s ability to operate at varying output power levels.

### 6.3.2 Minimum Requirement

The minimum requirement is in TS 37.104 [2] subclause 6.3.

### 6.3.3 Test purpose

The test purpose is to verify that the output power dynamics are met as specified by the minimum requirement.

### 6.3.4 Method of test

For this requirement Tables 5.1-1 and 5.2-1 refer to single-RAT specifications; see clause 5, for a BS declared to support CS1 to CS6, CS8 to CS14, CS16 to CS17 or CS19. The following shall apply for a BS declared to support CS1 to CS6, CS8 to CS14, CS16 to CS17 or CS19:

- For references to TS 38.141-1 [26], the method of test is specified in TS 38.141-1 [26], subclause 6.3.3.4 and 6.3.4.4.

- For references to TS 36.141 [9], the method of test is specified in TS 36.141 [9], subclause 6.3.2.4 and 6.3.3.4.

- For references to TS 25.141 [10], the method of test is specified in TS 25.141 [10], subclause 6.4.2.4, 6.4.3.4, 6.4.4.4 and 6.4.5.4.

- For references to TS 25.142 [12], the method of test is specified in TS 25.142 [12], subclause 6.4.2.4, 6.4.3.4, 6.4.4.4, 6.4.5.4 and 6.4.6.4.

- For references to TS 51.021 [11], the method of test is specified in TS 51.021 [11], subclause 6.3 and 6.4.

If a BS is declared to support CS7, CS15 or CS18, the following shall apply:

- For references to TS 36.141 [9], the method of test is specified in TS 36.141 [9], subclause 6.3.2.4 and 6.3.3.4.

- For references to TS 25.141 [10], the method of test is specified in TS 25.141 [10], subclause 6.4.2.4, 6.4.3.4, 6.4.4.4 and 6.4.5.4.

- For testing GSM/EDGE output power dynamics, steps in subclause 6.3.4.1 and 6.3.4.2 shall apply.

#### 6.3.4.1 Initial conditions for GSM/EDGE output power dynamics for CS7, CS15 or CS18

Base Station RF Bandwidth positions to be tested: MRFBW in single-band operation, see subclause 4.9.1,

1) Set up the equipment as shown in Annex D.1.1.

#### 6.3.4.2 Procedure for GSM/EDGE output power dynamics for CS7, CS15 or CS18

1) Set the BS to transmit according to the applicable test configuration in clause 5 using the corresponding test models or set of physical channels in subclause 4.9.2. The highest possible power shall be allocated to GSM carriers taking into account declared rated total output power for Sub-group 2 and maximum supported power difference between carriers.

2) Perform the measurement on a GSM/EDGE carrier as follows: For every measured GSM/EDGE carrier, the requirement and the method of test is specified in TS 51.021 [11], applicable parts of subclause 6.3 and 6.4.

In addition, for a multi-band capable BS, the following step shall apply:

- For multi-band capable BS and single band tests, repeat the tests per involved band where single carrier test models shall apply with no carrier activated in the other band. For multi-band capable BS with separate antenna connector, the antenna connector not being under test shall be terminated.

### 6.3.5 Test Requirement

For E-UTRA, the test requirement is specified in TS 36.141 [9], subclause 6.3.2.5.

For UTRA FDD, the test requirement is specified in TS 25.141 [10], subclause 6.4.2.5, 6.4.3.5, 6.4.4.5 and 6.4.5.5.

For UTRA TDD, the test requirement is specified in TS 25.142 [12], subclause 6.4.2.5, 6.4.3.5, 6.4.4.5, 6.4.5.5 and 6.4.6.5.

For GSM/EDGE, the test requirement is specified in TS 51.021 [11], subclause 6.3.4 and 6.4.4.

For NB-IoT operation in E-UTRA in-band or guard band, the test requirement is specified in TS 36.141 [9], subclause 6.3.3.5

For NB-IoT operation in NR in-band, the test requirement is specified in TS 38.141-1 [26], subclause 6.3.4.5.

For NR, the test requirement is specified in TS 38.141-1 [26], subclause 6.3.3.5.

**<NEXT of change>**

##### 6.6.4.5.5 NB-IoT test requirement

For NB-IoT in-band and guard band operation, the E-UTRA minimum requirement specified in clause 6.6.4.5.1 shall apply.

For NB-IoT operation in NR in-band, the NR minimum requirement specified in section 6.6.4.5.6 shall apply.

For NB-IoT standalone operation, the ACLR shall be higher than the value specified in Table 6.6.4.5.5-1.

**<NEXT of change>**

# 7 Receiver characteristics

## 7.1 General

General test conditions for receiver tests are given in clause 4, including interpretation of measurement results and configurations for testing. BS configurations for the tests are defined in subclause 4.10.

Unless otherwise stated the requirements in clause 7 apply during the Base Station receive period.

Unless otherwise stated, a BS declared to be capable of E-UTRA with NB-IoT in-band or guard band operations (or any combination with GSM and/or UTRA and/or NR) is only required to pass the receiver tests for E-UTRA with NB-IoT in-band or guard band (or any combination with GSM and/or UTRA and/or NR); it is not required to perform the receiver tests again for E-UTRA only (or any combination with GSM and/or UTRA and/or NR).

For a BS declared to be capable of E-UTRA (and where applicable NR) with NB-IoT in-band operations, it is not required to perform the receiver test for subPRB allocation.

Unless otherwise stated, a BS declared to be capable of NB-IoT operation in NR in-band (or any combination with GSM and/or UTRA and/or E-UTRA) is only required to pass the receiver tests for NB-IoT operation in NR in-band (or any combination with GSM and/or UTRA and/or E-UTRA); it is not required to perform the receiver tests again for NR only (or any combination with GSM and/or UTRA and/or E-UTRA).

For a BS declared to be capable of NB-IoT operation in NR in-band (and where applicable E-UTRA) , it is not required to perform the receiver test for subPRB allocation.

**<NEXT of change>**

## 7.2 Reference sensitivity level

### 7.2.5 Test requirements

For E-UTRA the test requirement is in TS 36.141 [9] subclause 7.2.5.

For UTRA-FDD the test requirement is in TS 25.141 [10] subclause 7.2.5.

For UTRA-TDD the test requirement is in TS 25.142 [12] subclause 7.2.5.

For GSM-EDGE the test requirement is in TS 51.021 [11] subclauses 7.3 and 7.4.

For NB-IoT standalone or operation in E-UTRA in-band/guard band the test requirement is in TS 36.141 [9] subclause 7.2.5.

For NB-IoT operation in NR in-band, the test requirement is in TS 38.141-1 [26] subclause 7.2.5.

For NR the test requirement is in TS 38.141-1 [26] subclause 7.2.5.

**<NEXT of change>**

## 7.3 Dynamic range

### 7.3.5 Test requirements

For E-UTRA the test requirement is in TS 36.141 [9] subclause 7.3.5.

For UTRA-FDD the test requirement is in TS 25.141 [10] subclause 7.3.5.

For UTRA-TDD the test requirement is in TS 25.142 [12] subclause 7.3.5.

For GSM-EDGE the test requirement is in TS 51.021 [11] subclause 7.1.

For NB-IoT standalone or operation in E-UTRA in-band/guard band the test requirement is in TS 36.141 [9] subclause 7.3.5.

For NB-IoT operation in NR in-band the test requirement is in TS 38.141-1 [26] subclause 7.3.5.

For NR the test requirement is in TS 38.141-1 [26] subclause 7.3.5.

**<NEXT of change>**

## 7.4 In-band selectivity and blocking

### 7.4.5 Test requirements

#### 7.4.5.1 General blocking test requirement

For the general blocking requirement, the interfering signal shall be a UTRA FDD signal as specified in Annex A.1 for a UTRA, E-UTRA, NB-IOT, GSM/EDGE or NR (≤ 20 MHz) wanted signal. The interfering signal shall be a 20 MHz E-UTRA signal for NR wanted signal channel bandwidth greater than 20MHz.

The requirement is applicable outside the Base Station RF Bandwidth or Maximum Radio Bandwidth. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Maximum Radio Bandwidth edges.

For BS operating in non-contiguous spectrum, the requirement applies in addition inside any sub-block gap, in case the sub-block gap size is at least 15MHz. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For BS capable of multi-band operation, the requirement applies in addition inside any Inter RF Bandwidth gap, in case the gap size is at least 15MHz. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

For the wanted and interfering signal coupled to the Base Station antenna input, using the parameters in Table 7.4.5.1-1 and 7.4.5.1-2, the following requirements shall be met:

- For any measured E-UTRA carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured UTRA FDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.104 [3], subclause 7.2.

- For any measured UTRA TDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.105 [4], subclause 7.2.

- For any measured GSM/EDGE carrier, the conditions are specified in TS 45.005 [6], Annex P.2.1.

- For any measured NB-IoT carrier (standalone or operating in E-UTRA in-band/guard band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2

- For any measured NB-IoT carrier (operating in NR in-band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

- For any measured NR carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

For BS capable of multi-band operation, the requirement applies according to Table 7.4.5.1‑1 for the in-band blocking frequency ranges of each supported operating band.

Table 7.4.5.1-1: General blocking requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Base Station Type | Mean power of interfering signal [dBm] | Wanted Signal mean power [dBm]  (Note 1) | Centre Frequency of Interfering Signal | Interfering signal centre frequency minimum frequency offset from the Base Station RF Bandwidth edge or sub-block edge inside a gap [MHz] |
| Wide Area BS | -40+y (Note 7) | PREFSENS + x dB  (Note 2) | FUL\_low - ΔfOOB to FUL\_high + ΔfOOB (Note 8) | ± (7.5 + z) (Note 9) |
| Medium Range BS | -35+y (Note 7) | PREFSENS + x dB  (Note 3, 6) |
| Local Area BS | -30+y (Note 7) | PREFSENS + x dB  (Note 4, 6) |
| NOTE 1: PREFSENS depends on the RAT, the BS class and on the channel bandwidth, see subclause 7.2 in TS 37.104.  NOTE 2: For WA BS, “x” is equal to 6 in case of NR or E-UTRA or UTRA or NB-IoT wanted signals and equal to 3 in case of GSM/EDGE wanted signal.  NOTE 3: For MR BS supporting GSM and/or UTRA, “x” is equal to 6 in case of UTRA wanted signals, 9 in case of NR or E-UTRA or NB-IoT wanted signal and 3 in case of GSM/EDGE wanted signal.  NOTE 4: For LA BS supporting GSM and/or UTRA, “x” is equal to 11 in case of NR or E-UTRA or NB-IoT wanted signal, 6 in case of UTRA wanted signal and equal to 3 in case of GSM/EDGE wanted signal.  NOTE 5: For a BS capable of multi-band operation, “x” in Note 2, 3, 4, 6 applies in case of interfering signals that are in the in-band blocking frequency range of the operating band where the wanted signal is present or in an adjacent or overlapping band. For other in-band blocking frequency ranges of the interfering signal for the supported operating bands, “x” is equal to 1.4 dB.  NOTE 6: For a BS neither supporting UTRA nor GSM, x is equal to 6 for all BS classes if NR is supported, otherwise “x” is equal to 9 for MR BS or 11 for LA BS if NR is not supported.  NOTE 7: For a BS supporting NR but neither UTRA nor GSM, “y” is equal to -3 for the WA and MR BS class and -5 for the LA BS class. For all other cases, “y” is equal to zero for all BS classes.  NOTE 8: The downlink frequency range of an FDD operating band is excluded from the general blocking requirement.  NOTE 9: For NR wanted signal channel bandwidth greater than 20 MHz, z = 22.5. For all other cases, z = 0. | | | | |

Table 7.4.5.1-2: Void

NOTE: The requirement in Table 7.4.5.1-1 assumes that two operating bands, where the downlink operating band (see Table 4.4-1 and Table 4.4-2) of one band would be within the in-band blocking region of the other band, are not deployed in the same geographical area.

#### 7.4.5.2 General narrowband blocking test requirement

For the narrowband blocking requirement, the interfering signal shall be an E-UTRA 1RB signal as specified in Annex A.3.

The requirement is applicable outside the Base Station RF Bandwidth or Maximum Radio Bandwidth. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Maximum Radio Bandwidth edges.

For BS operating in non-contiguous spectrum, the requirement applies in addition inside any sub-block gap, in case the sub-block gap size is at least 3MHz. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For BS capable of multi-band operation, the requirement applies in addition inside any Inter RF Bandwidth gap in case the gap size is at least 3MHz. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

For the wanted and interfering signal coupled to the Base Station antenna input, using the parameters in Table 7.4.5.2-1 the following requirements shall be met:

- For any measured E-UTRA carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured UTRA FDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.104 [3], subclause 7.2.

- For any measured UTRA TDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.105 [4], subclause 7.2.

- For any measured GSM/EDGE carrier, the conditions are specified in TS 45.005 [6], Annex P.2.1.

- For any measured NB-IoT carrier(standalone or operating in E-UTRA in-band/guard band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured NB-IoT carrier (operating in NR in-band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined inTS 38.104 [27], subclause 7.2.

- For any measured NR carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

Table 7.4.5.2-1: Narrowband blocking requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Base Station Type | RAT of the carrier | Wanted signal mean power [dBm]  (Note 1, 2, 6) | Interfering signal mean power [dBm] | Interfering RB (Note 3) centre frequency offset from the Base Station RF Bandwidth edge or sub-block edge inside a gap [kHz] |
| Wide Area BS | NR, E-UTRA, NB-IoT (Note 4), UTRA and GSM/EDGE | PREFSENS + x dB | -49 | ±(240 +m\*180),  m=0, 1, 2, 3, 4, 9, 14 (Note 5)  ±(550 +m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 (Note 6) |
| Medium Range BS | -44 |
| Local Area BS | -41 |
| NOTE 1: PREFSENS depends on the RAT, the BS class and on the channel bandwidth, see subclause 7.2 in TS 37.104.  NOTE 2: “x” is equal to 6 in case of NR, E-UTRA or UTRA wanted signals and equal to 3 in case of GSM/EDGE wanted signal. “x” is specified in Table 7.4.2-2 for NB-IoT standalone and NB-IoT operation in E-UTRA in-band/guard band and in Table 7.4.2-3 for NB-IoT operation in NR in-band.  NOTE 3: Interfering signal (E-UTRA 3MHz) consisting of one resource block positioned at the stated offset, the channel bandwidth of the interfering signal is located adjacently to the Base Station RF Bandwidth edge.  NOTE 4: For NB-IoT, the mentioned desensitized values consider only one NB-IoT PRB in the guard band, which is placed adjacent to the E-UTRA PRB edge as close as possible (i.e., away from edge of channel bandwidth).  NOTE 5: Applicable for *channel bandwidths* equal to or below 20 MHz.  NOTE 6: Applicable for *channel bandwidths* above 20 MHz*.*  NOTE 6: 7.5 kHz shift is not applied to the wanted signal of NR.  NOTE 7: Void | | | | |

Table 7.4.5.2-2: “x” for NB-IoT wanted signals operation in E-UTRA in-band/guard band and NB-IoT standalone

|  |  |  |
| --- | --- | --- |
| Operation mode | LTE channel bandwidth for in-band/guard band operation | x |
| Standalone | - | 12 |
| In Band | 3 MHz | 11 |
| 5 MHz | 9 |
| 10 MHz | 6 |
| 15 MHz | 6 |
| 20 MHz | 6 |
| Guard band | 5 MHz | 13 |
| 10 MHz | 6 |
| 15 MHz | 6 |
| 20 MHz | 6 |

Table 7.4.5.2-3: “x” for NB-IoT wanted signals operation in NR in-band

|  |  |  |
| --- | --- | --- |
| Operation mode | NR channel bandwidth for in-band operation | x |
| In Band | 5 MHz | 9 |
| ≥ 10 MHz | 6 |

#### 7.4.5.3 Additional narrowband blocking test requirement for GSM/EDGE

The GSM/EDGE in-band blocking test requirements are stated in TS 51.021 [11], applicable parts of subclause 7.6.

The conditions specified in TS 45.005 [6], Annex P.2.1 apply for GSM/EDGE in-band narrowband blocking.

#### 7.4.5.4 GSM/EDGE test requirements for AM suppression

The GSM/EDGE in-band blocking test requirements are stated in TS 51.021 [11], applicable parts of subclause 7.8.

The conditions specified in TS 45.005 [6], Annex P.2.3 apply for GSM/EDGE AM suppression.

#### 7.4.5.5 Additional BC3 blocking test requirement

The interfering signal is a 1.28Mcps UTRA TDD modulated signal as specified in Annex A.2.

The requirement is applicable outside the Base Station RF Bandwidth or Maximum Radio Bandwidth. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Maximum Radio Bandwidth edges.

For BS capable of multi-band operation, the requirement applies in addition inside any Inter RF Bandwidth gap, in case the gap size is at least 4.8MHz. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

For the wanted and interfering signal coupled to the Base Station antenna input, using the parameters in Table 7.4.5.5-1, the following requirements shall be met:

- For any measured E-UTRA TDD carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured UTRA TDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.105 [4], subclause 7.2.

Table 7.4.5.5-1: Additional blocking requirement for Band Category 3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Operating Band | Centre Frequency of Interfering Signal [MHz] | | | Interfering Signal mean power [dBm] | Wanted Signal mean power [dBm] | Interfering signal centre frequency minimum frequency offset from the Base Station RF Bandwidth edge [MHz] |
| 33 - 40 | (FUL\_low - 20) | to | (FUL\_high + 20) | -40, | PREFSENS + 6 dB\* | ±2.4 |
| NOTE\*: PREFSENS depends on the RAT and on the channel bandwidth, see clause 7.2. | | | | | | |

**<NEXT of change>**

## 7.5 Out-of-band blocking

### 7.5.5 Test requirements

#### 7.5.5.1 General out-of-band blocking test requirements

For a wanted and an interfering signal coupled to BS antenna input using the parameters in Table 7.5.5.1-1, the following requirements shall be met:

- For any measured E-UTRA carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured UTRA FDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.104 [3], subclause 7.2.

- For any measured UTRA TDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.105 [4], subclause 7.2.

- For any measured GSM/EDGE carrier, the conditions are specified in TS 45.005 [6], Annex P.2.1.

- For any measured NB-IoT carrier(standalone or operating in E-UTRA in-band/guard band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured NB-IoT carrier (operating in NR in-band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

- For any measured NR carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

For BS capable of multi-band operation, the requirement applies for each supported operating band. The in-band blocking frequency ranges of all supported operating bands according to Table 7.4.5.1-2 shall be excluded from the requirement.

The out-of-band blocking requirement applies from 1 MHz to FUL\_low - ΔfOOB and from FUL\_high + ΔfOOB up to 12750 MHz, including the downlink frequency range of the FDD *operating band* for BS supporting FDD. ΔfOOB is defined in table 7.4.1-1.

Table 7.5.5.1-1: Out-of-band blocking performance requirement

|  |  |  |
| --- | --- | --- |
| Interfering Signal mean power [dBm] | Wanted Signal mean power [dBm] | Type of Interfering Signal |
| -15 (NOTE2) | PREFSENS +xdB (NOTE1) | CW carrier |
| NOTE1: PREFSENS depends on the RAT, the BS class and the channel bandwidth, see subclause 7.2.  “x” is equal to 6 in case of NR, E-UTRA, UTRA or NB-IoT wanted signals and equal to 3 in case of GSM/EDGE wanted signal.  NOTE2: For NB-IoT, up to 24 exceptions are allowed for  spurious response frequencies in each wanted signal frequency when measured using a 1MHz step size. For these exceptions the above throughput requirement shall be met when the blocking signal is set to a level of -40 dBm for 15 kHz subcarrier spacing and -46 dBm for 3.75 kHz subcarrier spacing. In addition, each group of exceptions shall not exceed three contiguous measurements using a 1MHz step size. | | |

#### 7.5.5.2 Co-location test requirements

This additional blocking requirement may be applied for the protection of BS receivers when NR, E-UTRA, UTRA, CDMA or GSM/EDGE BS operating in a different frequency band are co-located with a BS.

The requirements in this subclause assume a 30 dB coupling loss between the interfering transmitter and the BS receiver and are based on co-location with base stations of the same class.

For a wanted and an interfering signal coupled to BS antenna input using the parameters in Table 7.5.5.2-1, the following requirements shall be met:

- For any measured E-UTRA carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured UTRA FDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.104 [3], subclause 7.2.

- For any measured UTRA TDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.105 [4], subclause 7.2.

- For any measured GSM/EDGE carrier, the conditions are specified in TS 45.005 [6], Annex P.2.1.

- For any measured NB-IoT carrier (standalone or operating in E-UTRA in-band/guard band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured NB-IoT carrier (operating in NR in-band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

- For any measured NR carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

Table 7.5.5.2-1: Blocking requirement for co-location with BS in other frequency bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of co-located BS | Centre Frequency of Interfering Signal (MHz) | Interfering Signal mean power for WA BS (dBm) | Interfering Signal mean power for MR BS (dBm) | Interfering Signal mean power for LA BS (dBm) | Wanted Signal mean power (dBm) | Type of Interfering Signal |
| GSM850 or CDMA850 | 869 – 894 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| GSM900 | 921 – 960 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| DCS1800 | 1805 – 1880  (Note 4) | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| PCS1900 | 1930 – 1990 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band I or E-UTRA Band 1 or NR Band n1 | 2110 – 2170 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band II or E-UTRA Band 2 or NR Band n2 | 1930 – 1990 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band III or E-UTRA Band 3 or NR Band n3 | 1805 – 1880  (Note 4) | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band IV or E-UTRA Band 4 | 2110 – 2155 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band V or E-UTRA Band 5 or NR Band n5 | 869 – 894 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band VI or E-UTRA Band 6 | 875 – 885 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band VII or E-UTRA Band 7 or NR Band n7 | 2620 – 2690 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band VIII or E-UTRA Band 8 or NR Band n8 | 925 – 960 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band IX or E-UTRA Band 9 | 1844.9 – 1879.9 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band X or E-UTRA Band 10 | 2110 – 2170 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XI or E-UTRA Band 11 | 1475.9 - 1495.9 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XII or E-UTRA Band 12 or NR Band n12 | 729 - 746 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XIIII or E-UTRA Band 13 | 746 - 756 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XIV or E-UTRA Band 14 or NR Band n14 | 758 - 768 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 17 | 734 - 746 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 18 or NR Band n18 | 860 - 875 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XIX or E-UTRA Band 19 | 875 - 890 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 791 - 821 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XXI or E-UTRA Band 21 | 1495.9 – 1510.9 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3510 – 3590 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 23 | 2180 - 2200 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 24 | 1525 – 1559 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XXV or E-UTRA Band 25 or NR Band n25 | 1930 – 1995 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA FDD Band XXVI or E-UTRA Band 26 | 859 – 894 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 27 | 852 - 869 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 28 or NR Band n28 | 758 – 803 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 29 or NR Band n29 | 717-728 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + 6dB\* | CW carrier |
| E-UTRA Band 30 or NR Band n30 | 2350-2360 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 31 | 462.5–467.5 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + 6dB\* | CW carrier |
| UTRA FDD Band XXXII or E-UTRA Band 32 | 1452 – 1496  (NOTE 5) | +16\*\* | +8\*\* | -6\*\* | PREFSENS + 6dB\* | CW carrier |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900-1920 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA TDD Band a) or E-UTRA Band 34 or NR Band n34 | 2010-2025 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850-1910 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930-1990 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910-1930 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570-2620 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA TDD Band f) or E-UTRA Band 39 or NR Band n39 | 1880-1920 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300-2400 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 41 or NR Band n41 | 2496 - 2690 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 42 | 3400 – 3600 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 43 | 3600 – 3800 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 44 | 703 - 803 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 45 | 1447 - 1467 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 46 | 5150 - 5925 | N/A | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 48 or NR Band n48 | 3550 - 3700 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 49 | 3550 - 3700 | N/A | N/A | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 50 or NR Band n50 | 1432 - 1517 | +16 | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 51 or NR Band n51 | 1427 - 1432 | N/A | N/A | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 52 | 3300 – 3400 | +16\*\* | +8 | -6 | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 53 | 2483.5 – 2495 | N/A | +8 | -6 | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 65 or NR Band n65 | 2110 – 2200 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 66 or NR Band n66 | 2110 – 2200 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 67 | 738 – 758 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 68 | 753 – 783 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 69 | 2570-2620 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 70 or NR Band n70 | 1995 - 2020 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 71 or NR Band n71 | 617 - 652 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 72 | 461 - 466 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 73 | 460 - 465 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 74 or NR Band n74 | 1475 - 1518 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 75 or NR Band n75 | 1432 - 1517 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 76 or NR Band n76 | 1427 - 1432 | N/A | N/A | -6\*\* | PREFSENS + x dB\* | CW carrier |
| NR Band n77 | 3300 - 4200 | +16\*\* | +8 | -6 | PREFSENS + x dB\* | CW carrier |
| NR Band n78 | 3300 - 3800 | +16\*\* | +8 | -6 | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 85 | 728 - 746 | +16\*\* | +8 | -6 | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 87 | 420 – 425 | +16\*\* | +8 | -6 | PREFSENS + x dB\* | CW carrier |
| E-UTRA Band 88 | 422 – 427 | +16\*\* | +8 | -6 | PREFSENS + x dB\* | CW carrier |
| NR Band n91 | 1427 - 1432 | N/A | N/A | -6\*\* | PREFSENS + x dB\* | CW carrier |
| NR Band n92 | 1432 - 1517 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| NR Band n93 | 1427 - 1432 | N/A | N/A | -6\*\* | PREFSENS + x dB\* | CW carrier |
| NR Band n94 | 1432 - 1517 | +16\*\* | +8\*\* | -6\*\* | PREFSENS + x dB\* | CW carrier |
| NOTE 1 (\*):PREFSENS depends on the RAT, the BS class and the channel bandwidth, see subclause 7.2. "x" is equal to 3 in case of GSM/EDGE wanted signal and equal to 6 in case of NR, UTRA or E-UTRA wanted signals.  NOTE 2: Except for a BS operating in Band 13, these requirements do not apply when the interfering signal falls within any of the supported uplink operating band or in the ΔfOOB immediately outside any of the supported uplink operating band. For a BS operating in band 13 the requirements do not apply when the interfering signal falls within the frequency range 768-797MHz.  NOTE 3: Some combinations of bands may not be possible to co-site based on the requirements above. The current state-of-the-art technology does not allow a single generic solution for co-location of UTRA TDD or E-UTRA TDD or NR TDD with E-UTRA FDD or NR FDD on adjacent frequencies for 30dB BS-BS minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [14].  NOTE 4: In China, the blocking requirement for co-location with DCS1800 and Band III BS is only applicable in the frequency range 1805-1850MHz.  NOTE 5: For a BS operating in band 11, 21 or 74, the requirement for co-location with Band 32 applies for interfering signal within the frequency range 1475.9-1495.9 MHz.  NOTE 6: Co-located TDD base stations that are synchronized and using the same or adjacent operating band can receive without special co-location requirements. For unsynchronized base stations, special co-location requirements may apply that are not covered by the 3GPP specifications.  NOTE 7 (\*\*): For NB-IoT, up to 24 exceptions are allowed for spurious response frequencies in each wanted signal frequency when measured using a 1MHz step size. For these exceptions the above throughput requirement shall be met when the blocking signal is set to a level of -40 dBm for 15 kHz subcarrier spacing and -46 dBm for 3.75 kHz subcarrier spacing. In addition, each group of exceptions shall not exceed three contiguous measurements using a 1MHz step size. | | | | | | |

**<NEXT of change>**

## 7.7 Receiver intermodulation

### 7.7.5 Test requirements

#### 7.7.5.1 General intermodulation test requirement

Interfering signals shall be a CW signal and an E-UTRA or UTRA signal, as specified in Annex A.

The requirement is applicable outside the Base Station RF Bandwidth or Maximum Radio Bandwidth. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Maximum Radio Bandwidth edges.

For BS capable of multi-band operation, the requirement applies in addition inside any Inter RF Bandwidth gap, in case the gap size is at least twice as wide as the UTRA/E-UTRA interfering signal centre frequency offset from the Base Station RF Bandwidth edge. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

For the wanted signal at the assigned channel frequency and two interfering signals coupled to the Base Station antenna input, using the parameters in Table 7.7.5.1-1 and 7.7.5.1-2, the following requirements shall be met:

- For any measured E-UTRA carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured UTRA FDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.104 [3], subclause 7.2.

- For any measured UTRA TDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.105 [4], subclause 7.2.

- For any measured GSM/EDGE carrier, the conditions are specified in TS 45.005 [6], Annex P.2.2.

- For any measured NB-IoT carrier (standalone or operating in E-UTRA in-band/guard band),, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured NB-IoT carrier (operating in NR in-band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

- For any measured NR carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

Table 7.7.5.1-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| Base Station Type | Mean power of interfering signals [dBm] | Wanted Signal mean power [dBm] | Type of interfering signal |
| Wide Area BS | -48+y (Note 6) | PREFSENS +x dB (Note 2) | See Table 7.7.5.1-2 |
| Medium Range BS | -44+y (Note 6) | PREFSENS +x dB (Note 3, 5) |
| Local Area BS | -38+y (Note 6) | PREFSENS +x dB (Note 4, 5) |
| NOTE 1: PREFSENS depends on the RAT, the BS class and on the channel bandwidth, see subclause 7.2 in TS 37.104 [2]. For E-UTRA channel bandwidths 10, 15 and 20 MHz this requirement shall apply only for a FRC A1-3 mapped to the frequency range at the channel edge adjacent to the interfering signals.  NOTE 2: For WA BS, “x” is equal to 6 in case of NR or E-UTRA or UTRA or NB-IoT wanted signals and equal to 3 in case of GSM/EDGE wanted signal.  NOTE 3: For MR BS supporting GSM and/or UTRA, “x” is equal to 6 in case of UTRA wanted signals, 9 in case of NR or E-UTRA or NB-IoT wanted signal and equal to 3 in case of GSM/EDGE wanted signal.  NOTE 4: For LA BS supporting GSM and/or UTRA, “x” is equal to 12 in case of NR or E-UTRA or NB-IoT wanted signals, 6 in case of UTRA wanted signal and equal to 3 in case of GSM/EDGE wanted signal.  NOTE 5: For a BS neither supporting GSM nor UTRA, x is equal to 6 for all BS classes if NR is supported, or x is equal to 9 for MR and 12 for LA BS if NR is not supported.  NOTE 6: For a BS supporting NR but neither UTRA nor GSM; “y” is equal to -4 for the WA BS class, -3 for the MR BS class and -6 for the LA BS class. For all other cases, “y” is equal to zero for all BS classes. | | | |

Table 7.7.5.1-2: Interfering signals for intermodulation requirement

|  |  |  |
| --- | --- | --- |
| RAT of the carrier adjacent to the upper/lower Base Station RF Bandwidth edge | Interfering signal centre frequency offset from the Base Station RF Bandwidth edge [MHz] | Type of interfering signal |
| E-UTRA 1.4 MHz | ±2.0 (BC1 and BC3) /  ±2.1 (BC2) | CW |
| ±4.9 | 1.4MHz E-UTRA signal |
| E-UTRA 3 MHz or E-UTRA with NB-IoT in-band | ±4.4 (BC1 and BC3) /  ±4.5 (BC2) | CW |
| ±10.5 | 3MHz E-UTRA signal |
| UTRA FDD and  E-UTRA or E-UTRA with NB-IoT in-band/guard band 5 MHz | ±7.5 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| E-UTRA or E-UTRA with NB-IoT in-band/guard band 10 MHz | ±7.375 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| E-UTRA or E-UTRA with NB-IoT in-band/guard band15 MHz | ±7.25 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| E-UTRA or E-UTRA with NB-IoT in-band/guard band 20 MHz | ±7.125 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| GSM/EDGE | ±7.575 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| NB-IoT standalone | ±7.575 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| 1.28 Mcps UTRA TDD | ±2.3 (BC3) | CW |
| ±5.6 (BC3) | 1.28Mcps UTRA TDD signal |
| NR 5 MHz or NR with *NB-IoT operation in NR in-band* | ±7.5 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| NR 10 MHz or NR with *NB-IoT operation in NR in-band* | ±7.465 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| NR 15 MHz or NR with *NB-IoT operation in NR in-band* | ±7.43 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| NR 20 MHz or NR with *NB-IoT operation in NR in-band* | ±7.395 | CW |
| ±17.5 | 5MHz E-UTRA signal |
| NR 25 MHz or NR with *NB-IoT operation in NR in-band* | ±7.465 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 30 MHz or NR with *NB-IoT operation in NR in-band* | ±7.43 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 40 MHz or NR with *NB-IoT operation in NR in-band* | ±7.45 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 50 MHz or NR with *NB-IoT operation in NR in-band* | ±7.35 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 60 MHz | ±7.49 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 70 MHz | ±7.42 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 80 MHz | ±7.44 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 90 MHz | ±7.46 | CW |
| ±25 | 20MHz E-UTRA signal |
| NR 100 MHz | ±7.48 | CW |
| ±25 | 20MHz E-UTRA signal |

#### 7.7.5.2 General narrowband intermodulation test requirement

Interfering signals shall be a CW signal and an E-UTRA 1RB signal, as specified in Annex A.

The requirement is applicable outside the Base Station RF Bandwidth or Maximum Radio Bandwidth. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Maximum Radio Bandwidth edges.

For BS operating in non-contiguous spectrum within each supported operating band, the requirement applies in addition inside any sub-block gap in case the sub-block gap is at least as wide as the channel bandwidth of the E-UTRA interfering signal in Table 7.7.5.2-2. The interfering signal offset is defined relative to the sub-block edges inside the gap.

For BS capable of multi-band operation, the requirement applies in addition inside any Inter RF Bandwidth gap in case the gap size is at least as wide as the E-UTRA interfering signal in Table 7.7.5.2-2. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

For the wanted signal at the assigned channel frequency and two interfering signals coupled to the Base Station antenna input, using the parameters in Table 7.7.5.2-1 and 7.7.5.2-2, the following requirements shall be met:

- For any measured E-UTRA carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured UTRA FDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.104 [3], subclause 7.2.

- For any measured UTRA TDD carrier, the BER shall not exceed 0.001 for the reference measurement channel defined in TS 25.105 [4], subclause 7.2.

- For any measured GSM/EDGE carrier, the conditions are specified in TS 45.005 [6], Annex P.2.2.

- For any measured NB-IoT carrier (standalone or operating in E-UTRA in-band/guard band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 36.104 [5], subclause 7.2.

- For any measured NB-IoT carrier (operating in NR in-band), the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

- For any measured NR carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel defined in TS 38.104 [27], subclause 7.2.

Table 7.7.5.2-1: General narrowband intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| Base Station Type | Mean power of interfering signals [dBm] | Wanted Signal mean power [dBm] | Type of interfering signal |
| Wide Area BS | -52 | PREFSENS +x dB (NOTE 1) | See Table 7.7.5.2-2 |
| Medium Range BS | -47 |
| Local Area BS | -44 |
| NOTE 1: PREFSENS depends on the RAT, the BS class and on the channel bandwidth, see subclause 7.2 in TS 37.104. “x” is equal to 6 in case of NR, NB-IoT,E-UTRA or UTRA wanted signals and equal to 3 in case of GSM/EDGE wanted signal. “x” is specified in Table 7.7.5.2-1a for NB-IoT | | | |



Table 7.7.5.2-2: Interfering signals for narrowband intermodulation requirement

|  |  |  |
| --- | --- | --- |
| RAT of the carrier adjacent to the upper/lower Base Station RF Bandwidth edge or sub-block edge | Interfering signal centre frequency offset from the Base Station RF Bandwidthedge or sub-block edge inside a gap [kHz] | Type of interfering signal |
| E-UTRA 1.4 MHz | ±260 (BC1 and BC3) /  ±270 (BC2) | CW |
| ±970 (BC1 and BC3) /  ±790 (BC2) | 1.4 MHz E-UTRA signal, 1 RB (NOTE 1) |
| E-UTRA or E-UTRA with NB-IoT in-band 3 MHz | ±260 (BC1 and BC3) /  ±270 (BC2) | CW |
| ±960 (BC1 and BC3) /  ±780 (BC2) | 3.0 MHz E-UTRA signal, 1 RB (NOTE 1) |
| E-UTRA or E-UTRA with NB-IoT in-band/guard band 5 MHz | ±360 (NOTE 3) | CW |
| ±1060 | 5 MHz E-UTRA signal, 1 RB (NOTE 1) |
| E-UTRA or E-UTRA with NB-IoT in-band/guard band 10 MHz  (NOTE 2) | ±325 (NOTE 3) | CW |
| ±1240 | 5 MHz E-UTRA signal, 1 RB (NOTE 1) |
| E-UTRA or E-UTRA with NB-IoT in-band/guard band 15 MHz  (NOTE 2) | ±380 (NOTE 3) | CW |
| ±1600 | 5MHz E-UTRA signal, 1 RB (NOTE 1) |
| E-UTRA or E-UTRA with NB-IoT in-band/guard band 20 MHz  (NOTE 2) | ±345 (NOTE 3) | CW |
| ±1780 | 5MHz E-UTRA signal, 1 RB (NOTE 1) |
| UTRA FDD | ±345 (BC1 and BC2) | CW |
| ±1780 (BC1 and BC2) | 5MHz E-UTRA signal, 1 RB (NOTE 1) |
| GSM/EDGE | ±340 | CW |
| ±880 | 5MHz E-UTRA signal, 1 RB (NOTE 1) |
| NB-IoT standalone | ±340 | CW |
| ±880 | 5MHz E-UTRA signal, 1 RB (NOTE 1) |
| 1.28Mcps UTRA TDD | ±190 (BC3) | CW |
| ±970 (BC3) | 1.4 MHz E-UTRA signal, 1 RB (NOTE 1) |
| NR 5 MHz or NR with *NB-IoT operation in NR in-band* | ±360 | CW |
| ±1420 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 10 MHz or NR with *NB-IoT operation in NR in-band* | ±370 | CW |
| ±1960 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 15 MHz or NR with *NB-IoT operation in NR in-band* (Note 2) | ±380 | CW |
| ±1960 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 20 MHz or NR with *NB-IoT operation in NR in-band* (Note 2) | ±390 | CW |
| ±2320 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 25 MHz or NR with *NB-IoT operation in NR in-band* (Note 2) | ±325 | CW |
| ±2350 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 30 MHz or NR with *NB-IoT operation in NR in-band* (Note 2) | ±335 | CW |
| ±2350 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 40 MHz or NR with *NB-IoT operation in NR in-band* (Note 2) | ±355 | CW |
| ±2710 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 50 MHz or NR with *NB-IoT operation in NR in-band* (Note 2) | ±375 | CW |
| ±2710 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 60 MHz (Note 2) | ±395 | CW |
| ±2710 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 70 MHz (Note 2) | ±415 | CW |
| ±2710 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 80 MHz (Note 2) | ±435 | CW |
| ±2710 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 90 MHz (Note 2) | ±365 | CW |
| ±2530 | E-UTRA signal, 1 RB (NOTE 1) |
| NR 100 MHz (Note 2) | ±385 | CW |
| ±2530 | E-UTRA signal, 1 RB (NOTE 1) |
| NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the channel bandwidth of the interfering signal is located adjacently to the Base Station RF Bandwidth edge or sub-block edge inside a gap.  NOTE 2: This requirement shall apply only for an E-UTRA FRC A1-3 or NR G-FRC mapped to the frequency range at the channel edge adjacent to the interfering signals.  NOTE 3: The frequency offset shall be adjusted to accommodate the IMD product to fall in the NB-IoT RB for NB-IoT in-band/guard band operation.  NOTE 4: The frequency offset shall be adjusted to accommodate the IMD product to fall in the NB-IoT RB for NB-IoT in-band/guard band operation.  NOTE 5: If a BS RF receiver fails the test of the requirement, the test shall be performed with the CW interfering signal frequency shifted away from the wanted signal by 180 kHz and the E-UTRA interfering signal frequency shifted away from the wanted signal by 360 kHz. If the BS RF receiver still fails the test after the frequency shift, then the BS RF receiver shall be deemed to fail the requirement. | | |

#### 7.7.5.3 Additional narrowband intermodulation test requirement for GSM/EDGE

The GSM/EDGE MC-BTS receiver intermodulation test requirements are stated in TS 51.021 [11], applicable parts of subclause 7.7, shall apply for GSM/EDGE carriers.

The conditions specified in TS 45.005 [6], Annex P.2.2 apply for the GSM/EDGE intermodulation requirement.

**<NEXT of change>**

## 7.8 In-channel selectivity

### 7.8.1 Definition and applicability

In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations in the presence of an interfering signal received at a larger power spectral density. In this condition a throughput requirement shall be met for a specified reference measurement channel. This requirement is applicable for NR, NB-IoT operation in NR in-band ,E-UTRA carriers and E-UTRA with NB-IoT in-band operation carrier.

**<NEXT of change>**

# C.2 Measurement of receiver

Table C.2-1: Derivation of test requirements (Receiver tests)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Minimum Requirement in TS 37.104 | Test Tolerance (TT) | Test Requirement |
| 7.4.5.1 In-band selectivity and blocking, General blocking requirement | Wanted Signal mean power = PREFSENS + x dB, where x is equal to 6 in case of E-UTRA or UTRA or NB-IoT or NR and equal to 3 in case of GSM/EDGE.  Interferer signal mean power:  -40 dBm. | 0 dB | Formula: Wanted signal power + TT.  Interferer signal power unchanged. |
| 7.4.5.2 In-band selectivity and blocking, General narrowband blocking requirement | Wanted Signal mean power = PREFSENS + x dB, where x is equal to 6 in case of NR or E-UTRA or UTRA and equal to 3 in case of GSM/EDGE, and equal to the following in case of NB-IoT.  For in-band NB-IoT, 1.4 MHz and 3 MHz BW:  X = 11  For in-band NB-IoT, 5 MHz BW:  X = 9  For in-band NB-IoT, 10MHz, 15MHz and 20MHz BW:  X = 6  For guard-band NB-IoT, 5 MHz BW:  X = 13  For guard-band NB-IoT, 10MHz, 15MHz and 20MHz BW:  X = 6  For standalone NB-IoT, 200 kHz BW:  X = 12  For NB-IoT operation in NR in-band:  For 5 MHz BW:X = 9  For channel BW ≥ 10MHz: X = 6.  Interferer signal mean power:  -49 dBm. | 0 dB | Formula: Wanted signal power + TT.  Interferer signal power unchanged. |
| 7.4.5.5 In-band selectivity and blocking, Additional BC3 requirement | Wanted Signal mean power = PREFSENS + x dB, where x is equal to 6 in case of NR or E-UTRA or UTRA [or NB-IoT].  Interferer signal mean power:  -40 dBm. | 0 dB | Formula: Wanted signal power + TT.  Interferer signal power unchanged. |
| 7.5.5.1 Out-of-band blocking, General requirement | Wanted Signal mean power = PREFSENS + x dB, where x is equal to 6 in case of NR or E-UTRA or UTRA or NB-IoT and equal to 3 in case of GSM/EDGE.  Interferer signal mean power:  -15 dBm. | 0 dB | Formula: Wanted signal power + TT.  Interferer signal power unchanged. |
| 7.5.5.2 Out-of-band blocking, Co-location | Wanted Signal mean power = PREFSENS + x dB, where x is equal to 6 in case of NR or E-UTRA or UTRA or NB-IoT and equal to 3 in case of GSM/EDGE.  Interferer signal mean power:  +16 dBm. | 0 dB | Formula: Wanted signal power + TT.  Interferer signal power unchanged. |
| 7.6.5 Receiver spurious emissions | Maximum level defined in Tables 7.6.5.1-1 and 7.6.5.2-1 of TS 37.104 [2]. | 0 dB | Formula: Maximum level + TT |
| 7.7.5.1 Receiver intermodulation, General requirement | Wanted Signal mean power = PREFSENS + x dB, where x is equal to 6 in case of NR or E-UTRA or UTRA or NB-IoT and equal to 3 in case of GSM/EDGE.  Interferer signal mean power:  -48 dBm. | 0 dB | Formula: Wanted signal mean power + TT.  CW interferer signal power unchanged.  Modulated interferer signal power unchanged. |
| 7.7.5.2 Receiver intermodulation, General narrowband requirement | Wanted Signal mean power = PREFSENS + x dB, where x is equal to 6 in case of NR or E-UTRA or UTRA or NB-IoT and equal to 3 in case of GSM/EDGE.  Interferer signal mean power:  -52 dBm. | 0 dB | Formula: Wanted signal mean power + TT.  CW interferer signal power unchanged.  Modulated interferer signal power unchanged. |

**<END of change>**