**3GPP TSG-RAN WG4 Meeting # 94-e *R4-2002743***

**Online, 24 February – 6 March 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **38.141-1** | **CR** | **0093** | **rev** | **1** | **Current version:** | **16.2.0** |  |
|  |
| *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:***  | CR to TS 38.141-1: Introduction of NB-IoT operation in NR channel bandwidth |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NB\_IOTenh3-Perf |  | ***Date:*** | 2020-03-04 |
|  |  |  |  |  |
| ***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 canbe 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 channel bandwidth is not supported. |
|  |  |
| ***Summary of change:*** | Introduce support of NB-IoT operation in NR channel bandwidth. |
|  |  |
| ***Consequences if not approved:*** | NB-IoT operation in NR channel bandwidth is not supported. |
|  |  |
| ***Clauses affected:*** | 1, 2, 3, 4.6, 4.7.3.1, 4.7.5.1, 4.8.3, 4.8.4, 4.9.2.2, new clause 4.9.2.2.9, new clause 4.9.2.4, new clause 4.9.3, 5, 6.2.5, new clause 6.3.4, 6.5.2.5, 6.5.3.5, 6.5.4.5, 6.6.2.4.1, 6.6.3.1, 6.6.3.4.2, 6.6.4.1, 6.6.4.4.2, 6.6.5.1, 6.6.5.4.2, 6.7.4.2, 6.7.5.1.1, 7.1, 7.2.4.2, 7.2.5, 7.3.4.2, 7.3.5, 7.4.1.4.2, 7.4.1.5, 7.4.2.4.2, 7.4.2.4.3, 7.4.2.5, 7.5.4.2, 7.5.5.1, 7.6.4.2, 7.6.5.2, 7.7.4.2, 7.7.5, 7.8.4.2, 7.8.5, annex A.1 |
|  |  |
|  | **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>**

# 1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for NR and NB-IoT operation in NR in-band Base Station (BS) *Type 1-C* and *Type 1-H*. These have been derived from, and are consistent with the conducted requirements for *BS Type 1-C* and *BS Type 1-H* in NR BS specification defined in TS 38.104 [2].

A *BS type 1-C* only has conducted requirements so it requires compliance to this specification only.

A *BS type 1-H* has both conducted and radiated requirements so it requires compliance to the applicable requirements of this specification and TS 38.141-2 [3].

*BS type 1-O* and *BS type 2-O* have only radiated requirements so they require compliance to TS 38.141-2 [3] only.

# 2 References

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

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

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

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

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

[2] 3GPP TS 38.104: "NR Base Station (BS) radio transmission and reception"

[3] 3GPP TS 38.141-2: "NR, Base Station (BS) conformance testing, Part 2: Radiated conformance testing"

[4] ITU-R Recommendation M.1545, "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000"

[5] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain"

[6] IEC 60 721-3-3: "Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations"

[7] IEC 60 721-3-4: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weather protected locations"

[8] IEC 60 721: "Classification of environmental conditions"

[9] IEC 60 068-2-1 (2007): "Environmental testing - Part 2: Tests. Tests A: Cold"

[10] IEC 60 068-2-2: (2007): "Environmental testing - Part 2: Tests. Tests B: Dry heat"

[11] IEC 60 068-2-6: (2007): "Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)"

[12] ITU-R Recommendation SM.328: "Spectra and bandwidth of emissions"

[13] Federal Communications Commission: "Title 47 of the Code of Federal Regulations (CFR) "

[14] ECC/DEC/(17)06: "The harmonised use of the frequency bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)"

[15] 3GPP TR 25.942: "RF system scenarios"

[16] 3GPP TS 38.212: "NR; Multiplexing and channel coding"

[17] 3GPP TS 38.211: "NR; Physical channels and modulation"

[18] 3GPP TS 38.214: "NR; Physical layer procedures for data"

[19] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification"

[20] 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz"

[21] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone"

[22] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception"

[23] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing"

# 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].

**aggregated BS channel bandwidth:** the RF bandwidth in which a Base Station transmits and receives multiple contiguously aggregated carriers. The *aggregated BS channel bandwidth* is measured in MHz

**antenna connector:** connector at the conducted interface of the *BS type 1-C*

**active transmitter unit:** transmitter unit which is ON, and has the ability to send modulated data streams that are parallel and distinct to those sent from other transmitter units to a *BS type 1-C* *antenna connector*, or to one or more *BS type 1-H* *TAB connectors* at the *transceiver array boundary*

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

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

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

**basic limit:** emissions limit relating to the power supplied by a single transmitter to a single antenna transmission line in ITU-R SM.329 [5] used for the formulation of unwanted emission requirements for FR1

**BS channel bandwidth**: RF bandwidth supporting a single NR RF carrier with the transmission bandwidth configured in the uplink or downlink

NOTE 1: The *BS channel bandwidth* is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

NOTE 2: It is possible for the BS to transmit to and/or receive from one or more UE bandwidth parts that are smaller than or equal to the BS transmission bandwidth configuration, in any part of the BS transmission bandwidth configuration.

**BS type 1-C:** NR base station operating at FR1 with requirements set consisting only of conducted requirements defined at individual *antenna connectors*

**BS type 1-H:** NR base station operating at FR1 with a requirement set consisting of conducted requirements defined at individual *TAB connectors* and OTA requirements defined at RIB

**BS type 1-O:** NR base station operating at FR1 with a requirement set consisting only of OTA requirements defined at the RIB

NOTE: *BS type 1-O* conformance requirements are captured in TS 38.141-2 [3] and are out of scope of this specification.

**BS type 2-O:** NR base station operating at FR2 with a requirement set consisting only of OTA requirements defined at the RIB

NOTE: *BS type 2-O* conformance requirements are captured in TS 38.141-2 [3] and are out of scope of this specification.

**channel edge:** lowest or highest frequency of the NR carrier, separated by the *BS channel bandwidth*

**carrier aggregation:** aggregation of two or more component carriers in order to support wider transmission bandwidths

**carrier aggregation configuration:** a set of one or more *operating bands* across which the BS aggregates carriers with a specific set of technical requirements

**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

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

**highest carrier:** The carrier with the highest carrier frequency transmitted/received in a specified frequency band

**inter-band carrier aggregation:** carrier aggregation of 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:** *contiguous carriers* aggregated in the same operating band

**intra-band non-contiguous carrier aggregation:** non-contiguous carriers aggregated in the same operating band

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

**lowest carrier:** the carrier with the lowest carrier frequency transmitted/received in a specified frequency band

**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 carrier output power:** mean power level measured per carrier at the indicted interface, during the *transmitter ON period* in a specified reference condition

**maximum total output power:** mean power level measured within the *operating band* at the indicated interface, during the *transmitter ON period* in a specified reference condition

**measurement bandwidth**: RF bandwidth in which an emission level is specified

**multi-band connector**: *antenna* connector of the *BS type 1-C* or *TAB connector* of the *BS type 1-H* 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-carrier transmission configuration:** set of one or more contiguous or non-contiguous carriers that a BS is able to transmit simultaneously according to the manufacturer's specification

**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.

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

**operating band:** frequency range in which NR operates (paired or unpaired), that is defined with a specific set of technical requirements

NOTE: The *operating band*(s) for a BS is declared by the manufacturer according to the designations in TS 38.104 [2], tables 5.2-1 and 5.2-2.

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

**rated carrier output power:** mean power level associated with a particular carrier the manufacturer has declared to be available at the indicated interface, during the *transmitter ON period* in a specified reference condition

**rated total output power:** mean power level associated with a particular *operating band* the manufacturer has declared to be available at the indicated interface, during the *transmitter ON period* in a specified reference condition

**requirement set:** one of the NR base station requirement's set as defined for *BS type 1-C*, *BS type 1-H*, *BS type 1-O*, and *BS type 2-O*

**single-band connector:** *antenna connector* of the *BS type 1-C* or *TAB connector* of the *BS type 1-H* supporting operation either in a single *operating band* only, or in multiple *operating bands* but does not meet the conditions for a *multi-band connector*

**sub-band**: 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 transmission and reception by the same base station

NOTE: There may be multiple instances of sub-blocks within a Base Station RF Bandwidth.

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

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

**TAB connector:** *transceiver array boundary* connector

**TAB connector RX min cell group:** *operating band* specific declared group of *TAB connectors* to which *BS type 1-H* conducted RX requirements are applied

NOTE: Within this definition, the group corresponds to the group of *TAB connectors* which are responsible for receiving a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells with reception on all *TAB connectors* supporting an *operating band*, but its existence is not limited to that condition

**TAB connector TX min cell group:** *operating band* specific declared group of *TAB connectors* to which *BS type 1-H* conducted TX requirements are applied.

NOTE: Within this definition, the group corresponds to the group of *TAB connectors* which are responsible for transmitting a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells with transmission on all *TAB connectors* supporting an *operating band*, but its existence is not limited to that condition

**total RF bandwidth**: maximum sum of Base Station RF Bandwidths in all supported *operating bands*

**transceiver array boundary:** conducted interface between the transceiver unit array and the composite antenna

**transmitter OFF period:** time period during which the BS transmitter is not allowed to transmit

**transmitter ON period:** time period during which the BS transmitter is transmitting data and/or reference symbols

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

**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:

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

BWChannel *BS channel bandwidth*

BWChannel\_CA *Aggregated BS channel bandwidth*, expressed in MHz. BWChannel\_CA= Fedge\_high- Fedge\_low.

BWChannel,block Sub-block bandwidth, expressed in MHz. BWChannel,block = Fedge,block,high- Fedge,block,low.

BWConfig Transmission bandwidth configuration, expressed in MHz, where BWConfig = *N*RB x SCS x 12 kHz

BWtot *Total RF bandwidth*

Δf Separation between the channel edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency

Δfmax f\_offsetmax minus half of the bandwidth of the measuring filter

ΔFGlobal Global frequency raster granularity

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

ΔFRaster Channel raster granularity

ΔSUL Channel raster offset for SUL

FC *RF reference frequency* on the channel raster

FC,block, high Fc of the highest transmitted/received carrier in a sub-block

FC,block, low Fc of the lowest transmitted/received carrier in a sub-block

FC\_low The Fc of the lowest carrier, expressed in MHz

FC\_high The Fc of the highest carrier, expressed in MHz

Fedge\_low The lower edge of *aggregated BS channel bandwidth*, expressed in MHz. Fedge\_low = FC\_low - Foffset\_low

Fedge\_high The upper edge of *aggregated BS channel bandwidth*, expressed in MHz. Fedge\_high = FC\_high + Foffset\_high.

Fedge,block,low The lower sub-block edge, where Fedge,block,low = FC,block,low - Foffset\_low

Fedge,block,high The upper sub-block edge, where Fedge,block,high = FC,block,high + Foffset\_high

Foffset\_high Frequency offset from FC\_high to the upper *Base Station RF Bandwidth edge*, or from FC,block, high to the upper sub-block edge

Foffset\_low Frequency offset from FC\_low to the lower *Base Station RF Bandwidth edge*, or from FC,block, low to the lower sub-block edge

FDL\_low The lowest frequency of the downlink *operating band*

FDL\_high The highest frequency of the downlink *operating band*

f\_offset Separation between the channel edge frequency and the centre of the measuring filter

f\_offsetmax The offset to the frequency ΔfOBUE outside the downlink *operating band*

FREF RF reference frequency

FREF,SUL RF reference frequency for Supplementary Uplink (SUL) bands

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 [2] clause 5.3.3

Iuant gNB internal logical interface between the implementation specific O&M function and the RET antennas and TMAs control unit function of the gNB

Ncells The declared number corresponding to the minimum number of cells that can be transmitted by an *BS type 1-H* in a particular *operating band*

NRB Transmission bandwidth configuration, expressed in resource blocks

NREF NR Absolute Radio Frequency Channel Number (NR-ARFCN)

NRXU,active The number of active receiver units. The same as the number of *demodulation branches* to which compliance is declared for chapter 8 performance requirements

NRXU,counted The number of active receiver units that are taken into account for conducted Rx spurious emission scaling, as calculated in clause 7.6.1

NRXU,countedpercell The number of active receiver units that are taken into account for conducted RX spurious emissions scaling per cell, as calculated in clause 7.6.1

NTXU,counted The number of *active transmitter units* as calculated in clause 6.1, that are taken into account for conducted TX output power limit in clause 6.2.1, and for unwanted TX emissions scaling

NTXU,countedpercell The number of *active transmitter units* that are taken into account for conducted TX emissions scaling per cell, as calculated in clause 6.1

PEM,n50,ind Declared emission level for Band n50 in the band 1518-1559 MHz; ind = a, b

Pmax,c,AC*Maximum carrier output power* measuredper *antenna connector*

Pmax,c,cell The *maximum carrier output power* per *TAB connector TX min cell group*

Pmax,c,TABC The *maximum carrier output power per TAB connector*

Prated,c,AC The *rated carrier output power per antenna connector*

Prated,c,sys The sum of Prated,c,TABC for all *TAB connectors* for a single carrier

Prated,c,TABC The *rated carrier output power per TAB connector*

Prated,t,AC The *rated total output power* declared at the antenna connector

Prated,t,TABC The *rated total output power* declared at *TAB connector*

PREFSENS Conducted Reference Sensitivity power level

SSREF SS block reference frequency position

Wgap Sub-block gap or Inter RF Bandwidth gap size

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AAS Active Antenna System

ACLR Adjacent Channel Leakage Ratio

ACS Adjacent Channel Selectivity

AWGN Additive White Gaussian Noise

BS Base Station

BW Bandwidth

CA Carrier Aggregation

CACLR Cumulative ACLR

CP-OFDM Cyclic Prefix-OFDM

CW Continuous Wave

DFT-s-OFDM Discrete Fourier Transform-spread-OFDM

DM-RS Demodulation Reference Signal

E-UTRA Evolved UTRA

EVM Error Vector Magnitude

FDD Frequency Division Duplex

FR Frequency Range

GSCN Global Synchronization Channel Number

GSM Global System for Mobile communications

ITU‑R Radiocommunication Sector of the International Telecommunication Union

ICS In-Channel Selectivity

LA Local Area

LNA Low Noise Amplifier

MR Medium Range

NB-IoT Narrowband – Internet of Things

NR New Radio

NR-ARFCN NR Absolute Radio Frequency Channel Number

OBUE Operating Band Unwanted Emissions

OCC Orthogonal Covering Code

OTA Over The Air

RB Resource Block

RDN Radio Distribution Network

REFSENS Reference Sensitivity

RF Radio Frequency

RIB Radiated Interface Boundary

RMS Root Mean Square (value)

RS Reference Signal

RV Redundancy Version

RX Receiver

SCS Sub-Carrier Spacing

SDL Supplementary Downlink

SSB Synchronization Signal Block

SUL Supplementary Uplink

TAB Transceiver Array Boundary

TAE Time Alignment Error

TDD Time division Duplex

TDL Tapped Delay Line

TX Transmitter

TT Test Tolerance

UCI Uplink Control Information

ZF Zero Forcing

**<Next change>**

## 4.6 Manufacturer declarations

The following BS declarations listed in table 4.6-1, when applicable to the BS under test, are required to be provided by the manufacturer for the conducted requirements testing of the *BS type 1-C* and *BS type 1-H*.

For the *BS type 1-H* declarations required for the radiated requirements testing, refer to TS 38.141-2 [3].

Table 4.6-1 Manufacturer declarations for *BS type 1-C* and *BS type 1-H* conducted test requirements

| Declaration identifier | Declaration | Description | Applicability |
| --- | --- | --- | --- |
| *BS type 1-C* | *BS type 1-H* |
| D.1 | BS requirements set | Declaration of one of the NR base station *requirement's set* as defined for *BS type 1-C*, or *BS type 1-H*. | x | x |
| D.2 | BS class | BS class of the BS, declared as Wide Area BS, Medium Range BS, or Local Area Bs. | x | x |
| D.3 | *Operating bands* and frequency ranges | List of NR *operating band(s)* supported by *single-band connector(s)* and/or *multi-band connector(s)* of the BS and if applicable, frequency range(s) within the *operating band(s)* that the BS can operate in. Declarations shall be made per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.4 | Spurious emission category | Declare the BS spurious emission category as either category A or B with respect to the limits for spurious emissions, as defined in Recommendation ITU-R SM.329 [5].  | x | x |
| D.5 | Additional operating band unwanted emissions | The manufacturer shall declare whether the BS under test is intended to operate in geographic areas where the additional operating band unwanted emission limits defined in clause 6.6.4.5.6 apply. (Note 3). | x | x |
| D.6 | Co-existence with other systems | The manufacturer shall declare whether the BS under test is intended to operate in geographic areas where one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA, PHS and/or NR operating in another band are deployed.  | x | x |
| D.7 | Co-location with other base stations | The manufacturer shall declare whether the BS under test is intended to operate co-located with Base Stations of one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA and/or NR operating in another band.  | x | x |
| D.8 | *Single band connector* or *multi-band connector* | Declaration of the single band or multi-band capability of *single band connector(s)* or *multi-band connector(s),* declared for every connector. | x | x |
| D.9 | Contiguous or non-contiguous spectrum operation support | Ability to support contiguous or non-contiguous (or both) frequency distribution of carriers when operating multi-carrier. Declared per *single band connector* or *multi-band connector*, per *operating band*. | x | x |
| D.10 | Maximum *Radio Bandwidth*  | Maximum *radio bandwidth* that can be supported by the *multi-band connector*. May be different for transmit and receive.Declared for each supported *operating band* and operating bands combination (D.27) supported for every *multi-band connector.* | x | x |
| D.11 | Maximum *Base Station RF Bandwidth* | Maximum *Base Station RF Bandwidth* in the *operating band* for single-band operation. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* (Note 2) | x | x |
| D.12 | Maximum *Base Station RF Bandwidth* for multi-band operation | Maximum *Base Station RF Bandwidth* for multi-band operation. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.13 | Total RF bandwidth (BWtot) | Total RF bandwidth BWtot of transmitter and receiver, declared per the band combinations (D.27).  | x | x |
| D.14 | NR supported channel bandwidths and SCS | NR supported SCS and channel bandwidths per supported SCS. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.15 | CA only operation | Declaration of CA-only operation (with equal power spectral density among carriers) but not multiple carriers, declared per *operating band* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.16 | Single or multiple carrier | Capable of operating with a single carrier (only) or multiple carriers. Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.17 | Maximum number of supported carriers per operating band | Maximum number of supported carriers per supported *operation band.* Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* (Note 2) | x | x |
| D.18 | Maximum number of supported carriers in multi-band operation | Maximum number of supported carriers in multi-band operation. | x | x |
| D.19 | Total maximum number of supported carriers  | Maximum number of supported carriers for all supported *operating bands.* Declared for all connectors (D.18)*.* | x | x |
| D.20 | Other band combination multi-band restrictions | Declare any other limitations under simultaneous operation in the declared band combinations (D.35) for each *multi-band connector* which have any impact on the test configuration generation.Declared for every *multi-band connector*. | x | x |
| D.21 | Rated carrier output power(Prated,c,AC, or Prated,c,TABC) | Conducted rated carrier output power, per *single band connector* or *multi-band connector.*Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. (Note 1, 2) | x | x |
| D.22 | R*ated total output power* (Prated,t,AC, or Prated,t,TABC) | Conducted total rated output power*.*Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.*For *multi-band connectors* declared for each supported *operating band* in each supported band combination. (Note 1, 2) | x | x |
| D.23 | Rated multi-band total output power, Prated,MB,TABC | Conducted multi-band rated total output power*.*Declared per supported operating band combinations, per *multi-band connector*. (Note 1) | x | x |
| D.24 | Ncells | Number corresponding to the minimum number of cells that can be transmitted by a BS in a particular *operating band* with transmission on all *TAB connectors* supporting the *operating band*.  |  | x |
| D.25 | Maximum supported power difference between carriers | Maximum supported power difference between carriers. Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.26 | Maximum supported power difference between carriers is different *operating bands* | Supported power difference between any two carriers in any two different supported *operating bands.* Declared per supported operating band combination, per *multi-band connector.* | x | x |
| D.27 | Operating band combination support | List of operating bands combinations supported by *single-band connector(s)* and/or *multi-band connector(s)* of the BS. Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.28 | Total number of supported carriers for the declared band combinations  | Total number of supported carriers for the declared band combinations (D.27). | x | x |
| D.29 | Intra-system interfering signal declaration list | List of *single band connector(s)* or *multi-band connector(s)* for which an intra-system interfering signal level is required to be declared. Declaration is required if the intra-system interfering signal level is larger than the co-location interfering signal level. |  | x |
| D.30 | Intra-system interfering signal level | The interfering signal level in dBm. Declared per supported *operating band*, per *TAB connector* for *BS type 1-H* covered by D.29. |  | x |
| D.31 | TAE groups | Set of declared *TAB connector beam forming groups* on which the TAE requirements apply.*All TAB connectors* belong to at least one *TAB connector beam forming group* (even if it's a *TAB connector beam forming group* consisting of one connector).The smallest possible number of *TAB connector beam forming groups* need to be declared such that there is no *TAB connector* not contained in at least one of the declared *TAB connector beam forming groups*.Declared per supported *operating band*. |  | x |
| D.32 | Equivalent connectors | List of *antenna connectors* of *BS type 1-C*, or *TAB connector* of *BS type 1-H*, which have been declared equivalent.Equivalent connectors imply that the *antenna connector* of *BS type 1-C*, or *TAB connector* of *BS type 1-H*, are expected to behave in the same way when presented with identical signals under the same operating conditions. All declarations made for the *antenna connector* of *BS type 1-C*, or *TAB connector* of *BS type 1-H* are identical and the transmitter unit and/or receiver unit driving the *antenna connector* of *BS type 1-C* or *TAB connector* of *BS type 1-H* are of identical design. | x | x |
| D.33 | *TAB connector RX min cell group* | Declared as a group of *TAB connectors* to which RX requirements are applied. This declaration corresponds to group of *TAB connectors* which are responsible for receiving a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. |  | x |
| D.34 | *TAB connector TX min cell group* | Declared group of *TAB connectors* to which TX requirements are applied. This declaration corresponds to group of *TAB connectors* which are responsible for transmitting a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. |  | x |
| D.35 | Connecting network loss range for BS testing with ancillary RF amplifiers | Declaration of the range of connecting network losses (in dB) for *BS type 1-C* testing with ancillary Tx RF amplifier only, or with Rx RF amplifier only, or with combined Tx/Rx RF amplifiers. (Note 4) | x |  |
| D.36 | Relation between supported maximum RF bandwidth, number of carriers and Rated total output power | If the rated total output power and total number of supported carriers are not simultaneously supported, the manufacturer shall declare the following additional parameters:- The reduced number of supported carriers at the rated total output power;- The reduced total output power at the maximum number of supported carriers. | x | x |
| D.37 | *TAB connectors* used for performance requirement testing | To reduce test complexity, declaration of a representative (sub)set of *TAB connectors* to be used for performance requirement test purposes. At least one *TAB connector* mapped to each *demodulation branch* is declared. |  | x |
| D.38 | Inter-band CA  | Band combinations declared to support inter-band CA (per CA capable *multi-band connector(s)*, as in D.15).Declared for every *multi-band connector* which support CA. | x | x |
| D.39 | Intra-band contiguous CA  | Bands declared to support intra-band contiguous CA (per CA capable *single band connector(s)* or *multi-band connector(s)*, as in D.15).Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.40 | Intra-band non-contiguous CA | Bands declared to support intra-band non-contiguous CA (per CA capable *single band connector(s)* or *multi-band connector(s)*, as in D.15).Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.41 | NB-IoT operation | Manufacturer shall declare the support of NB-IoT operation in NR in-band and the number of supported NB-IoT carriers in total and for each supported band, frequency range and channel bandwidth. | x |  |
| D.42 | NB-IoT sub-carrier spacing | If the BS supports NB-IoT operation in NR in-band, manufacturer shall declare if it supports 15 kHz sub-carrier spacing, 3.75 kHz sub-carrier spacing, or both for NPUSCH. | x |  |
| D.43 | NB-IoT power dynamic range | 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 of +6dB or +3dB as specified in clause 6.3.4 of TS 38.104 [2] (Note 5). | x |  |
| D.100 | PUSCH mapping type | Declaration of the supported PUSCH mapping type as specified in TS 38.211 [17], i.e., type A, type B or both. | x | x |
| D.101 | PUSCH additional DM-RS positions  | Declaration of the supported additional DM-RS position(s), i.e., pos0, pos1 or both. |  |  |
| D.102 | PUCCH format | Declaration of the supported PUCCH format(s) as specified in TS 38.211 [17], i.e., format 0, format 1, format 2, format 3, format 4. | x | x |
| D.103 | PRACH format and SCS | Declaration of the supported PRACH format(s) as specified in TS 38.211 [17], i.e., format: 0, A1, A2, A3, B4, C0, C2.Declaration of the supported SCS(s) per supported PRACH format with short sequence, as specified in TS 38.211 [17], i.e., 15 kHz, 30 kHz or both. | x | x |
| D.104 | Additional DM-RS for PUCCH format 3 | Declaration of the supported additional DM-RS for PUCCH format 3: without additional DM-RS, with additional DM-RS or both. | x | x |
| D.105 | Additional DM-RS for PUCCH format 4 | Declaration of the supported additional DM-RS for PUCCH format 4: without additional DM-RS, with additional DM-RS or both. | x | x |
| D.106 | PUCCH multi-slot  | Declaration of multi-slot PUCCH support. | x | x |
| NOTE 1: If a BS is capable of 256QAM DL operation then two rated output power declarations may be made. One declaration is applicable when configured for 256QAM transmissions and the other declaration is applicable when not configured for 256QAM transmissions.NOTE 2: Parameters for contiguous or non-contiguous spectrum operation in the operating band are assumed to be the same unless they are separately declared.NOTE 3: If BS is declared to support Band n20 (D.3), the manufacturer shall declare if the BS may operate in geographical areas allocated to broadcasting (DTT). Additionally, related declarations of the emission levels and maximum output power shall be declared.NOTE 4: This manufacturer declaration is optional.NOTE 5: This manufacturer may declare two values, one with a minimum of +6dB and the other with a minimum of +3dB. |

**<Next change>**

#### 4.7.3.1 NRTC1 generation

NRTC1 shall be constructed on a per band basis using the following method:

- Declared maximum Base Station RF Bandwidth supported for contiguous spectrum operation (D.11) shall be used;

- Select the carrier to be tested according to 4.7.2 and place it adjacent to the lower Base Station RF Bandwidth edge. Place same signal adjacent to the upper Base Station RF Bandwidth edge.

- If NB-IoT operation in NR in-band is supported, place the power boosted NB-IoT RB at the lower outermost RB eligible for NB-IoT operation in NR in-band according to clause 5.7.3 of TS 36.104 [22] and the definition in clause 3.1. If more than one NB-IoT carrier is supported with NB-IoT operation in NR in-band, place the power boosted NB-IoT RB at the upper outermost RB eligible for NB-IoT operation in NR in-band.

- For transmitter tests, select as many carriers (according to 4.7.2) that the BS supports within an *operating band* and fit in the rest of the declared maximum Base Station RF Bandwidth (D.11). Place the carriers adjacent to each other starting from the upper Base Station RF Bandwidth edge. The nominal channel spacing defined in TS 38.104 [2], clause 5.4.1 shall apply.

The test configuration should be constructed sequentially on a per band basis for all component carriers of the inter-band CA bands declared to be supported by the BS and are transmitted using the same *antenna connector*. All configured component carriers are transmitted simultaneously in the tests where the transmitter should be ON.

**<Next change>**

#### 4.7.5.1 NRTC3 generation

NRTC3 is constructed on a per band basis using the following method:

- The Base Station RF Bandwidth shall be the maximum Base Station RF Bandwidth supported for non-contiguous spectrum operation (D.11). The Base Station RF Bandwidth consists of one sub-block gap and two sub-blocks located at the edges of the declared maximum supported Base Station RF Bandwidth (D.11).

- Select the carrier to be tested according to 4.7.2. Place it adjacent to the upper Base Station RF Bandwidth edge and another carrier (as described in 4.7.2) adjacent to the lower Base Station RF Bandwidth edge.

- If NB-IoT operation in NR in-band is supported, place the power boosted NB-IoT RB at the lower outermost RB eligible for NB-IoT operation in NR in-band according to clause 5.7.3 of TS 36.104 [22] and the definition in clause 3.1. If more than one NB-IoT carrier is supported with NB-IoT operation in NR in-band, place the power boosted NB-IoT RB at the upper outermost RB eligible for NB-IoT operation in NR in-band.

- For single-band operation receiver tests, if the remaining gap is at least 15 MHz (or 60 MHz if channel bandwidth of the carrier to be tested is 20 MHz) plus two times the channel BW used in the previous step and the BS supports at least 4 carriers, place a carrier of this BW adjacent to each already placed carrier for each sub-block. The nominal channel spacing defined in TS 38.104 [2], clause 5.4.1 shall apply.

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

**<Next change>**

### 4.8.3 Applicability of test configurations for single-bandoperation

The applicable test configurations are specified in the tables below for each the supported RF configuration, which shall be declared according to clause 4.6. The generation and power allocation for each test configuration is defined in clause 4.7. This clause contains the test configurations for a BS capable of single carrier, multi-carrier and/or CA operation in both contiguous and non-contiguous spectrum in single band.

For a BS declared to be capable of single carrier operation only (D.16), a single carrier (SC) shall be used for testing.

For a BSdeclared to support multi-carrier and/or CA operation in contiguous spectrum within a single band (D.15-D.16), the test configurations in the second column of table 4.8.3-1 shall be used for testing.

For a BSdeclared to support multi-carrier and/or CA operation in contiguous and non-contiguous spectrum within a single band (D.15-D.16) and where the parameters in the manufacture's declaration according to clause 4.6 are identical for contiguous (C) and non-contiguous (NC) spectrum operation (D.9), the test configurations in the third column of table 4.8.3-1 shall be used for testing.

For a BSdeclared to support multi-carrier and/or CA in operation contiguous and non-contiguous spectrum within a single band (D.15-D.16) and where the parameters in the manufacture's declaration according to clause 4.6 are not identical for contiguous (C) and non-contiguous (NC) spectrum operation (D.9), the test configurations in the fourth column of table 4.8.3-1 shall be used for testing.

Unless otherwise stated, single carrier configuration (SC) tests shall be performed using signal with narrowest supported channel bandwidth and the smallest supported sub-carrier spacing.

Table 4.8.3-1: Test configurations for a BS capable of multi-carrier and/or CA in a single band

|  |  |  |  |
| --- | --- | --- | --- |
| BS test case | Contiguous spectrum capable BS | C and NC capable BS with identical parameters | C and NC capable BS with different parameters |
| Base station output power | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| RE Power control dynamic range | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Total power dynamic range (Note 3) | SC | SC | SC |
| Transmit ON/OFF power (only applied for NR TDD BS) | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| Frequency error | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Error Vector Magnitude (Note 3) | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| Time alignment error (Note 3) | NRTC1 | NRTC1 | NRTC1, NRTC3 |
| Occupied bandwidth | SC, NRTC2 (Note 1) | SC, NRTC2 (Note 1) | SC, NRTC2 (Note 1) |
| Adjacent Channel Leakage power Ratio (ACLR) | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| Cumulative ACLR requirement in non-contiguous spectrum | - | NRTC3 | NRTC3 |
| Operating band unwanted emissions | NRTC1, SC (Note 2) | NRTC1, NRTC3, SC (Note 2) | NRTC1, NRTC3, SC (Note 2) |
| Transmitter spurious emissions | NRTC1 |  NRTC3 | NRTC1, NRTC3 |
| Transmitter intermodulation | NRTC1 | NRTC1, NRTC3 | NRTC1, NRTC3 |
| Reference sensitivity level | SC | SC | SC |
| Dynamic range | SC | SC | SC |
| Adjacent Channel Selectivity (ACS) | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| In-band blocking | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| Out-of-band blocking | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| Receiver spurious emissions | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| Receiver intermodulation | NRTC1 | NRTC3 | NRTC1, NRTC3 |
| In-channel selectivity | SC | SC | SC |
| Note 1: NRTC2 is only applicable when contiguous CA is supported.Note 2: OBUE SC shall be tested using the widest supported channel bandwidth and the highest supported sub-carrier spacing.Note 3: There is no specific test for NB-IoT operation in NR in-band for these requirements, tests could be performed using NR signal only, without NB-IoT. |

### 4.8.4 Applicability of test configurations for multi-bandoperation

For a BS declared to be capable of multi-band operation, the test configuration in table 4.8.4-1 and/or table 4.8.3-1 shall be used for testing. In the case where multiple bands are mapped on common *multi-band connector*, the test configuration in the second column of table 4.8.4-1 shall be used. In the case where multiple bands are mapped on common *single-band connector*, the test configuration in table 4.8.3-1 shall be used. In the case where multiple bands are mapped on separate *single-band connector* or *multi-band connector*, the test configuration in the third column of table 4.8.4-1 shall be used.

Unless otherwise stated, single carrier configuration (SC) tests shall be performed using signal with narrowest supported channel bandwidth and the smallest supported sub-carrier spacing.

Table 4.8.4-1: Test configuration for a BS capable of multi-band operation

|  |  |
| --- | --- |
| BS test case | Test configuration  |
| Common connector | Separate connectors |
| Base station output power | NRTC1/3 (Note 1), NRTC4 | NRTC1/3 (Note 1), NRTC4 |
| RE Power control dynamic range | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Total power dynamic range (Note 8) | SC | SC |
| Transmit ON/OFF power (only applied for NR TDD BS) | NRTC4 | NRTC4  |
| Frequency error | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Error Vector Magnitude (Note 8) | NRTC1/3 (Note 1), NRTC4 | NRTC1/3 (Note 1), NRTC4 |
| Time alignment error (Note 8) | NRTC1/3 (Note 1), NRTC5 (Note 2) | NRTC1/3 (Note 1), NRTC5 (Note 2) |
| Occupied bandwidth | SC, NRTC2 (Note 3) | SC, NRTC2 (Note 3) |
| Adjacent Channel Leakage power Ratio (ACLR) | NRTC1/3 (Note 1), NRTC5 (Note 4) | NRTC1/3 (Note 1, 5), NRTC5 (Note 4, 5) |
| Cumulative ACLR requirement in non-contiguous spectrum | NRTC3 (Note 1), NRTC5 (Note 4) | NRTC3 (Note 1, 5) |
| Operating band unwanted emissions | NRTC1/3 (Note 1), NRTC5, SC (Note 7) | NRTC1/3 (Note 1, 5), NRTC5 (Note 5),SC(Note 7) |
| Transmitter spurious emissions | NRTC1/3 (Note 1), NRTC5 | NRTC1/3 (Note 1, 5), NRTC5 (Note 5) |
| Transmitter intermodulation | NRTC1/3 (Note 1) | NRTC1/3 (Note 1, 5) |
| Reference sensitivity level | SC | SC |
| Dynamic range | SC | SC |
| Adjacent Channel Selectivity(ACS) | NRTC5 | NRTC1/3 (Note 1), NRTC5 (Note 6) |
| In-band blocking | NRTC5 | NRTC1/3 (Note 1), NRTC5 (Note 6) |
| Out-of-band blocking | NRTC5 | NRTC1/3 (Note 1), NRTC5 (Note 6) |
| Receiver spurious emissions | NRTC1/3 (Note 1), NRTC5 | NRTC1/3 (Note 1, 5), NRTC5 (Note 5) |
| Receiver intermodulation | NRTC5 | NRTC1/3 (Note 1), NRTC5 (Note 6) |
| In-channel selectivity | SC | SC |
| Note 1: NRTC1 and/or NRTC3 shall be applied in each supported operating band.Note 2: NRTC5 is only applicable when inter-band CA is supported.Note 3: NRTC2 is only applicable when contiguous CA is supported.Note 4: NRTC5 may be applied for Inter RF Bandwidth gap only.Note 5: For single-band operation test, other antenna connector(s) is (are) terminated.Note 6: NRTC5 is only applicable for multi-band receiver.Note 7: OBUE SC shall be tested using the widest supported channel bandwidth and the highest supported sub-carrier spacing.Note 8: There is no specific test for NB-IoT operation in NR in-band for these requirements, tests could be performed using NR signal only, without NB-IoT. |

**<Next change>**

#### 4.9.2.2 FR1 test models

The set-up of physical channels for transmitter tests shall be according to one of the NR FR1 test models (NR-FR1‑TM) below. A reference to the applicable test model is made within each test.

The following general parameters are used by all NR test models:

- Duration is 1 radio frame (10 ms) for FDD and 2 radio frames for TDD (20 ms)

- The slots are numbered 0 to 10×2µ – 1 where µ is the numerology corresponding to the subcarrier spacing

- NRB is the maximum transmission bandwidth configuration seen in table 5.3.2-1 in TS 38.104 [2].

- Normal CP

- Virtual resource blocks of localized type

For FR1-TDD without NB-IoT operation in NR in-band, test models are derived based on the uplink/downlink configuration as shown in the table 4.9.2.2-1 using information element *TDD-UL-DL-ConfigCommon* as defined in TS 38.331 [19].

Table 4.9.2.2-1: Configurations of TDD for *BS type 1-C* and *BS type 1-H* test models

|  |  |
| --- | --- |
| Field name | Value  |
| referenceSubcarrierSpacing (kHz) | 15 | 30 | 60 |
| Periodicity (ms) for dl-UL-TransmissionPeriodicity | 5  | 5 | 5 |
| nrofDownlinkSlots | 3 | 7 | 14 |
| nrofDownlinkSymbols | 10 | 6 | 12 |
| nrofUplinkSlots | 1 | 2 | 4 |
| nrofUplinkSymbols | 2 | 4 | 8 |

For FR1-TDD with NB-IoT operation in NR in-band, test models are derived based on the uplink/downlink configuration as shown in the table 4.9.2.2-1a using information elements *TDD-UL-DL-ConfigCommon* and TDD-UL-DL-ConfigDedicated as defined in TS 38.331 [19].

Table 4.9.2.2-1a: Configurations of TDD for NR with NB-IoT operation in NR in-bandtest models

|  |  |
| --- | --- |
| Field name | Value |
| *Tdd-UL-DL-Configuration* |  |
| *referenceSubcarrierSpacing* | 15 |
| Periodicity (ms) for *dl-UL-TransmissionPeriodicity* | 5 |
| *nrofDownlinkSlots* | 1 |
| *nrofDownlinkSymbols* | 0 |
| *nrofUplinkSlots* | 0 |
| *nrofUplinkSymbols* | 0 |
| *Tdd-UL-DL-ConfigDedicated* |  |
| *nrofDownlinkSymbols* | For Slot#1: 10 |
| *nrofUplinkSymbols* | For Slot#1: 2 |
| *slotIndex* | 1 |
| *nrofDownlinkSymbols* | 10 |
| *nrofUplinkSymbols* | 2 |
| *slotIndex* | 2,3 |
| *symbols* | allUplink |
| *slotIndex*  | 4 |
| *symbols* | allDownlink |

Common physical channel parameters for all NR FR1 test models are specified in the following tables: table 4.9.2.2-2 for PDCCH, table 4.9.2.2-3 and table 4.9.2.2-4 for PDSCH. Specific physical channel parameters for NR FR1 test models are described in clauses 4.9.2.2.1 to 4.9.2.2.8.

Table 4.9.2.2-2: Common physical channel parameters for PDCCH for *BS type 1-C* and *BS type 1-H* test models

|  |  |
| --- | --- |
| Parameter | Value |
| # of symbols used for control channel | 2 |
| Starting symbol number for control channel | 0 |
| # of CCEs allocated to PDCCH  | 1 |
| Starting RB location for PDCCH | 0 |
| # of available REGs | 6 |
| Aggregation level | 1 |
| # of RBs not allocated for PDCCH in each symbol | NRB – 3 |
| Ratio of PDCCH EPRE to DM-RS EPRE | 0 dB |
| Boosting level of control channel | 0 dB |

Table 4.9.2.2-3: Common physical channel parameters for PDSCH for *BS type 1-C* and *BS type 1-H* test models

|  |  |
| --- | --- |
| Parameter | Value |
| Mapping type | PDSCH mapping type A |
| *dmrs-TypeA-Position* for the first DM-RS symbol | pos2 |
| *dmrs-AdditionalPosition* for additional DM-RS symbol(s) | 1 |
| *dmrs-Type* for comb pattern | Configuration type 1 |
| *maxLength* | 1 |
| Ratio of PDSCH EPRE to DM-RS EPRE | 0 dB |

Table 4.9.2.2-4: Common physical channel parameters for PDSCH by RNTI for *BS type 1-C* and *BS type 1-H* test models

|  |  |
| --- | --- |
| Parameter | Value |
| PDSCH  |
| Starting symbol | 0 |
| Ratio of PDSCH EPRE to PDCCH EPRE | 0 dB |
| PDSCH  |
| Starting symbol | 0 |
| Ratio of PDSCH EPRE to PDCCH EPRE | 0 dB |
| PDSCH  |
| Starting symbol | 2 |
| Ratio of PDSCH EPRE to PDCCH EPRE | 0 dB |
| Starting PRB location | 0 |
| Number of PRBs | 3 |

**<Next change>**

##### 4.9.2.2.9 NB-IoT operation in NR in-band test model (NR-N-TM)

The NB-IoT operation in NR in-band test shall be performed by puncturing one NR RB at the eligible (according to clause 5.7.3 of TS 36.104 [22] and the definition in clause 3.1) in-band position closest to NR minimum guard band.

The set-up of physical channels for transmitter tests shall be according to the NB-IoT Test Model (N-TM) defined in TS 36.141 [23].

The power for NR RE and NB-IoT RE is set by following procedures:

* The average power per RE over all RBs (both NR and NB-IoT) is calculated according to manufacturer’s declared rated carrier output power (Prated,c,AC, D.21);
* The power of boosted NB-IoT RE (PNB-IoT) is calculated according to manufacturer’s declared rated NB-IoT maximum power dynamic range (X dB >= 6 dB or 3 dB), with the power boosting only applies on the NNB\_IoT REs containing NB-IoT signal.
* The remaining power is allocated to NNR NR REs.

**<Next change>**

#### 4.9.2.4 Data content of Physical channels and Signals for NR-N-TM

Detailed configuration for the transmitter characteristic tests are defined in TS 36.141 [23],

### 4.9.3 NB-IoT testing

Unless otherwise stated, the NB-IoT operation in NR in-band test shall be performed by puncturing one NR RB at the eligible (according to clause 5.7.3 of TS 36.104 [22] and the definition in clause 3.1) in-band position closest to NR minimum guard band; those are denoted LNB-IoT (Left) and RNB-IoT (Right).

Unless otherwise stated, the NB-IoT operation in NR in-band receiver tests shall be performed by using the tone located on the NB-IoT RB’s edge, which is closest to NR minimum guard band; those are denoted BNB-IoT for LNB-IoT and TNB-IoT for RNB-IoT.

Unless otherwise stated, a BS declared to be capable of NB-IoT operation in NR in-band is only required to pass the transmitter tests for NR with NB-IoT operation in NR in-band; it is not required to perform the transmitter tests again for NR only.

Unless otherwise stated, a BS declared to be capable of NB-IoT operation in NR in-band is only required to pass the receiver tests for NR with NB-IoT operation in NR in-band; it is not required to perform the receiver tests again for NR only.

NOTE: The BS should be configured (in RRC signalling perspective) in the NB-IoT E-UTRA guard band operation mode during the tests.

**<Next change>**

# 5 Operating bands and channel arrangement

For the NR and NB-IoT operation in NR in-band operating bands specification, their channel bandwidth configurations, channel spacing and raster, as well as synchronization raster specification, refer to TS 38.104 [2], clause 5 and its relevant clauses.

For the conducted testing purposes in this specification, only FR1 operating bands are considered.

**<Next change>**

### 6.2.5 Test requirement

For each *single-band connector* or *multi-band connector* under test, the power measured in clause 6.2.4.2 in step 3 shall remain within the values provided in table 6.2.5-1 for normal and extreme test environments, relative to the manufacturer's declared Prated,c,AC for *BS type 1-C*, or relative to the manufacturer's declared Prated,c,TABC for *BS type 1-H* (D.21):

Table 6.2.5-1: Test requirement for conducted BS output power

|  |  |  |
| --- | --- | --- |
|  | Normal test environment | Extreme test environment |
| *BS type 1-C*,*BS type 1-H* | f ≤ 3.0 GHz: ± 2.7 dB | f ≤ 3.0 GHz: ± 3.2 dB |
| 3.0 GHz < f ≤ 6.0 GHz: ± 3.0 dB | 3.0 GHz < f ≤ 6.0 GHz: ± 3.5 dB |

NOTE: For NB-IoT operation in NR in-band, the NR carrier and NB-IoT carrier shall be seen as a single carrier occupied NR channel bandwidth, the output power over this carrier is shared between NR and NB-IoT. This note shall apply for Pmax,c,AC andPrated,c,AC.

**<Next change>**

### 6.3.4 NB-IoT RB power dynamic range

#### 6.3.4.1 Definition and applicability

The NB-IoT RB power dynamic range (or NB-IoT power boosting) is the difference between the average power of NB-IoT REs (which occupy certain REs within a NR transmission bandwidth configuration plus 15 kHz at each edge but not within the NR minimum guard band GBChannel) and the average power over all REs (from both NB-IoT and the NR carrier containing the NB-IoT REs).

#### 6.3.4.2 Minimum requirement

The minimum requirement applies per *single-band connector*, or per *multi-band connector*.

The minimum requirement for *BS type 1-C* is in TS 38.104 [2], clause 6.3.4.2.

#### 6.3.4.3 Test purpose

The test purpose is to verify that the NB-IoT RB power dynamic range for NB-IoT operation in NR in-band is met as specified by the minimum requirement.

#### 6.3.4.4 Method of test

Requirement is tested together with operating band unwanted emissions test, as described in clause 6.6.4.

#### 6.3.4.5 Test requirements

NB-IoT RB power dynamic range for NB-IoT operation in NR in-band shall be larger than or equal to the level specified in Table 6.3.4.5-1 or the NB-IoT power dynamic range declared by the BS manufacturer (D.43). This power dynamic range level is only required for one NB-IoT RB.

Table 6.3.4.5-1: NB-IoT RB power dynamic range for NB-IoT operation in NR in-band

|  |  |  |
| --- | --- | --- |
| BS channel bandwidth (MHz) | NB-IoT RB frequency position | NB-IoT RB power dynamic range (dB) |
| 5, 10 | Any | +5.6 |
| 15 | Within center 77\*180kHz+15kHz at each edge | +5.6 |
| Other | +2.6 |
| 20 | Within center 102\*180kHz+15kHz at each edge | +5.6 |
| Other | +2.6 |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | Within center 90% of BS channel bandwidth | +5.6 |
| Other | +2.6 |

**<Next change>**

#### 6.5.2.5 Test Requirements

The modulated carrier frequency of each NR carrier configured by the BS shall be accurate to within the accuracy range given in table 6.5.2.5-1 observed over 1 ms.

Table 6.5.2.5-1: Frequency error test requirement

|  |  |
| --- | --- |
| BS class | Accuracy |
| Wide Area BS | ±(0.05 ppm + 12 Hz) |
| Medium Range BS | ±(0.1 ppm + 12 Hz) |
| Local Area BS | ±(0.1 ppm + 12 Hz) |

The frequency error requirement for NB-IoT is specified in TS 36.141 [23] clause 6.5.1.5.

**<Next change>**

#### 6.5.3.5 Test requirements

The EVM of each NR carrier for different modulation schemes on PDSCH shall be less than the limits in table 6.5.3.5-1.

Table 6.5.3.5-1 EVM requirements for *BS type 1-C* and *BS type 1-H*

|  |  |
| --- | --- |
| Modulation scheme for PDSCH | Required EVM (%) |
| QPSK | 18.5 % |
| 16QAM | 13.5 % |
| 64QAM | 9 % |
| 256QAM | 4.5 % |

EVM shall be evaluated for each NR carrier over all allocated resource blocks and downlink slots. Different modulation schemes listed in table 6.5.3.5-1 shall be considered for rank 1.

For all bandwidths, the EVM measurement shall be performed for each NR carrier over all allocated resource blocks and downlink slots within 10 ms measurement periods. The boundaries of the EVM measurement periods need not be aligned with radio frame boundaries.

Table 6.5.3.5-2, 6.5.3.5-3, 6.5.3.5-4 below specify the EVM window length (*W*) for normal CP for *BS type 1-C* and *BS type 1-H*.

Table 6.5.3.5-2 EVM window length for normal CP for NR, FR1, 15 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channelbandwidth (MHz) | FFT size | Cyclic prefix length for symbols 1‑6 and 8-13 in FFT samples | EVM window length *W* | Ratio of *W* to total CP length for symbols 1‑6 and 8-13 (%)(Note) |
| 5 | 512 | 36 | 14 | 40 |
| 10 | 1024 | 72 | 28 | 40 |
| 15 | 1536 | 108 | 44 | 40 |
| 20 | 2048 | 144 | 58 | 40 |
| 25 | 2048 | 144 | 72 | 50 |
| 30 | 3072 | 216 | 108 | 50 |
| 40 | 4096 | 288 | 144 | 50 |
| 50 | 4096 | 288 | 144 | 50 |
| Note: These percentages are informative and apply to a slot’s symbols 1 to 6 and 8 to 13. Symbols 0 and 7 have a longer CP and therefore a lower percentage. |

Table 6.5.3.5-3 EVM window length for normal CP for NR, FR1, 30 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channelbandwidth (MHz) | FFT size | Cyclic prefix length for symbols 1‑13 in FFT samples | EVM window length *W* | Ratio of *W* to total CP length for symbols 1‑13 (%)(Note) |
| 5 | 256 | 18 | 8 | 40 |
| 10 | 512 | 36 | 14 | 40 |
| 15 | 768 | 54 | 22 | 40 |
| 20 | 1024 | 72 | 28 | 40 |
| 25 | 1024 | 72 | 36 | 50 |
| 30 | 1536 | 108 | 54 | 50 |
| 40 | 2048 | 144 | 72 | 50 |
| 50 | 2048 | 144 | 72 | 50 |
| 60 | 3072 | 216 | 130 | 60 |
| 70 | 3072 | 216 | 130 | 60 |
| 80 | 4096 | 288 | 172 | 60 |
| 90 | 4096 | 288 | 172 | 60 |
| 100 | 4096 | 288 | 172 | 60 |
| Note: These percentages are informative and apply to a slot’s symbols 1 through 13. Symbol 0 has a longer CP and therefore a lower percentage. |

Table 6.5.3.5-4 EVM window length for normal CP for NR, FR1, 60 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channelbandwidth (MHz) | FFT size | Cyclic prefix length in FFT samples | EVM window length *W* | Ratio of *W* to total CP length (%)(Note) |
| 10 | 256 | 18 | 8 | 40 |
| 15 | 384 | 27 | 11 | 40 |
| 20 | 512 | 36 | 14 | 40 |
| 25 | 512 | 36 | 18 | 50 |
| 30 | 768 | 54 | 26 | 50 |
| 40 | 1024 | 72 | 36 | 50 |
| 50 | 1024 | 72 | 36 | 50 |
| 60 | 1536 | 108 | 64 | 60 |
| 70 | 1536 | 108 | 64 | 60 |
| 80 | 2048 | 144 | 86 | 60 |
| 90 | 2048 | 144 | 86 | 60 |
| 100 | 2048 | 144 | 86 | 60 |
| Note: These percentages are informative and apply to all OFDM symbols within subframe except for symbol 0 of slot 0 and slot 2. Symbol 0 of slot 0 and slot 2 has a longer CP and therefore a lower percentage. |

The modulation quality requirements for NB-IoT are specified in TS 36.141 [23] clause 6.5.2.5.

**<Next change>**

#### 6.5.4.5 Test requirement

For MIMO transmission, at each carrier frequency, TAE shall not exceed 90 ns.

For intra-band contiguous CA, with or without MIMO, TAE shall not exceed 285 ns.

For intra-band non-contiguous CA, with or without MIMO, TAE shall not exceed 3.025 µs.

For inter-band CA, with or without MIMO, TAE shall not exceed 3.025 µs.

The time alignment error requirements for NB-IoT are specified in TS 36.141 [23] clause 6.5.3.5.

**<Next change>**

##### 6.6.2.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: M; see clause 4.9.1.

*Aggregated BS channel bandwidth* positions to be tested for contiguous carrier aggregation: MBW Channel CA; see clause 4.9.1.

1) Connect the measurement device to the BS *antenna connector* or *TAB connector* as shown in annex D1.1 for *BS type 1-C* or D3.1 for *BS type 1-H*.

2) For a BS declared to be capable of single carrier operation (D.16), start transmission according to the applicable test configuration in clause 4.8 using the corresponding test model NR-FR1-TM1.1 at manufacturer's declared rated output power (Prated,c,AC, or Prated,c,TABC, D.21).

 For a BS declared to be capable of contiguous CA operation, set the BS to transmit according to NR-FR1-TM1.1 on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7.4 and 4.8.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

**<Next change>**

#### 6.6.3.1 Definition and applicability

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency.

The requirements shall apply outside the Base Station RF Bandwidth or Radio Bandwidth whatever the type of transmitter considered (single carrier or multi-carrier) and for all transmission modes foreseen by the manufacturer's specification.

The requirements shall also apply if the BS supports NB-IoT operation in NR in-band.

For a BS operating in non-contiguous spectrum, the ACLR requirement in clause 6.6.3.2 shall apply in *sub block gaps* for the frequency ranges defined in table 6.6.3.5.2-3, while the CACLR requirement in clause 6.6.3.2 shall apply in *sub block gaps* for the frequency ranges defined in table 6.6.3.2-4.

For a *multi-band connector*, the ACLR requirement in clause 6.6.3.2 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 6.6.3.5.2-3, while the CACLR requirement in clause 6.6.3.2 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 6.6.3.2-4.

The requirement applies during the *transmitter ON period*.

**<Next change>**

##### 6.6.3.4.2 Procedure

For *BS type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.1.1 for *BS type 1-C* or in annex D.3.1 for *BS type 1-H*. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment as shown in annex D.1.1 for *BS type 1-C* and in annex D.3.1 for *BS type 1-H*. All connectors not under test shall be terminated.

 The measurement device characteristics shall be:

- Measurement filter bandwidth: defined in clause 6.6.3.5.

- Detection mode: true RMS voltage or true average power.

2) For a connectors declared to be capable of single carrier operation only (D.16), set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models NR-FR1‑TM 1.1 in clause 4.9.2 at *rated carrier output power* Prated,c,AC for *BS type 1-C* and Prated,c,TABC for *BS type 1-H* (D.21).

 For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

3) Measure ACLR for the frequency offsets both side of channel frequency as specified in table 6.6.3.5.2‑1. In multiple carrier case only offset frequencies below the lowest and above the highest carrier frequency used shall be measured.

4) For the ACLR requirement applied inside sub-block gap for non-contiguous spectrum operation, or inside *Inter RF Bandwidth gap* for multi-band operation:

a) Measure ACLR inside sub-block gap or *Inter RF Bandwidth gap* as specified in clause 6.6.3.5.2, if applicable.

b) Measure CACLR inside sub-block gap or *Inter RF Bandwidth gap* as specified in clause 6.6.3.5.2, if applicable.

5) Repeat the test with the channel set-up according to NR-FR1-TM 1.2 in clause 4.9.2.

In addition, for *multi-band connectors*, the following steps shall apply:

6) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

**<Next change>**

#### 6.6.4.1 Definition and applicability

Unless otherwise stated, the operating band unwanted emission (OBUE) limits in FR1 are defined from ΔfOBUE below the lowest frequency of each supported downlink *operating band* up to ΔfOBUE above the highest frequency of each supported downlink *operating band*. The values of ΔfOBUE are defined in table 6.6.1‑1 for the NR *operating bands*.

The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer's specification. In addition, for a BS operating in non-contiguous spectrum, the requirements apply inside any sub-block gap. In addition, for a BS operating in multiple bands, the requirements apply inside any Inter RF Bandwidth gap.

B*asic limits* are specified in the tables below, where:

- Δf is the separation between the channel edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.

- f\_offset is the separation between the channel edge frequency and the centre of the measuring filter.

- f\_offsetmax is the offset to the frequency ΔfOBUE outside the downlink *operating band*, where ΔfOBUE is defined in table 6.6.1-1.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For a *multi-band connector* inside any *Inter RF Bandwidth gaps* with Wgap < 2\*ΔfOBUE, a combined *basic* limit shall be applied which is the cumulative sum of the *basic limit*s specified at the *Base Station RF Bandwidth edges* on each side of the *Inter RF Bandwidth gap*. The *basic limit* for *Base Station RF Bandwidth edge* is specified in the clauses 6.6.4.5.2 to 6.6.4.5.5below, where in this case:

- Δf is the separation between the *Base Station RF Bandwidth edge* frequency and the nominal -3 dB point of the measuring filter closest to the *Base Station RF Bandwidth edge*.

- f\_offset is the separation between the *Base Station RF Bandwidth edge* frequency and the centre of the measuring filter.

- f\_offsetmax is equal to the *Inter RF Bandwidth gap* minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For a *multi-band connector*, the operating band unwanted emission *basic limits* apply also in a supported operating band without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported operating band. In this case, no cumulative *basic limit* is applied in the *inter-band gap* between a supported downlink operating band with carrier(s) transmitted and a supported downlink operating band without any carrier transmitted and

- In case the *inter-band gap* between a supported downlink operating band with carrier(s) transmitted and a supported downlink operating band without any carrier transmitted is less than 2\*ΔfOBUE, f\_offsetmax shall be the offset to the frequency ΔfOBUE MHz outside the outermost edges of the two supported downlink operating bands and the operating band unwanted emission *basic limit* of the band where there are carriers transmitted, as defined in the tables of the present clause, shall apply across both downlink bands.

- In other cases, the operating band unwanted emission *basic limits* of the band where there are carriers transmitted, as defined in the tables of the present clause for the largest frequency offset (Δfmax), shall apply from ΔfOBUE MHz below the lowest frequency, up to ΔfOBUE MHz above the highest frequency of the supported downlink operating band without any carrier transmitted.

For a multicarrier *single-band connector* or a *single-band connector* configured for intra-band contiguous or non-contiguous carrier aggregation the definitions above apply to the lower edge of the carrier transmitted at the lowest carrier frequency and the upper edge of the carrier transmitted at the highest carrier frequency within a specified frequency band.

In addition inside any sub-block gap for a *single-band connector* operating in non-contiguous spectrum, a combined *basic limit* shall be applied which is the cumulative sum of the *basic limit*s specified for the adjacent sub blocks on each side of the sub block gap. The *basic limit* for each sub block is specified in the subcluases 6.6.4.5.2 to 6.6.4.5.5below, where in this case:

- Δf is the separation between the sub block edge frequency and the nominal -3 dB point of the measuring filter closest to the sub block edge.

- f\_offset is the separation between the sub block edge frequency and the centre of the measuring filter.

- f\_offsetmax is equal to the sub block gap bandwidth minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

For Wide Area BS, the requirements of either clause 6.6.4.5.2 (Category A limits) or clause 6.6.4.5.3 (Category B limits) shall apply.

For Medium Range BS, the requirements in clause 6.6.4.5.4 shall apply (Category A and B).

For Local Area BS, the requirements of clause 6.6.4.5.5 shall apply (Category A and B).

The requirements shall also apply if the BS supports NB-IoT operation in NR in-band.

The application of either Category A or Category B *basic limits* shall be the same as for transmitter spurious emissions in clause 6.6.5.

**<Next change>**

##### 6.6.4.4.2 Procedure

For *BS type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment as shown in annex D.1.1 for *BS type 1-C* or in annex D.3.1 for *BS type 1-H*. All connectors not under test shall be terminated.

 As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity, efficiency and avoiding e.g. carrier leakage, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

 The measurement device characteristics shall be:

- Detection mode: True RMS.

2) For a connectors declared to be capable of single carrier operation only, set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 at *rated carrier output power* Prated,c,AC for *BS type 1-C* and Prated,c,TABC for *BS type 1-H* (D.21). Channel set-up shall be according to NR-FR1-TM 1.1.

 For a connector under test declared to be capable of multi-carrier and/or CA operation set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

3) Step the centre frequency of the measurement filter in contiguous steps and measure the emission within the specified frequency ranges with the specified measurement bandwidth. For connector under test declared to operate in multiple bands or non-contiguous spectrum, the emission within the *Inter RF Bandwidth* or *sub-block gap* shall be measured using the specified measurement bandwidth from the closest RF Bandwidth or sub block edge.

4) Repeat the test for the remaining test cases, with the channel set-up according to NR-FR1-TM 1.2.

In addition, for *multi-band connectors*, the following steps shall apply:

5) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

**<Next change>**

#### 6.6.5.1 Definition and applicability

The transmitter spurious emission limits shall apply from 9 kHz to 12.75 GHz, excluding the frequency range from ΔfOBUE below the lowest frequency of each supported downlink *operating band*, up to ΔfOBUE above the highest frequency of each supported downlink *operating band*, where the ΔfOBUE is defined in table 6.6.1. For some *operating bands*, the upper limit is higher than 12.75 GHz in order to comply with the 5th harmonic limit of the downlink *operating band*, as specified in ITU-R recommendation SM.329 [5].

For a *multi-band connector*, each supported *operating band* together with ΔfOBUE around the band is excluded from the transmitter spurious emissions requirement.

The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

The requirements shall apply to BS that support NR or NR with NB-IoT operation in NR in-band.

Unless otherwise stated, all requirements are measured as mean power (RMS).

For operation in region 2, where the FCC guidance for MIMO systems in FCC Title 47 [13] is applicable, NTXU,countedpercell shall be equal to one for the purposes of calculating the spurious emissions limits in clauses 6.6.5. For all other unwanted emissions requirements, NTXU,countedpercell shall be the value calculated according to clause 6.1.

**<Next change>**

##### 6.6.5.4.2 Procedure

For *BS type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment as shown in annex D.1.1 for *BS type 1-C* and in annex D.3.1 for *BS type 1-H*. All connectors not under test shall be terminated.

2) Measurements shall use a measurement bandwidth in accordance to the conditions in clause 6.6.5.5.

 The measurement device characteristics shall be:

- Detection mode: True RMS.

3) For a connectors declared to be capable of single carrier operation only (D.16), set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 at *rated carrier output power* (Prated,c,AC, or Prated,c,TABC, D.21). Channel set-up shall be according to NR-FR1-TM 1.1.

 For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

4) Measure the emission at the specified frequencies with specified measurement bandwidth.

In addition, for *multi-band connectors*, the following steps shall apply:

5) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

**<Next change>**

#### 6.7.4.2 Procedure

For *BS type 1-H* where there may be multiple *TAB connectors*, they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.3.1. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment as shown in annex D.1.2 for *BS type 1-C* and in annex D.3.2 for *BS type 1-H*. All connectors not under test shall be terminated.

2) The measurement device characteristics shall be:

- Detection mode: True RMS.

3) For a connectors declared to be capable of single carrier operation only (D.16), set the representative connectors under test to transmit according to the applicable test configuration in clause 4.8 at *rated carrier output power* Prated,c,AC for *BS type 1-C* and Prated,c,TABC for *BS type 1-H* (D.21). Channel set-up shall be according to NR-FR1-TM 1.1.

 For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

For a BS declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

4) Generate the interfering signal according to NR-FR1-TM-1.1, as defined in clause 4.9.2, with the minimum channel bandwidth (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5 of TS 38.104 [2] and a centre frequency offset from the lower/upper edge of the wanted signal or edge of sub-block inside a sub-block gap , for n = 1, 2 and 3, but exclude interfering frequencies that are outside of the allocated downlink operating band or interfering frequencies that are not completely within the sub-block gap or within the *Inter RF Bandwidth gap*.

5) Adjust ATT attenuator (as in the test setup in annex D.1.2 for *BS type 1-C* and in annex D.3.2 for *BS type 1-H*) so that level of the interfering signal is as defined in clause 6.7.5.

6) Perform the unwanted emission tests specified in clauses 6.6.3 and 6.6.4 for all third and fifth order intermodulation products which appear in the frequency ranges defined in clauses 6.6.3 and 6.6.4. The width of the intermodulation products shall be taken into account.

7) Perform the transmitter spurious emissions test as specified in clause 6.6.5, for all third and fifth order intermodulation products which appear in the frequency ranges defined in clause 6.6.5. The width of the intermodulation products shall be taken into account.

8) Verify that the emission level does not exceed the required level in clause 6.7.5 with the exception of interfering signal frequencies.

9) Repeat the test for the remaining interfering signal centre frequency offsets according to step 4.

10) Repeat the test for the remaining test signals defined in clause 6.7.5 for additional requirements and for *BS type 1-H* intra-system requirements.

In addition, for *multi-band connectors*, the following steps shall apply:

11) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

NOTE: The third order intermodulation products are centred at 2F1±F2 and 2F2±F1. The fifth order intermodulation products are centred at 3F1±2F2, 3F2±2F1, 4F1±F2, and 4F2±F1 where F1 represents the test signal centre frequency or centre frequency of each sub-block and F2 represents the interfering signal centre frequency. The widths of intermodulation products are:

- (n\*BWF1 + m\* BWF2) for the nF1±mF2 products;

- (n\* BWF2 + m\* BWF1) for the nF2±mF1 products;

 where BWF1 represents the test wanted signal RF bandwidth or channel bandwidth in case of single carrier, or sub-block bandwidth and BWF2 represents the interfering signal channel bandwidth.

**<Next change>**

##### 6.7.5.1.1 Co-location minimum requirements

For *BS type 1-C*, the wanted signal and interfering signal centre frequency is specified in table 6.7.5.1.1-1, where interfering signal level is *rated total output power* (Prated,t,AC) at *antenna connector* in the *operating band* – 30 dB.

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

For a BS operating in non-contiguous spectrum, the requirement is also applicable inside a sub-block gap for interfering signal offsets where the interfering signal falls completely within the sub-block gap. The interfering signal offset is defined relative to the sub-block edges.

For a *multi-band connector*, the requirement shall apply relative to the Base Station RF Bandwidth edges of each supported operating band. In case the Inter RF Bandwidth gap is less than 3\*BWChannel MHz (where BWChannel is the minimal *BS channel bandwidth* of the band), the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the Inter RF Bandwidth gap.

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3, 6.6.4 and 6.6.5 in the presence of an NR interfering signal according to table 6.7.5.1.1-1.

Table 6.7.5.1.1-1: Interfering and wanted signals for the co-location transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal type | NR single carrier, or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers, with NB-IoT operation in NR in-band if supported. |
| Interfering signal type | NR signal, the minimum *BS channel bandwidth* (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5 of TS 38.104 [2]. |
| Interfering signal level | Rated total output power (Prated,t,AC) in the *operating band* – 30 dB |
| Interfering signal centre frequency offset from the lower/upper edge of the wanted signal or edge of sub-block inside a sub-block gap | , for n=1, 2 and 3  |
| NOTE 1: Interfering signal positions that are partially or completely outside of any downlink *operating band* of the BS are excluded from the requirement, unless the interfering signal positions fall within the frequency range of adjacent downlink *operating bands* in the same geographical area.NOTE 2: In Japan, NOTE 1 is not applied in Band n77, n78, n79. |

**<Next change>**

## 7.1 General

Conducted receiver characteristics are specified at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H*, with full complement of transceivers for the configuration in normal operating condition.

Unless otherwise stated, the following arrangements apply for conducted receiver characteristics requirements in clause 7:

- Requirements apply during the BS receive period.

- Requirements shall be met for any transmitter setting.

- For FDD operation the requirements shall be met with the transmitter unit(s) ON.

- Throughput requirements defined for the conducted receiver characteristics do not assume HARQ retransmissions.

- When BS is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.

- For ACS, blocking and intermodulation characteristics, the negative offsets of the interfering signal apply relative to the lower *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*, and the positive offsets of the interfering signal apply relative to the upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*.

- Requirements shall also apply for BS supporting NB-IoT operation in NR in-band. The corresponding NB-IoT requirements are specified in clause 7 of TS 36.141 [23].

NOTE 1: In normal operating condition the BS in FDD operation is configured to transmit and receive at the same time.

NOTE 2: In normal operating condition the BS in TDD operation is configured to TX OFF power during *receive period*.

For *BS type 1-H* if a number of *TAB connectors* have been declared equivalent (D.32), only a representative one is necessary to demonstrate conformance.

In clause 7.6.5.3, if representative *TAB connectors* are used then per connector criteria (option 2) shall be applied.

**<Next change>**

#### 7.2.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.1 for *BS type 1-C* and in annex D.4.1 for *BS type 1-H*.

2) Set the BS to transmit a signal according to clause 4.9.2, for *BS type 1-C* set the *antenna connector* to the manufacturers declared *rated carrier output power* (PRated,c,AC or PRated,c,TABC, D.21).

3) Start the signal generator for the wanted signal to transmit the Fixed Reference Channels for reference sensitivity according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

4) Set the signal generator for the wanted signal power as specified in clause 7.2.5.

5) Measure the throughput according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band connector*, the following steps shall apply:

6) For *multi-band connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.2.5 Test requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 7.2.5-1 for Wide Area BS, in table 7.2.5-2 for Medium Range BS and in table 7.2.5-3 for Local Area BS.

The reference sensitivity level requirements for NB-IoT are specified in clause 7.2.5 of TS 36.141 [23].

Table 7.2.5-1: NR Wide Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz)  | Sub-carrier spacing (kHz) | Reference measurement channel |  Reference sensitivity power level, PREFSENS (dBm) |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15  | 15 | G-FR1-A1-1 (Note 1) | -101 | -100.7 | -100.5 |
| G-FR1-A1-10 (Note 3) | -101 (Note 2) | -100.7 (Note 2) | -100.5 (Note 2) |
| 10, 15  | 30 | G-FR1-A1-2 (Note 1) | -101.1 | -100.8 | -100.6 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) | -98.2 | -97.9 | -97.7 |
| 20, 25, 30, 40, 50  | 15 | G-FR1-A1-4 (Note 1) | -94.6 | -94.3 | -94.1 |
| G-FR1-A1-11 (Note 4) | -94.6 (Note 2) | -94.3 (Note 2) | -94.1 (Note 2) |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 30 | G-FR1-A1-5 (Note 1) | -94.9 | -94.6 | -94.4 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 60 | G-FR1-A1-6 (Note 1) | -95 | -94.7 | -94.5 |
| NOTE 1: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.NOTE 2: The requirements apply to BS that supports NB-IoT operation in NR in-band.NOTE 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.NOTE 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each. |

Table 7.2.5-2: NR Medium Range BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz)  | Sub-carrier spacing (kHz) | Reference measurement channel |  Reference sensitivity power level, PREFSENS (dBm) |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15  | 15 | G-FR1-A1-1 (Note 1) | -96 | -95.7 | -95.5 |
| G-FR1-A1-10 (Note 3) | -96 (Note 2) | -95.7 (Note 2) | -95.5 (Note 2) |
| 10, 15  | 30 | G-FR1-A1-2 (Note 1) | -96.1 | -95.8 | -95.6 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) | -93.2 | -92.9 | -92.7 |
| 20, 25, 30, 40, 50  | 15 | G-FR1-A1-4 (Note 1) | -89.6 | -89.3 | -89.1 |
| G-FR1-A1-11 (Note 4) | -89.6 (Note 2) | -89.3 (Note 2) | -89.1 (Note 2) |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 30 | G-FR1-A1-5 (Note 1) | -89.9 | -89.6 | -89.4 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 60 | G-FR1-A1-6 (Note 1) | -90 | -89.7 | -89.5 |
| NOTE 1: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.NOTE 2: The requirements apply to BS that supports NB-IoT operation in NR in-band.NOTE 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.NOTE 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each. |

Table 7.2.5-3: NR Local Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz)  | Sub-carrier spacing (kHz) | Reference measurement channel |  Reference sensitivity power level, PREFSENS (dBm) |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5, 10, 15  | 15 | G-FR1-A1-1 (Note 1) | -93 | -92.7 | -92.5 |
| G-FR1-A1-10 (Note 3) | -93 (Note 2) | -92.7 (Note 2) | -92.5 (Note 2) |
| 10, 15  | 30 | G-FR1-A1-2 (Note 1) | -93.1 | -92.8 | -92.6 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) | -90.2 | -89.9 | -89.7 |
| 20, 25, 30, 40, 50  | 15 | G-FR1-A1-4 (Note 1) | -86.6 | -86.3 | -86.1 |
| G-FR1-A1-11 (Note 4) | -86.6 (Note 2) | -86.3 (Note 2) | -86.1 (Note 2) |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 30 | G-FR1-A1-5 (Note 1) | -86.9 | -86.6 | -86.4 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 60 | G-FR1-A1-6 (Note 1) | -87 | -86.7 | -86.5 |
| NOTE 1: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.NOTE 2: The requirements apply to BS that supports NB-IoT operation in NR in-band.NOTE 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.NOTE 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each. |

**<Next change>**

#### 7.3.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.2 for *BS type 1-C* and in annex D.4.2 for *BS type 1-H*.

2) Set the signal generator for the wanted signal to transmit as specified in table 7.3.5-1 to table 7.3.5-3 according to the appropriate BS class, as well as table 7.3.5-1a to table 7.3.5-3a for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

3) Set the Signal generator for the AWGN interfering signal at the same frequency as the wanted signal to transmit as specified in table 7.3.5-1 to table 7.3.5-3 according to the appropriate BS class, as well as table 7.3.5-1a to table 7.3.5-3a for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

4) Measure the throughput according to annex A.2, as well as annex A.15 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band connector*, the following steps shall apply:

5) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.3.5 Test requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.2 with parameters specified in table 7.3.2-1 for Wide Area BS, in table 7.3.2-2 for Medium Range BS and in table 7.3.2-3 for Local Area BS.

For NB-IoT operation in NR in-band, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in Annex A of TS 36.141 [23] with parameters specified in table 7.3.5-1a for Wide Area BS, in table 7.3.5-2a for Medium Range BS and in table 7.3.5-3a for Local Area BS.

Table 7.3.5-1: Wide Area BS dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | 15 | G-FR1-A2-1 | -70.4 | -82.5 | AWGN |
| 30 | G-FR1-A2-2 | -71.1 |
| 10 | 15 | G-FR1-A2-1 | -70.4 | -79.3 | AWGN |
| 30 | G-FR1-A2-2 | -71.1 |
| 60 | G-FR1-A2-3 | -68.1 |
| 15 | 15 | G-FR1-A2-1 | -70.4 | -77.5 | AWGN |
| 30 | G-FR1-A2-2 | -71.1 |
| 60 | G-FR1-A2-3 | -68.1 |
| 20 | 15 | G-FR1-A2-4 | -64.2 | -76.2 | AWGN |
| 30 | G-FR1-A2-5 | -64.2 |
| 60 | G-FR1-A2-6 | -64.5 |
| 25 | 15 | G-FR1-A2-4 | -64.2 | -75.2 | AWGN |
| 30 | G-FR1-A2-5 | -64.2 |
| 60 | G-FR1-A2-6 | -64.5 |
| 30 | 15 | G-FR1-A2-4 | -64.2 | -74.4 | AWGN |
| 30 | G-FR1-A2-5 | -64.2 |
| 60 | G-FR1-A2-6 | -64.5 |
| 40 | 15 | G-FR1-A2-4 | -64.2 | -73.1 | AWGN |
| 30 | G-FR1-A2-5 | -64.2 |
| 60 | G-FR1-A2-6 | -64.5 |
| 50 | 15 | G-FR1-A2-4 | -64.2 | -72.1 | AWGN |
| 30 | G-FR1-A2-5 | -64.2 |
| 60 | G-FR1-A2-6 | -64.5 |
| 60 | 30 | G-FR1-A2-5 | -64.2 | -71.3 | AWGN |
| 60 | G-FR1-A2-6 | -64.5 |
| 70 | 30 | G-FR1-A2-5 | -64.2 | -70.7 | AWGN |
| 60 | G-FR1-A2-6 | -64.5 |
| 80 | 30 | G-FR1-A2-5 | -64.2 | -70.1 | AWGN |
| 60 | G-FR1-A2-6 | -64.5 |
| 90 | 30 | G-FR1-A2-5 | -64.2 | -69.5 | AWGN |
| 60 | G-FR1-A2-6 | -64.5 |
| 100 | 30 | G-FR1-A2-5 | -64.2 | -69.1 | AWGN |
| 60 | G-FR1-A2-6 | -64.5 |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. |

Table 7.3.5-1a: Wide Area BS dynamic range for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A15-1 in Annex A.15 in TS 36.141 [23] | -99.4 | -82.5 | AWGN |
| 10 | -79.3 |
| 15 | -77.5 |
| 20 | -76.2 |
| 25 | -75.2 |
| 30 | -74.4 |
| 40 | -73.1 |
| 50 | -72.1 |
| 5 | FRC A15-2 in Annex A.15 in TS 36.141 [23] | -105.3 | -82.5 | AWGN |
| 10 | -79.3 |
| 15 | -77.5 |
| 20 | -76.2 |
| 25 | -75.2 |
| 30 | -74.4 |
| 40 | -73.1 |
| 50 | -72.1 |

Table 7.3.5-2: Medium Range BS dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | 15 | G-FR1-A2-1 | -65.4 | -77.5 | AWGN |
| 30 | G-FR1-A2-2 | -66.1 |
| 10 | 15 | G-FR1-A2-1 | -65.4 | -74.3 | AWGN |
| 30 | G-FR1-A2-2 | -66.1 |
| 60 | G-FR1-A2-3 | -63.1 |
| 15 | 15 | G-FR1-A2-1 | -65.4 | -72.5 | AWGN |
| 30 | G-FR1-A2-2 | -66.1 |
| 60 | G-FR1-A2-3 | -63.1 |
| 20 | 15 | G-FR1-A2-4 | -59.2 | -71.2 | AWGN |
| 30 | G-FR1-A2-5 | -59.2 |
| 60 | G-FR1-A2-6 | -59.5 |
| 25 | 15 | G-FR1-A2-4 | -59.2 | -70.2 | AWGN |
| 30 | G-FR1-A2-5 | -59.2 |
| 60 | G-FR1-A2-6 | -59.5 |
| 30 | 15 | G-FR1-A2-4 | -59.2 | -69.4 | AWGN |
| 30 | G-FR1-A2-5 | -59.2 |
| 60 | G-FR1-A2-6 | -59.5 |
| 40 | 15 | G-FR1-A2-4 | -59.2 | -68.1 | AWGN |
| 30 | G-FR1-A2-5 | -59.2 |
| 60 | G-FR1-A2-6 | -59.5 |
| 50 | 15 | G-FR1-A2-4 | -59.2 | -67.1 | AWGN |
| 30 | G-FR1-A2-5 | 59.8 |
| 60 | G-FR1-A2-6 | -59.5 |
| 60 | 30 | G-FR1-A2-5 | -59.2 | -66.3 | AWGN |
| 60 | G-FR1-A2-6 | -59.5 |
| 70 | 30 | G-FR1-A2-5 | -59.2 | -65.7 | AWGN |
| 60 | G-FR1-A2-6 | -59.5 |
| 80 | 30 | G-FR1-A2-5 | -59.2 | -65.1 | AWGN |
| 60 | G-FR1-A2-6 | -59.5 |
| 90 | 30 | G-FR1-A2-5 | -59.2 | -64.5 | AWGN |
| 60 | G-FR1-A2-6 | -59.5 |
| 100 | 30 | G-FR1-A2-5 | -59.2 | -64.1 | AWGN |
| 60 | G-FR1-A2-6 | -59.5 |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. |

Table 7.3.5-2a: Medium Range BS dynamic range for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A15-1 in Annex A.15 in TS 36.141 [23] | -94.4 | -77.5 | AWGN |
| 10 | -74.3 |
| 15 | -72.5 |
| 20 | -71.2 |
| 25 | -70.2 |
| 30 | -69.4 |
| 40 | -68.1 |
| 50 | -67.1 |
| 5 | FRC A15-2 in Annex A.15 in TS 36.141 [23] | -100.3 | -77.5 | AWGN |
| 10 | -74.3 |
| 15 | -72.5 |
| 20 | -71.2 |
| 25 | -70.2 |
| 30 | -69.4 |
| 40 | -68.1 |
| 50 | -67.1 |

Table 7.3.5-3: Local Area BS dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | 15 | G-FR1-A2-1 | -62.4 | -74.5 | AWGN |
| 30 | G-FR1-A2-2 | -63.1 |
| 10 | 15 | G-FR1-A2-1 | -62.4 | -71.3 | AWGN |
| 30 | G-FR1-A2-2 | -63.1 |
| 60 | G-FR1-A2-3 | -60.1 |
| 15 | 15 | G-FR1-A2-1 | -62.4 | -69.5 | AWGN |
| 30 | G-FR1-A2-2 | -63.1 |
| 60 | G-FR1-A2-3 | -60.1 |
| 20 | 15 | G-FR1-A2-4 | -56.2 | -68.2 | AWGN |
| 30 | G-FR1-A2-5 | -56.2 |
| 60 | G-FR1-A2-6 | -56.5 |
| 25 | 15 | G-FR1-A2-4 | -56.2 | -67.2 | AWGN |
| 30 | G-FR1-A2-5 | -56.2 |
| 60 | G-FR1-A2-6 | -56.5 |
| 30 | 15 | G-FR1-A2-4 | -56.2 | -66.4 | AWGN |
| 30 | G-FR1-A2-5 | -56.2 |
| 60 | G-FR1-A2-6 | -56.5 |
| 40 | 15 | G-FR1-A2-4 | -56.2 | -65.1 | AWGN |
| 30 | G-FR1-A2-5 | -56.2 |
| 60 | G-FR1-A2-6 | -56.5 |
| 50 | 15 | G-FR1-A2-4 | -56.2 | -64.1 | AWGN |
| 30 | G-FR1-A2-5 | -56.2 |
| 60 | G-FR1-A2-6 | -56.5 |
| 60 | 30 | G-FR1-A2-5 | -56.2 | -63.3 | AWGN |
| 60 | G-FR1-A2-6 | -56.5 |
| 70 | 30 | G-FR1-A2-5 | -56.2 | -62.7 | AWGN |
| 60 | G-FR1-A2-6 | -56.5 |
| 80 | 30 | G-FR1-A2-5 | -56.2 | -62.1 | AWGN |
| 60 | G-FR1-A2-6 | -56.5 |
| 90 | 30 | G-FR1-A2-5 | -56.2 | -61.5 | AWGN |
| 60 | G-FR1-A2-6 | -56.5 |
| 100 | 30 | G-FR1-A2-5 | -56.2 | -61.1 | AWGN |
| 60 | G-FR1-A2-6 | -56.5 |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. |

Table 7.3.5-3a: Local Area BS dynamic range for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A15-1 in Annex A.15 in TS 36.141 [23] | -91.4 | -74.5 | AWGN |
| 10 | -71.3 |
| 15 | -69.5 |
| 20 | -68.2 |
| 25 | -67.2 |
| 30 | -66.4 |
| 40 | -65.1 |
| 50 | -64.1 |
| 5 | FRC A15-2 in Annex A.15 in TS 36.141 [23] | -97.3 | -74.5 | AWGN |
| 10 | -71.3 |
| 15 | -69.5 |
| 20 | -68.2 |
| 25 | -67.2 |
| 30 | -66.4 |
| 40 | -65.1 |
| 50 | -64.1 |

**<Next change>**

##### 7.4.1.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.3 for *BS type 1-C* and in annex D.4.3 for *BS type 1-H*.

2) Set the BS to transmit:

- For single carrier operation set the connector under test to transmit at manufacturers declared *rated carrier output power* (PRated,c,AC or PRated,c,TABC, D.21).

- For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2

3) Set the signal generator for the wanted signal to transmit as specified in table 7.4.1.5-1.

4) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.1.5-1 and 7.4.1.5-2.

5) Measure the throughput according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band* *connector*, the following steps shall apply:

6) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

#### 7.4.1.5 Test requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

For BS, the wanted and the interfering signal coupled to the *BS* *type 1-C* *antenna connector* or *BS type 1-H* *TAB connector* are specified in table 7.4.1.5-1 and the frequency offset between the wanted and interfering signal in table 7.4.1.5-2 for ACS. The reference measurement channel for the wanted signal is identified in table 7.2.5-1, 7.2.5-2 and 7.2.5-3 for each channel bandwidth and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex E.

For BS supporting NB-IoT operation in NR in-band, the wanted and the interfering signal coupled to the *BS* *type 1-C* *antenna connector* are specified in table 7.4.1.5-1 and the frequency offset between the wanted and interfering signal in table 7.4.1.5-2 for ACS. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.5 of TS 36.141 [23]. The characteristics of the interfering signal is further specified in annex E.

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

For a BS operating in non-contiguous spectrum within any *operating band*, the ACS requirement shall apply in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as the NR interfering signal in table 7.4.1.5-2. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For a *multi-band connector*, the ACS requirement shall apply in addition inside any Inter RF Bandwidth gap, in case the Inter RF Bandwidth gap size is at least as wide as the NR interfering signal in table 7.4.1.5‑2. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap

Conducted requirement is defined at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H.*

Table 7.4.1.5-1: Base station ACS requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 (Note 1) | PREFSENS + 6 dB | Wide Area BS: -52Medium Range BS: -47Local Area BS: -44 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that bandwidth.NOTE 2: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in TS 38.104 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2-5, 7.2-6 and 7.2-8 of TS 36.141 [23]. |

Table 7.4.1.5-2: Base Station ACS interferer frequency offset values

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz) | Type of interfering signal |
| 5 | ±2.5025 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs |
| 10 | ±2.5075 |
| 15 | ±2.5125 |
| 20 | ±2.5025 |
| 25 | ±9.4675 | 20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 30 | ±9.4725 |
| 40 | ±9.4675 |
| 50 | ±9.4625 |
| 60 | ±9.4725 |
| 70 | ±9.4675 |
| 80 | ±9.4625 |
| 90 | ±9.4725 |
| 100 | ±9.4675 |

**<Next change>**

##### 7.4.2.4.2 Procedure for general blocking

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.3 for *BS type 1-C* and in annex D.4.3 for *BS type 1-H*.

2) Set the BS to transmit:

- For single carrier operation set the connector under test to transmit at manufacturers declared *rated carrier output power* (PRated,c,AC or PRated,c,TABC, D.21).

- For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

3) Set the signal generator for the wanted signal to transmit as specified in table 7.4.2.5-1.

4) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.2.5-1. The interfering signal shall be swept with a step size of 1 MHz starting from the minimum offset to the channel edges of the wanted signals as specified in table 7.4.2.5-1.

5) Measure the throughput according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band* *connector*, the following steps shall apply:

6) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

##### 7.4.2.4.3 Procedure for narrowband blocking

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.3 for *BS type 1-C* and in annex D.4.3 for *BS type 1-H*.

2) Set the BS to transmit:

- For single carrier operation set the connector under test to transmit at manufacturers declared *rated carrier output power* (PRated,c,AC or PRated,c,TABC, D.21).

- For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

3) Set the signal generator for the wanted signal to transmit as specified in table 7.4.2.5-2, as well as table 7.4.2.5-2a for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

4) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.2.5-2 and 7.4.2.5-3, as well as table 7.4.2.5-2a for a BS declared to be capable of NB-IoT operation in NR in-band (D.41). Set-up and sweep the interfering RB centre frequency offset to the channel edge of the wanted signal according to table 7.4.2.5-3.

5) Measure the throughput according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band* *connector*, the following steps shall apply:

6) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

#### 7.4.2.5 Test requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *BS type 1-C* *antenna connector* or *BS type 1‑H* *TAB connector* using the parameters in tables 7.4.2.5-1, 7.4.2.5-2 and 7.4.2.5-3 for general blocking and narrowband blocking requirements. The reference measurement channel for the wanted signal is identified in clause 7.2.5 for each channel bandwidth and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex E.

For NB-IoT operation in NR in-band, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *BS type 1-C* *antenna connector* using the parameters in tables 7.4.2.5-1, 7.4.2.5-2a and 7.4.2.5-3 for general blocking and narrowband blocking requirements. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.5 of TS 36.141 [23]. The characteristics of the interfering signal is further specified in annex E.

The in-band blocking requirements apply outside the Base Station RF Bandwidth or Radio Bandwidth. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges or Radio Bandwidth edges.

For *BS type 1-C* and *BS type 1-H,* the in-band blocking requirement applies from FUL\_low - ΔfOOB to FUL\_high + ΔfOOB, excluding the downlink frequency range of the *operating band*. The ΔfOOB for *BS type 1-C* and *BS type 1-H* is defined in table 7.4.2.5-0.

Minimum conducted requirement is defined at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H.*

Table 7.4.2.5-0: ΔfOOB offset for NR *operating bands*

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics | ΔfOOB (MHz) |
| *BS type 1-C* | FUL\_high – FUL\_low ≤ 200 MHz | 20 |
| 200 MHz < FUL\_high – FUL\_low ≤ 900 MHz | 60 |
| *BS type 1-H* | FUL\_high – FUL\_low < 100 MHz | 20 |
| 100 MHz ≤ FUL\_high – FUL\_low ≤ 900 MHz  | 60 |

For a BS operating in non-contiguous spectrum within any *operating band*, the in-band blocking requirements apply in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as twice the interfering signal minimum offset in table 7.4.2.5-1. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For a *multi-band connector*, the blocking requirements apply in the in-band blocking frequency ranges for each supported *operating band*. The requirement applies in addition inside any Inter RF Bandwidth gap, in case the Inter RF Bandwidth gap size is at least as wide as twice the interfering signal minimum offset in table 7.4.2.5-1.

For a BS operating in non-contiguous spectrum within any operating band, the narrowband blocking requirement applies in addition inside any sub-block gap, in case the sub-block gap size is at least as wide as the channel bandwidth of the NR interfering signal in table 7.4.2.5-3. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For a *multi-band connector*, the narrowband blocking requirement applies in addition inside any Inter RF Bandwidth gap, in case the Inter RF Bandwidth gap size is at least as wide as the NR interfering signal in table 7.4.2.5-3. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

Table 7.4.2.5-1: Base station general blocking requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Interfering signal centre frequency minimum offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz) | Type of interfering signal |
| 5, 10, 15, 20 | PREFSENS + 6 dB | Wide Area BS: -43Medium Range BS: -38Local Area BS: -35 | ±7.5 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | PREFSENS + 6 dB | Wide Area BS: -43Medium Range BS: -38Local Area BS: -35 | ±30 | 20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| NOTE: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in TS 38.104 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2-5, 7.2-6 and 7.2-8 of TS 36.141 [23]. |

Table 7.4.2.5-2: Base station narrowband blocking requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100(Note 1) | PREFSENS + 6 dB | Wide Area BS: -49Medium Range BS: -44Local Area BS: -41 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that *BS channel bandwidth*NOTE 2: PREFSENS depends on the *BS channel bandwidth* as specified in TS 38.104 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3.NOTE 3: 7.5 kHz shift is not applied to the wanted signal. |

Table 7.4.2.5-2a: Base Station narrowband blocking requirement for NB-IoT operation in NR in-band

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 5, 10, 15, 20, 25, 30, 40, 50  | PREFSENS + x dB (Note 2) | Wide Area: -49Medium Range: -44Local Area: -41 |
| NOTE 1: PREFSENS depends on the *sub-carrier spacing* as specified in tables 7.2-5, 7.2-6 and 7.2-8 of TS 36.141 [23].NOTE 2: “x” is equal to 8 in case of 5 MHz channel bandwidth and equal to 6 otherwise. |

Table 7.4.2.5-3: Base station narrowband blocking interferer frequency offsets

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering RB centre frequency offset to the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz)(Note 2) | Type of interfering signal |
| 5 | ±(350+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 10 | ±(355+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 |
| 15 | ±(360+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 |
| 20 | ±(350+m\*180),m=0, 1, 2, 3, 4, 9, 14, 19, 24 |
| 25 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 | 20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 30 | ±(570+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 40 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 50 | ±(560+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 60 | ±(570+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 70 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 80 | ±(560+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 90 | ±(570+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 100 | ±(565+m\*180),m=0, 1, 2, 3, 4, 29, 54, 79, 99 |
| 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 lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap.NOTE 2: The centre of the interfering RB refers to the frequency location between the two central subcarriers. |

**<Next change>**

#### 7.5.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.5 for *BS type 1-C* and in annex D.4.3 for *BS type 1-H*.

2) Set the BS to transmit a signal according to clause 4.9.2, connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8.

 The transmitter may be turned off for the out-of-band blocker tests when the frequency of the blocker is such that no IM2 or IM3 products fall inside the bandwidth of the wanted signal.

3) Set the signal generator for the wanted signal as defined in clause 7.5.5 to transmit as specified in table 7.5.5.1-1 and 7.5.5.2-1.

4) Set the Signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.5.5.1-1 and 7.5.5.2-1. The CW interfering signal shall be swept with a step size of 1 MHz over than range 1 MHz to (FUL\_low - ΔfOOB) MHz and (FUL\_high + ΔfOOB) MHz to 12750 MHz.

5) Measure the throughput according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band* *connector*, the following steps shall apply:

6) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.5.5 Test requirements

#### 7.5.5.1 General requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *BS type 1-C* *antenna connector* or *BS type 1-H* *TAB connector* using the parameters in table 7.5.5.1-1. The reference measurement channel for the wanted signal is identified in clause 7.2.2 for each channel bandwidth and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex E.

For NB-IoT operation in NR in-band, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *BS type 1-C* *antenna connector* using the parameters in table 7.5.5.1-1. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.5 of TS 36.141 [23]. The characteristics of the interfering signal is further specified in annex E.

For *BS type 1-C* and *BS type 1-H* the out-of-band blocking requirement apply 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. The ΔfOOB for or *BS type 1-C* and *BS type 1-H* is defined in table 7.4.2.5-0.

Minimum conducted requirement is defined at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H.*

For a BS capable of multi-band operation, the requirement in the out-of-band blocking frequency ranges apply for each *operating band*, with the exception that the in-band blocking frequency ranges of all supported *operating bands* according to clause 7.4.2.5 shall be excluded from the out-of-band blocking requirement.

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

|  |  |  |
| --- | --- | --- |
| Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signal |
| PREFSENS +6 dB(Note 1) | -15  | CW carrier  |
| NOTE 1: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in TS 38.104 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2-5, 7.2-6 and 7.2-8 of TS 36.141 [23].NOTE 2: 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 change>**

#### 7.6.4.2 Procedure

The minimum requirement is applied to all connectors under test,

For *BS type 1-H* where there may be multiple *TAB connectors* they may be tested one at a time or multiple *TAB connectors* may be tested in parallel as shown in annex D.4.4. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the connector under test to measurement equipment as shown in annex D.2.6 for *BS type 1-C* and in annex D.4.4 for *BS type 1-H*.

2) For separate RX only connectors with single carrier operation set the connector under test to transmit at manufacturers declared *rated carrier output power* (PRated,c,AC or PRated,c,TABC, D.21). Channel set-up shall be according to NR-FR1-TM 1.1.

 For separate RX only connectors declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.

For separate RX only connectors declared to be capable of NB-IoT operation in NR in-band (D.41), test shall be performed using N-TM according to clause 4.9.2.2.9.

 For TDD connectors capable of transmit and receive ensure the transmitter is OFF.

3) Set the measurement equipment parameters as specified in table 7.6.5.1-1.

4) Measure the spurious emissions over each frequency range described in table 7.6.5.1-1.

In addition, for a *multi-band* *connector*, the following steps shall apply:

5) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

**<Next change>**

#### 7.6.5.2 BS type 1-C

The RX spurious emissions requirements for *BS type 1-C* are that for each *antenna connector,* the power of emissions shall not exceed *basic limits* specified in table 7.6.5.1-1.

The Rx spurious emissions requirements shall apply to BS that support NR or NR with NB-IoT operation in NR in-band.

**<Next change>**

#### 7.7.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.7 for *BS type 1-C* and in annex D.4.6 for *BS type 1-H*.

2) Set the BS to transmit:

- For single carrier operation set the connector under test to transmit at manufacturers declared *rated carrier output power* (PRated,c,AC or PRated,c,TABC, D.21).

- For a connector under test declared to be capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

3) Set the signal generator for the wanted signal to transmit as specified in table 7.7.5-1 and 7.7.5-3.

4) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.7.5-2 and 7.7.5-4.

5) Measure the throughput according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band* *connector*, the following steps shall apply:

6) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.7.5 Test requirements

The throughputshall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted signal at the assigned channel frequency and two interfering signals coupled to the *BS type 1-C antenna connector* or *BS type 1-H* *TAB connector*, with the conditions specified in tables 7.7.5-1 and 7.7.5-2 for intermodulation performance and in tables 7.7.5-3, and 7.7.5-4 for narrowband intermodulation performance. The reference measurement channel for the wanted signal is identified in tables 7.2.5-1 to 7.2.5-3 for each channel bandwidth and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex E.

For NB-IoT operation in NR in-band, the throughputshall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted signal at the assigned channel frequency and two interfering signals coupled to the *BS type 1-C antenna connector*, with the conditions specified in tables 7.7.5-1 and 7.7.5-2 for intermodulation performance and in tables 7.7.5-3, and 7.7.5-4 for narrowband intermodulation performance. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.5 of TS 36.141 [23]. The characteristics of the interfering signal is further specified in annex E.

The subcarrier spacing for the modulated interfering signal shall in general be the same as the subcarrier spacing for the wanted signal, except for the case of wanted signal subcarrier spacing 60 kHz and BS channel bandwidth <=20MHz, for which the subcarrier spacing of the interfering signal should be 30 kHz.

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

For a BS operating in non-contiguous spectrum within any *operating band*, the narrowband intermodulation 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 NR interfering signal in table 7.7.5-2 or 7.7.5-4. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

For a *multi-band connectors*, the intermodulation requirement applies in addition inside any Inter RF Bandwidth gap, in case the gap size is at least twice as wide as the NR interfering signal centre frequency offset from the Base Station RF Bandwidth edge.

For a *multi-band connectors*, the narrowband intermodulation requirement applies in addition inside any Inter RF Bandwidth gap in case the gap size is at least as wide as the NR interfering signal in tables 7.7.5-2 and 7.7.5-4. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the Inter RF Bandwidth gap.

Table 7.7.5-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| Base Station type | Wanted Signal mean power (dBm) | Mean power of interfering signals (dBm) | Type of interfering signals |
| Wide Area BS | PREFSENS + 6 dB  | -52 | See table 7.7.5-2 |
| Medium Range BS | PREFSENS + 6 dB  | -47 |
| Local Area BS | PREFSENS + 6 dB  | -44 |
| NOTE: PREFSENS depends on the RAT and the BS class. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified inTS 38.104 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2-5, 7.2-6 and 7.2-8 of TS 36.141 [23].  |

Table 7.7.5-2: Interfering signals for intermodulation requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge (MHz) | Type of interfering signal (Note 3) |
| 5 | ±7.5 | CW |
| ±17.5 | 5 MHz DFT-s-OFDM NR signal, (Note 1) |
| 10 | ±7.465 | CW |
| ±17.5 | 5 MHz DFT-s-OFDM NR signal, (Note 1) |
| 15 | ±7.43 | CW |
| ±17.5 | 5 MHz DFT-s-OFDM NR signal, (Note 1) |
| 20 | ±7.395 | CW |
| ±17.5 | 5 MHz DFT-s-OFDM NR signal, (Note 1) |
| 25 | ±7.465 | CW |
| ±25 | 20MHz DFT-s-OFDM NR signal, (Note 2) |
| 30 | ±7.43 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| 40 | ±7.45 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| 50 | ±7.35 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| 60 | ±7.49 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| 70 | ±7.42 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| 80 | ±7.44 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| 90 | ±7.46 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| 100 | ±7.48 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal, (Note 2) |
| NOTE 1: For the 15 kHz subcarrier spacing, the number of RB is 25. For the 30 kHz subcarrier spacing, the number of RB is 10.NOTE 2: For the 15 kHz subcarrier spacing, the number of RB is 100. For the 30 kHz subcarrier spacing, the number of RB is 50. For the 60 kHz subcarrier spacing, the number of RB is 24. NOTE 3: The RBs shall be placed adjacent to the transmission bandwidth configuration edge which is closer to the *Base Station RF Bandwidth* edge. |

Table 7.7.5-3: Narrowband intermodulation performance requirement in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| BS type | Wanted signal mean power (dBm)(Note 1) | Mean power of interfering signals (dBm) | Type of interfering signal |
| Wide Area BS | PREFSENS + 6 dB | -52 | See table 7.7.5-4 |
| Medium Range BS | PREFSENS + 6 dB | -47 |
| Local Area BS | PREFSENS + 6 dB | -44 |
| NOTE 1: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in TS 38.104 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2-5, 7.2-6 and 7.2-8 of TS 36.141 [23].NOTE 2: For NB-IoT, the requirement shall apply only for a FRC A1-3 of TS 36.141 [23] mapped to the frequency range at the channel edge adjacent to the interfering signals.NOTE 3: For NB-IoT, the frequency offset shall be adjusted to accommodate the IMD product to fall in the NB-IoT RB for NB-IoT operation in NR in-band.NOTE 4: For NB-IoT, 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 NR 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. |

Table 7.7.5-4: Interfering signals for narrowband intermodulation requirement in FR1

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering RB centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz) (Note 3) | Type of interfering signals |
| 5 | ±360 | CW |
| ±1420 | 5 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 10 | ±370 | CW |
| ±1960 | 5 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 15 (Note 2) | ±380 | CW |
| ±1960 | 5 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 20 (Note 2) | ±390 | CW |
| ±2320 | 5 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 25 (Note 2) | ±325 | CW |
| ±2350 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 30 (Note 2) | ±335 | CW |
| ±2350 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 40 (Note 2) | ±355 | CW |
| ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 50 (Note 2) | ±375 | CW |
| ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 60 (Note 2) | ±395 | CW |
| ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 70 (Note 2) | ±415 | CW |
| ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 80 (Note 2) | ±435 | CW |
| ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 90 (Note 2) | ±365 | CW |
| ±2530 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| 100 (Note 2) | ±385 | CW |
| ±2530 | 20 MHz DFT-s-OFDM NR signal, 1 RB (Note 1) |
| NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the *BS channel bandwidth* of the interfering signal is located adjacently to the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap.NOTE 2: This requirement shall apply only for a G-FRC mapped to the frequency range at the channel edge adjacent to the interfering signals.NOTE 3: The centre of the interfering RB refers to the frequency location between the two central subcarriers. |

**<Next change>**

#### 7.8.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *BS type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Set the signal generator for the wanted signal to transmit as specified from table 7.8.5-1 to 7.8.5-3, as well as table 7.8.5-1a to 7.8.5-3a for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

2) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified from table 7.8.5-1 to 7.8.5-3, as well as table 7.8.5-1a to 7.8.5-3a for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

3) Measure the throughput according to annex A.1, as well as annex A.14 of TS 36.141 [23] for a BS declared to be capable of NB-IoT operation in NR in-band (D.41).

In addition, for a *multi-band* *connector*, the following steps shall apply:

4) For *multi-band* *connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

### 7.8.5 Test requirements

For *BS type 1-C* and *BS type 1-H*, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 7.8.5-1 for Wide Area BS, in table 7.8.5-2 for Medium Range BS and in table 7.8.5-3 for Local Area BS. The characteristics of the interfering signal is further specified in annex E.

For NB-IoT operation in NR in-band, the throughput shall be ≥ 95% of the maximum throughput of the NB-IoT reference measurement channel as specified in Annex A of TS 36.141 [23] with parameters specified in table 7.8.5-1a for Wide Area BS, in table 7.8.5-2a for Medium Range BS and in table 7.8.5-3a for Local Area BS.

Table 7.8.5-1: Wide Area BS in-channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR channel bandwidth (MHz) | Subcarrier spacing(kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A1-7 | -99.2 | -98.8 | -98.5 | -81.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 10 RBs |
| 10, 15, 20, 25, 30 | 15 | G-FR1-A1-1 | -97.3 | -96.9 | -96.6 | -77.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs |
| 40, 50 | 15 | G-FR1-A1-4 | -90.9 | -90.5 | -90.2 | -71.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 5 | 30 | G-FR1-A1-8 | -99.9 | -99.5 | -99.2 | -81.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 5 RBs |
| 10, 15, 20, 25, 30 | 30 | G-FR1-A1-2 | -97.4 | -97 | -96.7 | -78.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 10 RBs |
| 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -91.2 | -90.8 | -90.5 | -71.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 50 RBs |
| 10, 15, 20, 25, 30 | 60 | G-FR1-A1-9 | -96.8 | -96.4 | -96.1 | -78.4 | DFT-s-OFDM NR signal, 60 kHz SCS, 5 RBs |
| 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -91.3 | -90.9 | -90.6 | -71.6 | DFT-s-OFDM NR signal, 60 kHz SCS, 24 RBs |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signalaccording to the table 5.4.2.2-1 in TS 38.104 [2]. The aggregated wanted and interferer signal shall be centred in the BS channel bandwidth of the wanted signal. |

Table 7.8.5-1a: Wide Area BS in-channel selectivity for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A14-1 in Annex A.14 in TS 36.141 [23] | -122.9 | -81.4 | DFT-s-OFDM NR signal, 15 kHz SCS,10 RBs |
| 10, 15, 20, 25, 30 | -77.4 | DFT-s-OFDM NR signal, 15 kHz SCS,25 RBs |
| 40, 50 | -71.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 5 | FRC A14-2 in Annex A.14 in TS 36.141 [23] | -128.8 | -81.4 | DFT-s-OFDM NR signal, 15 kHz SCS,10 RBs |
| 10, 15, 20, 25, 30 | -77.4 | DFT-s-OFDM NR signal, 15 kHz SCS,25 RBs |
| 40, 50 | -71.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| NOTE: Interfering signal is placed in one side of the Fc, while the NB-IoT PRB is placed on the other side. Both interfering signal and NB-IoT PRB are placed at the middle of the available PRB locations. The wanted NB-IoT tone is placed at the centre of this NB-IoT PRB. |

Table 7.8.5-2: Medium Range BS in-channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR channel bandwidth (MHz) | Subcarrier spacing(kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signal |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A1-7 | -94.2 | -93.8 | -93.5 | -76.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 10 RBs |
| 10, 15, 20, 25, 30 | 15 | G-FR1-A1-1 | -92.3 | -91.9 | -91.6 | -72.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs |
| 40, 50 | 15 | G-FR1-A1-4 | -85.9 | -85.5 | -85.2 | -66.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 5 | 30 | G-FR1-A1-8 | -94.9 | -94.5 | -94.2 | -76.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 5 RBs |
| 10, 15, 20, 25, 30 | 30 | G-FR1-A1-2 | -92.4 | -92 | -91.7 | -73.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 10 RBs |
| 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -86.2 | -85.8 | -85.5 | -66.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 50 RBs |
| 10, 15, 20, 25, 30 | 60 | G-FR1-A1-9 | -91.8 | -91.4 | -91.1 | -73.4 | DFT-s-OFDM NR signal, 60 kHz SCS, 5 RBs |
| 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -86.3 | -85.9 | -85.6 | -66.6 | DFT-s-OFDM NR signal, 60 kHz SCS, 24 RBs |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signalaccording to the table 5.4.2.2-1 in TS 38.104 [2]. The aggregated wanted and interferer signal shall be centred in the BS channel bandwidth of the wanted signal. |

Table 7.8.5-2a: Medium Range BS in-channel selectivity for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A14-1 in Annex A.14 in TS 36.141 [23] | -117.9 | -76.4 | DFT-s-OFDM NR signal, 15 kHz SCS,10 RBs |
| 10, 15, 20, 25, 30 | -72.4 | DFT-s-OFDM NR signal, 15 kHz SCS,25 RBs |
| 40, 50 | -66.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 5 | FRC A14-2 in Annex A.14 in TS 36.141 [23] | -123.8 | -76.4 | DFT-s-OFDM NR signal, 15 kHz SCS,10 RBs |
| 10, 15, 20, 25, 30 | -72.4 | DFT-s-OFDM NR signal, 15 kHz SCS,25 RBs |
| 40, 50 | -66.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| NOTE: Interfering signal is placed in one side of the Fc, while the NB-IoT PRB is placed on the other side. Both interfering signal and NB-IoT PRB are placed at the middle of the available PRB locations. The wanted NB-IoT tone is placed at the centre of this NB-IoT PRB. |

Table 7.8.5-3: Local area BS in-channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NR channel bandwidth (MHz)** | **Subcarrier spacing****(kHz)** | **Reference measurement channel** | **Wanted signal mean power (dBm)** | **Interfering signal mean power (dBm)** | **Type of interfering signal** |
| f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 5 | 15 | G-FR1-A1-7 | -91.2 | -90.8 | -90.5 | -73.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 10 RBs |
| 10, 15, 20, 25, 30 | 15 | G-FR1-A1-1 | -89.3 | -88.9 | -88.6 | -69.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 25 RB |
| 40, 50 | 15 | G-FR1-A1-4 | -82.9 | -82.5 | -82.2 | -63.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 5 | 30 | G-FR1-A1-8 | -91.9 | -91.5 | -91.2 | -73.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 5 RBs |
| 10, 15, 20, 25, 30 | 30 | G-FR1-A1-2 | -89.4 | -89 | -88.7 | -70.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 10 RBs |
| 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -83.2 | -82.8 | -82.5 | -63.4 | DFT-s-OFDM NR signal, 30 kHz SCS, 50 RBs |
| 10, 15, 20, 25, 30 | 60 | G-FR1-A1-9 | -88.8 | -88.4 | -88.1 | -70.4 | DFT-s-OFDM NR signal, 60 kHz SCS, 5 RBs |
| 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -83.3 | -82.9 | -82.6 | -63.6 | DFT-s-OFDM NR signal, 60 kHz SCS, 24 RBs |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1 in TS 38.104 [2]. The aggregated wanted and interferer signal shall be centred in the BS channel bandwidth of the wanted signal. |

Table 7.8.5-3a: Local Area BS in-channel selectivity for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A14-1 in Annex A.14 in TS 36.104 [13] | -114.9 | -73.4 | DFT-s-OFDM NR signal, 15 kHz SCS,10 RBs |
| 10, 15, 20, 25, 30 | -69.4 | DFT-s-OFDM NR signal, 15 kHz SCS,25 RBs |
| 40, 50 | -63.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 5 | FRC A14-2 in Annex A.14 in TS 36.104 [13] | -120.8 | -73.4 | DFT-s-OFDM NR signal, 15 kHz SCS,10 RBs |
| 10, 15, 20, 25, 30 | -69.4 | DFT-s-OFDM NR signal, 15 kHz SCS,25 RBs |
| 40, 50 | -63.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| NOTE: Interfering signal is placed in one side of the Fc, while the NB-IoT PRB is placed on the other side. Both interfering signal and NB-IoT PRB are placed at the middle of the available PRB locations. The wanted NB-IoT tone is placed at the centre of this NB-IoT PRB. |

**<Next change>**

# A.1 Fixed Reference Channels for reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation and in-channel selectivity (QPSK, R=1/3)

The parameters for the reference measurement channels are specified in table A.1-1 for FR1 reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation and in-channel selectivity.

Table A.1-1: FRC parameters for FR1 reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation and in-channel selectivity

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A1-1 | G-FR1-A1-2 | G-FR1-A1-3 | G-FR1-A1-4 | G-FR1-A1-5 | G-FR1-A1-6 | G-FR1-A1-7 | G-FR1-A1-8 | G-FR1-A1-9 | G-FR1-A1-10 | G-FR1-A1-11 |
| Subcarrier spacing (kHz) | 15  | 30 | 60 | 15 | 30 | 60 | 15 | 30 | 60 | 15 | 15 |
| Allocated resource blocks | 25 | 11 | 11 | 106 | 51 | 24 | 15 | 6 | 6 | 24 | 105 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 2152 | 984 | 984 | 9224 | 4352 | 2088 | 1320 | 528 | 528 | [2088] | [8968] |
| Transport block CRC (bits) | 16 | 16 | 16 | 24 | 24 | 16 | 16 | 16 | 16 | 16 | 24 |
| Code block CRC size (bits) | - | - | - | 24 | - | - | - | - | - | - | 24 |
| Number of code blocks - C | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Code block size including CRC (bits) (Note 3) | 2168 | 1000 | 1000 | 4648 | 4376 | 2104 | 1336 | 544 | 544 | [2104] | [4520] |
| Total number of bits per slot | 7200 | 3168 | 3168 | 30528 | 14688 | 6912 | 4320 | 1728 | 1728 | [6912] | [30240] |
| Total symbols per slot | 3600 | 1584 | 1584 | 15264 | 7344 | 3456 | 2160 | 864 | 864 | [3456] | [15120] |
| NOTE 1: DM-RS configuration type = 1 with DM-RS duration = single-symbol DM-RS, additional DM-RS position = pos1 with *l0* = 2, *l* = 11 as per table 6.4.1.1.3-3 of TS 38.211 [17].NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size.NOTE 3: Code block size including CRC (bits) equals to *K'* in TS 38.212 [16], clause 5.2.2. |

**<End of change>**