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| 3GPP TS 38.176-1 V0.2.0 (2021-06) | |
| Technical Specification | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Network;  NR;  Integrated access and backhaul (IAB) conformance testing  Part 1: Conducted conformance testing  (Release 16) | |
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For definitive guidance on drafting 3GPP TSs and TRs, see [3GPP TS 21.801](http://www.3gpp.org/DynaReport/21801.htm) supplemented by the 3GPP web page <http://www.3gpp.org/specifications-groups/delegates-corner/writing-a-new-spec>.

Ensure all blue guidance text is removed before submitting the TS/TR to the TSG for approval.

# Foreword

This clause is mandatory; do not alter the text in any way other than to choose between "Specification" and "Report".

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

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

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where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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

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

In drafting the TS/TR, pay particular attention to the use of modal auxiliary verbs! TRs shall not contain any normative provisions.

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

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

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

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

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

**should** indicates a recommendation to do something

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

**may** indicates permission to do something

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

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

**can** indicates that something is possible

**cannot** indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

# 1 Scope

The present document establishes the minimum RF characteristics and minimum performance requirements of NR Integrated access and backhaul (IAB).

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for NR Integrated access and backhaul (IAB) type 1-H. These have been derived from, and are consistent with the conducted requirements for NR Integrated access and backhaul (IAB) type 1-H in NR Integrated access and backhaul specification defined in TS 38.174 [2].

An *IAB type 1-H* has both conducted and radiated requirements so it requires compliance to the applicable requirements of this specification and TS 38.176-2 [3].

*IAB type 1-O* and IAB *type 2-O* have only radiated requirements so they require compliance to TS 38.176-2 [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 38.174: "NR Integrated access and backhaul radio transmission and reception".

[3] 3GPP TS 38.176-2: " NR; Integrated Access and Backhaul (IAB) 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] Recommendation ITU-R SM.328: "Spectra and bandwidth of emissions".

[7] “Title 47 of the Code of Federal Regulations (CFR)", Federal Communications Commission.

[8] 3GPP TR 25.942: "RF system scenarios"

[9] 3GPP TS 38.211: "NR; Physical channels and modulation"

[10] 3GPP TS 38.212: "NR; Multiplexing and channel coding"

[11] 3GPP TS 38.104: "NR Base Station (BS) radio transmission and reception"

[12] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[13] 3GPP TS 38.141-1: "NR; Base Station (BS) conformance testing; Part 1: Conducted conformance testing".

[14] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[15] ITU-T Recommendation O.150, "Equipment for the measurement of digital and analogue/digital parameters"

[16] 3GPP TS 38.521-1: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone".

[17] 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"

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

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

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

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

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

# 3 Definitions of terms, symbols and abbreviations

This clause and its three subclauses are mandatory. The contents shall be shown as "void" if the TS/TR does not define any terms, symbols, or abbreviations.

## 3.1 Terms

For the purposes of the present document, the terms given in 3GPP 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 3GPP TR 21.905 [1].

**aggregated IAB channel bandwidth:** the RF bandwidth in which a IAB-DU or IAB-MT transmits and receives multiple contiguously aggregated carriers. The *aggregated IAB channel bandwidth* is measured in MHz

**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 one or more *IAB type 1-H* *TAB connectors* at the *transceiver array boundary*

**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

**beam:** beam (of the antenna) is the main lobe of the radiation pattern of an *antenna array*

NOTE: For certain *antenna array*, there may be more than one beam.

**beam centre direction:** direction equal to the geometric centre of the half-power contour of the beam

**beam direction pair:** data set consisting of the *beam centre direction* and the related *beam peak direction*

**beam peak direction:** direction where the maximum EIRP is found

**beamwidth:** beam which has a half-power contour that is essentially elliptical, the half-power beamwidths in the two pattern cuts that respectively contain the major and minor axis of the ellipse

**Channel edge:** lowest or highest frequency of the NR carrier, separated by the *IAB-MT channel bandwidth* or *IAB-DU 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 IAB-DU or IAB-MT aggregates carriers with a specific set of technical requirements

**co-location reference antenna**: a passive antenna used as reference for co-location requirements

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

**directional requirement:** requirement which is applied in a specific direction within the *OTA coverage range* for the Tx and when the AoA of the incident wave of a received signal is within the *OTA REFSENS RoAoA* or the *minSENS RoAoA* as appropriate for the receiver

**equivalent isotropic radiated power:** equivalent power radiated from an isotropic directivity device producing the same field intensity at a point of observation as the field intensity radiated in the direction of the same point of observation by the discussed device

NOTE: Isotropic directivity is equal in all directions (i.e. 0 dBi).

**equivalent isotropic sensitivity:** sensitivity for an isotropic directivity device equivalent to the sensitivity of the discussed device exposed to an incoming wave from a defined AoA

NOTE 1: The sensitivity is the minimum received power level at which specific requirement is met.

NOTE 2: Isotropic directivity is equal in all directions (i.e. 0 dBi).

**fractional bandwidth:** *fractional bandwidth* FBW is defined as

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

**IAB-donor**:gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-DU channel bandwidth**: RF bandwidth supporting a single IAB-DU RF carrier with the *transmission bandwidth* configured in the uplink or downlink

NOTE 1: The *IAB-DU 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 IAB to transmit to and/or receive from one or more UE bandwidth parts that are smaller than or equal to the *IAB transmission bandwidth configuration*, in any part of the *IAB transmission bandwidth configuration*.

**IAB-DU RF Bandwidth:** RF bandwidth in which an IAB-DU transmits and/or receives single or multiple carrier(s) within a supported *operating band*

**IAB-DU RF Bandwidth edge:** frequency of one of the edges of the *IAB-DU RF Bandwidth*.

**IAB-MT channel bandwidth**: RF bandwidth supporting a single IAB-MT RF carrier with the *transmission bandwidth* configured in the uplink or downlink

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

**IAB-MT RF Bandwidth**: RF bandwidth in which an IAB-MT transmits and/or receives single or multiple carrier(s) within a supported *operating band*

NOTE:      In single carrier operation, the *IAB-MT RF Bandwidth* is equal to the *IAB-MT channel bandwidth*.

**IAB-MT RF Bandwidth edge:** frequency of one of the edges of the *IAB-MT RF Bandwidth*.

**IAB RF Bandwidth:** RF bandwidth in which an IAB-DU or IAB-MT transmits and/or receives single or multiple carrier(s) within a supported *operating band*

**IAB RF Bandwidth edge:** frequency of one of the edges of the *IAB RF Bandwidth*.

**IAB type 1-H:** IAB-DU or IAB-MT operating at FR1 with a *requirement set* consisting of conducted requirements defined at individual *TAB connectors* and OTA requirements defined at RIB

**IAB type 1-O:** IAB-DU or IAB-MT operating at FR1 with a *requirement set* consisting only of OTA requirements defined at the RIB

**IAB type 2-O:** IAB-DU or IAB-MT operating at FR2 with a *requirement set* consisting only of OTA requirements defined at the RIB

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

**Inter RF Bandwidth gap:** frequency gap between two consecutive *IAB-DU* or *IAB-MT 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.

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

**maximum carrier TRP output power:** mean power level measured perRIB during the *transmitter ON period* for a specific carrier in a specified reference condition and corresponding to the declared *rated carrier TRP output* power (Prated,c,TRP)

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

**minSENS:** the lowest declared EIS value for the OSDD's declared for OTA sensitivity requirement.

**minSENS RoAoA:** The *reference RoAoA* associated with the OSDD with the lowest declared EIS

**multi-band connector**: *TAB connector* of *IAB 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-band RIB:** *operating band* specific RIB 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*

**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 an IAB-DU and IAB-MT are declared by the manufacturer

**OTA coverage range**: a common range of directions within which TX OTA requirements that are neither specified in the *OTA peak directions sets* nor as *TRP requirement* are intended to be met

**OTA peak directions set:** set(s) of *beam peak directions* within which certain TX OTA requirements are intended to be met, where all *OTA peak directions set(s)* are subsets of the *OTA coverage range*

NOTE:     The *beam peak directions* are related to a corresponding contiguous range or discrete list of *beam centre directions*by the *beam direction pairs* included in the set.

**OTA REFSENS RoAoA:** the RoAoA determined by the contour defined by the points at which the achieved EIS is 3dB higher than the achieved EIS in the reference direction assuming that for any AoA, the receiver gain is optimized for that AoA

NOTE: This contour will be related to the average element/sub-array radiation pattern 3dB beamwidth.

**OTA sensitivity directions declaration:** set of manufacturer declarations comprising at least one set of declared minimum EIS values (with *IAB-DU channel bandwidth* or *IAB-MT channel bandwidth*), and related directions over which the EIS applies

NOTE: All the directions apply to all the EIS values in an OSDD.

**Parent node**: IAB-MT's next hop neighbour node; the parent node can be IAB-node or IAB-donor.

**polarization match:** condition that exists when a plane wave, incident upon an antenna from a given direction, has a polarization that is the same as the receiving polarization of the antenna in that direction

**radiated interface boundary**: *operating band* specific radiated requirements reference where the radiated requirements apply

NOTE: For requirements based on EIRP/EIS, the *radiated interface boundary* is associated to the far-field region

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

**rated beam EIRP:** For a declared beam and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the IAB-DU or IAB-MT is declared to radiate at the associated *beam peak direction* during the *transmitter ON period*

**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 carrier TRP output power:** mean power level declared by the manufacturer per carrier, for IAB-DU or IAB-MT operating in single carrier, multi-carrier, or carrier aggregation configurations that the manufacturer has declared to be available at the RIB during the *transmitter ON period*

**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

**rated total TRP output power:** mean power level declared by the manufacturer, that the manufacturer has declared to be available at the RIB during the *transmitter ON period*

**reference beam direction pair:** declared *beam direction pair*, including reference *beam centre direction* and reference *beam peak direction* where the reference *beam peak direction* is the direction for the intended maximum EIRP within the *OTA peak directions set*

**receiver target:** AoA in which reception is performedby *IAB type 1-H* or *IAB type 1-O*

**receiver target redirection range:** union of all the *sensitivity RoAoA* achievable through redirecting the *receiver target* related to particular OSDD

**receiver target reference direction:** direction inside the *OTA sensitivity directions declaration* declared by the manufacturer for conformance testing. For an OSDD without *receiver target redirection range*, this is a direction inside the *sensitivity RoAoA*

**reference RoAoA**: the *sensitivity RoAoA* associated with the *receiver target reference direction* for each OSDD.

**requirement set:** one of the NR requirement sets as defined for *IAB type 1-H*, *IAB type 1-O*, and *IAB type 2-O*

**sensitivity RoAoA:** RoAoA within the *OTA sensitivity directions declaration*, within which the declared EIS(s) of an OSDD is intended to be achieved at any instance of time for a specific IAB-DU or IAB-MT direction setting

**single-band connector:** *IAB type 1-H* *TAB connector* 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**: A *sub-band* of an operating band contains a part of the uplink and downlink frequency range of the operating band.

**sub-block:** one contiguous allocated block of spectrum for transmission and reception by the same IAB-DU or IAB-MT

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

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

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

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

**TAB connector RX min cell group:** *operating band* specific declared group of *TAB connectors* to which *IAB 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 *IAB 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 *IAB 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 *IAB 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 radiated power:** is the total power radiated by the antenna

NOTE: The *total radiated power* is the power radiating in all direction for two orthogonal polarizations. *Total radiated power* is defined in both the near-field region and the far-field region

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

**transmission bandwidth:** RF Bandwidth of an instantaneous transmission from an IAB-DU or IAB-MT, measured in resource block units

**transmitter OFF period:** time period during which the IAB-DU or IAB-MT transmitter is not allowed to transmit

**transmitter ON period**: time period during which the IAB-DU or IAB-MT 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

## 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.

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

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

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

FC *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.

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*

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*

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

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

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

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

Wgap Sub-block gap or Inter RF Bandwidth gap size

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

Abbreviation format (EW)

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

GSM Global System for Mobile communications

ITU‑R Radiocommunication Sector of the International Telecommunication Union

IAB Integrated Access and Backhaul

IAB-DU IAB Distribution Unit

IAB-MT IAB Mobile Termination

ICS In-Channel Selectivity

LA Local Area

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

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

TX Transmitter

TT Test Tolerance

UCI Uplink Control Information

WA Wide Area

ZF Zero Forcing

# 4 General conducted test conditions and declarations

## 4.1 Measurement uncertainties and test requirements

### 4.1.1 General

The requirements of this clause apply to all applicable tests in part 1 of this specification, i.e. to all conducted tests defined for FR1. The frequency ranges FR1 and FR2 are defined in clause 5.1 of TS 38.174 [2].

The minimum requirements are given in TS 38.174 [2] and the references therein. Test Tolerances for the conducted test requirements explicitly stated in the present document are given in Annex C of the present document.

Test Tolerances are individually calculated for each test. The Test Tolerances are used to relax the minimum requirements to create test requirements.

When a test requirement differs from the corresponding minimum requirement, then the Test Tolerance applied for the test is non-zero. The Test Tolerance for the test and the explanation of how the minimum requirement has been relaxed by the Test Tolerance are given in Annex C.

### 4.1.2 Acceptable uncertainty of Test System

#### 4.1.2.1 General

The maximum acceptable uncertainty of the Test System is specified below for each test defined explicitly in the present specification, where appropriate. The maximum acceptable uncertainty of the Test System for test requirements included by reference is defined in the respective referred test specification.

For *IAB type 1-H* when a requirement is applied per *TAB connector* then the test uncertainty is applied to the measured value. When a requirement is applied for a group of *TAB connectors* then the test uncertainty is applied to sum of the measured power on each *TAB connector* in the group.

The Test System shall enable the stimulus signals in the test case to be adjusted to within the specified tolerance and the equipment under test to be measured with an uncertainty not exceeding the specified values. All tolerances and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95 % is the measurement uncertainty tolerance interval for a specific measurement that contains 95 % of the performance of a population of test equipment.

For RF tests, it should be noted that the uncertainties in clause 4.1.2 apply to the Test System operating into a nominal 50 ohm load and do not include system effects due to mismatch between the DUT and the Test System.

#### 4.1.2.2 Measurement of transmitter

Table 4.1.2.2-1: Maximum Test System uncertainty for transmitter tests

| Clause | Maximum Test System Uncertainty | Derivation of Test System Uncertainty |
| --- | --- | --- |
| 6.2 IAB output power | ±0.7 dB, f ≤ 3 GHz  ±1.0 dB, 3 GHz < f ≤ 6 GHz (Note) |  |
| 6.3.1 IAB-DU Output power dynamics | ± 0.4 dB |  |
| 6.3.2 IAB-MT Output power dynamics | ±0.7 dB, BW ≤ 40MHz  ±1.0 dB, 40MHz < f ≤ 100MHz |  |
| 6.4.1 Transmit OFF power | ±2.0 dB , f ≤ 3 GHz  ±2.5 dB, 3 GHz < f ≤ 6 GHz (Note) |  |
| 6.4.2 Transmitter transient period | N/A |  |
| 6.5.2.1 IAB-DU Frequency error | ± 12 Hz |  |
| 6.5.2.2 IAB-MT Frequency error | ±15 Hz, f ≤ 3.0GHz  ±36 Hz, f > 3.0GHz |  |
| 6.5.3 EVM | ± 1% |  |
| 6.5.4 Time alignment error | ± 25ns |  |
| 6.6.2 Occupied bandwidth | 10 MHz BS Channel BW: ±100 kHz  15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz IAB Channel BW: ±300 kHz  60 MHz, 70 MHz, 80 MHz, 90 MHz, 100 MHz IAB Channel BW: ±600 kHz |  |
| 6.6.3 Adjacent Channel Leakage power Ratio (ACLR) | ACLR/ CACLR  BW ≤ 20MHz: ±0.8 dB  BW > 20MHz: ±1.2 dB  Absolute power ±2.0 dB, f ≤ 3 GHz  Absolute power ±2.5 dB, 3 GHz < f ≤ 6 GHz (Note)  CACLR  BW ≤ 20MHz: ±0.8 dB  BW > 20MHz: ±1.2 dB  CACLR absolute power ±2.0 dB , f ≤ 3 GHz  CACLR absolute power ±2.5 dB, 3 GHz < f ≤ 6 GHz (Note) |  |
| 6.6.4 Operating band unwanted emissions | ±1.5 dB, f ≤ 3 GHz  ±1.8 dB, 3 GHz < f ≤ 6 GHz (Note) |  |
| 6.6.5.5.1.1 Transmitter spurious emissions, Mandatory Requirements | 9 kHz < f ≤ 4 GHz: ±2.0 dB  4 GHz < f ≤ 19 GHz: ±4.0 dB  19 GHz < f ≤ 26 GHz: ±4.5 dB |  |
| 6.6.5.5.1.2 Transmitter spurious emissions, Additional spurious emission requirements | ±2.0 dB for > -60 dBm, f ≤ 3 GHz  ±2.5 dB, 3 GHz < f ≤ 4.2 GHz  ±3.0 dB, 4.2 GHz < f ≤ 6 GHz  ±3.0 dB for ≤ -60 dBm, f ≤ 3 GHz  ±3.5 dB, 3 GHz < f ≤ 4.2 GHz  ±4.0 dB, 4.2 GHz < f ≤ 6 GHz |  |
| 6.6.5.2.3 Transmitter spurious emissions, Co-location | ±3.0 dB |  |
| 6.7 Transmitter intermodulation  (interferer requirements)  This tolerance applies to the stimulus and not the measurements defined in 6.6.3, 6.6.4 and 6.6.5 | The value below applies only to the interfering signal and is unrelated to the measurement uncertainty of the tests in 6.6.3 (ACLR), 6.6.4 (OBUE) and 6.6.5 (spurious emissions) which have to be carried out in the presence of the interferer.  ±1.0 dB | The uncertainty of interferer has double the effect on the result due to the frequency offset |
| NOTE: Test system uncertainty values for 4.2 GHz < f ≤ 6 GHz apply for IAB operates in licensed spectrum only. | | |

#### 4.1.2.3 Measurement of receiver

Table 4.1.2.3-1: Maximum Test System uncertainty for receiver tests

| Clause | Maximum Test System Uncertainty | Derivation of Test System Uncertainty |
| --- | --- | --- |
| 7.2 Reference sensitivity level | ±0.7 dB, f ≤ 3 GHz  ±1.0 dB, 3 GHz < f ≤ 4.2 GHz  ±1.2 dB, 4.2 GHz < f ≤ 6 GHz |  |
| 7.3 Dynamic range | ±0.3 dB |  |
| 7.4.1 Adjacent channel selectivity | ±1.4 dB, f ≤ 3 GHz  ±1.8 dB, 3 GHz < f ≤ 4.2 GHz  ±2.1 dB, 4.2 GHz < f ≤ 6 GHz (NOTE 2) | Overall system uncertainty comprises three quantities:  1. Wanted signal level error  2. Interferer signal level error  3. Additional impact of interferer leakage  Items 1 and 2 are assumed to be uncorrelated so can be root sum squared to provide the ratio error of the two signals. The interferer leakage effect is systematic, and is added arithmetically.  Test System uncertainty = SQRT (wanted\_level\_error2 + interferer\_level\_error2) + leakage effect.  f ≤ 3 GHz  Wanted signal level ±0.7 dB  Interferer signal level ±0.7 dB  3 GHz < f ≤ 4.2 GHz  Wanted signal level ±1.0 dB  Interferer signal level ±1.0 dB  4.2 GHz < f ≤ 6 GHz  Wanted signal level ±1.22 dB  Interferer signal level ±1.22 dB  f ≤ 6 GHz  Impact of interferer leakage 0.4 dB |
| 7.4.2 In-band blocking (General blocking) | ±1.6 dB, f ≤ 3 GHz  ±2.0 dB, 3 GHz < f ≤ 4.2 GHz  ±2.2 dB, 4.2 GHz < f ≤ 6 GHz (NOTE 2) |  |
| 7.4.2 In-band blocking  (Narrow band blocking) | ±1.4 dB, f ≤ 3 GHz  ±1.8 dB, 3 GHz < f ≤ 4.2 GHz  ±2.1 dB, 4.2 GHz < f ≤ 6 GHz (NOTE 2) |  |
| 7.5.5.1, 7.5.5.3 Out-of-band blocking (General requirements) | fwanted ≤ 3GHz  1MHz < finterferer ≤ 3 GHz: ±1.3 dB  3.0GHz < finterferer ≤ 4.2 GHz: ±1.5 dB  4.2GHz < finterferer ≤ 12.75 GHz: ±3.2 dB  3GHz < fwanted ≤ 4.2GHz:  1MHz < finterferer ≤ 3 GHz: ±1.5 dB  3.0GHz < finterferer ≤ 4.2 GHz: ±1.7 dB  4.2GHz < finterferer ≤ 12.75 GHz: ±3.3 dB  4.2GHz < fwanted ≤ 6.0GHz:  1MHz < finterferer ≤ 3 GHz: ±1.7 dB  3.0GHz < finterferer ≤ 4.2 GHz: ±1.8 dB  4.2GHz < finterferer ≤ 12.75 GHz: ±3.3 dB | Overall system uncertainty comprises three quantities:  1. Wanted signal level error  2. Interferer signal level error  3. Interferer broadband noise  Items 1 and 2 are assumed to be uncorrelated so can be root sum squared to provide the ratio error of the two signals. The Interferer Broadband noise effect is systematic, and is added arithmetically.  Test System uncertainty = SQRT (wanted\_level\_error2 + interferer\_level\_error2) + Broadband noise effect.  Out of band blocking, using CW interferer:  Wanted signal level:  ±0.7 dB up to 3 GHz  ±1.0 dB up to 4.2 GHz  ±1.22 dB up to 6 GHz  Interferer signal level:  ±1.0 dB up to 3 GHz  ±1.2 dB up to 4.2 GHz  ±3.0 dB up to 12.75 GHz  Impact of interferer Broadband noise 0.1 dB |
| 7.5.5.2, 7.5.5.4 Out-of-band blocking (Co-location requirements) | Co-location blocking, using CW interferer:  ±2.5 dB, f ≤ 3.0 GHz  ±2.6 dB, 3.0 GHz < f ≤ 4.2 GHz  ±2.7 dB, 4.2 GHz < f ≤ 6.0 GHz | Co-location blocking, using CW interferer:  f ≤ 3.0 GHz  Wanted signal level ± 0.7 dB  3.0 GHz < f ≤ 4.2 GHz  Wanted signal level ± 1.0dB  4.2 GHz < f ≤ 6.0 GHz  Wanted signal level ± 1.22 dB  f ≤ 6.0 GHz  Interferer signal level:  ± 2.0 dB  Interferer ACLR not applicable  Impact of interferer Broadband noise 0.4 dB |
| 7.6 Receiver spurious emissions | 30 MHz ≤ f ≤ 4 GHz: ±2.0 dB  4 GHz < f ≤ 19 GHz: ±4.0 dB  19 GHz < f ≤ 26 GHz: ±4.5 dB |  |
| 7.7 Receiver intermodulation | ±1.8 dB, f ≤ 3.0 GHz  ±2.4 dB, 3.0 GHz < f ≤ 4.2 GHz  ±3.0 dB, 4.2 GHz < f ≤ 6.0 GHz (NOTE 2) | Overall system uncertainty comprises four quantities:  1. Wanted signal level error  2. CW Interferer level error  3. Modulated Interferer level error  4. Impact of interferer ACLR  The effect of the closer CW signal has twice the effect.  Items 1, 2 and 3 are assumed to be uncorrelated so can be root sum squared to provide the combined effect of the three signals. The interferer ACLR effect is systematic, and is added arithmetically.  Test System uncertainty = SQRT [(2 x CW\_level\_error)2 +(mod interferer\_level\_error)2 +(wanted signal\_level\_error)2] + ACLR effect.  f ≤ 3.0 GHz  Wanted signal level ± 0.7dB  CW interferer level ± 0.5 dB  Mod interferer level ± 0.7 dB  3.0 GHz < f ≤ 4.2 GHz  Wanted signal level ± 1.0 dB  CW Interferer level ± 0.7 dB  Mod Interferer level ± 1.0 dB  4.2 GHz < f ≤ 6 GHz  Wanted signal level ± 1.22 dB  CW Interferer level ± 0.98 dB  Mod Interferer level ± 1.22 dB  f ≤ 6 GHz  Impact of interferer ACLR 0.4 dB |
| 7.8 In-channel selectivity | ±1.4 dB, f ≤ 3 GHz  ±1.8 dB, 3 GHz < f ≤ 4.2 GHz  ±2.1 dB, 4.2 GHz < f ≤ 6 GHz (NOTE 2) |  |
| NOTE 1: Unless otherwise noted, only the Test System stimulus error is considered here. The effect of errors in the throughput measurements due to finite test duration is not considered.  NOTE 2: Test system uncertainty values for 4.2 GHz < f ≤ 6 GHz apply for IAB operates in licensed spectrum only. | | |

#### 4.1.2.4 Measurement of performance requirements

{Editor note: table(s) to added}

### 4.1.3 Interpretation of measurement results

The measurement results returned by the Test System are compared - without any modification - against the test requirements as defined by the Shared Risk principle.

The Shared Risk principle is defined in Recommendation ITU-R M.1545 [4].

The actual measurement uncertainty of the Test System for the measurement of each parameter shall be included in the test report.

The recorded value for the Test System uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in clause 4.1.2 of the present document.

If the Test System for a test is known to have a measurement uncertainty greater than that specified in clause 4.1.2, it is still permitted to use this apparatus provided that an adjustment is made as follows.

Any additional uncertainty in the Test System over and above that specified in clause 4.1.2 shall be used to tighten the test requirement, making the test harder to pass. For some tests e.g. receiver tests, this may require modification of stimulus signals. This procedure will ensure that a Test System not compliant with clause 4.1.2 does not increase the chance of passing a device under test where that device would otherwise have failed the test if a Test System compliant with clause 4.1.2 had been used.

## 4.2 Conducted requirement reference points

### 4.2.1 *IAB type 1-H*

*IAB type 1-H* requirements are defined for two points of reference, signified by radiated requirements and conducted requirements.



Figure 4.2.1-1: Radiated and conducted reference points for *IAB type 1-H*

Radiated characteristics are defined over the air (OTA), where the *operating band* specific radiated interface is referred to as the *Radiated Interface Boundary* (RIB). Radiated requirements are also referred to as OTA requirements. The (spatial) characteristics in which the OTA requirements apply are detailed for each requirement.

NOTE: Radiated conformance requirements are captured in TS 38.176-2 [3] and are out of scope of this specification.

Conducted characteristics are defined at individual or groups of *TAB connectors* at the *transceiver array boundary*, which is the conducted interface between the transceiver unit array and the composite antenna.

The transceiver unit array is part of the composite transceiver functionality generating modulated transmit signal structures and performing receiver combining and demodulation.

The transceiver unit array contains an implementation specific number of transmitter units and an implementation specific number of receiver units. Transmitter units and receiver units may be combined into transceiver units. The transmitter/receiver units have the ability to transmit/receive parallel independent modulated symbol streams.

The composite antenna contains a radio distribution network (RDN) and an antenna array. The RDN is a linear passive network which distributes the RF power generated by the transceiver unit array to the antenna array, and/or distributes the radio signals collected by the antenna array to the transceiver unit array, in an implementation specific way.

How a conducted requirement is applied to the *transceiver array boundary* is detailed in the respective requirement clause.

## 4.3 IAB classes

### 4.3.1 *IAB-DU class*

The requirements in this specification apply to Wide Area IAB-DU, Medium Range IAB-DU and Local Area IAB-DU unless otherwise stated. For *IAB type* 1-H, IAB-DU classes are defined as indicated below:

- Wide Area IAB-DU are characterised by requirements derived from Macro Cell scenarios with a BS to UE minimum coupling loss equal to 70 dB.

- Medium Range IAB-DU are characterised by requirements derived from Micro Cell scenarios with a BS to UE minimum coupling loss equals to 53 dB.

- Local Area IAB-DU are characterised by requirements derived from Pico Cell scenarios with a BS to UE minimum coupling loss equal to 45 dB.

### 4.3.2 *IAB-MT class*

The requirements in this specification apply to Wide Area IAB-MT and Local Area IAB-MT classes unless otherwise stated.

For *IAB type* 1-H, IAB-MT classes are defined as indicated below:

- Wide Area IAB-MT are characterised by requirements derived from Macro Cell and/or Micro Cell scenarios.

- Local Area IAB-MT are characterised by requirements derived from Pico Cell and /or Micro Cell scenarios.

## 4.4 Regional requirements

Some requirements in the present document may only apply in certain regions either as optional requirements, or as mandatory requirements set by local and regional regulation. It is normally not stated in the 3GPP specifications under what exact circumstances the regional requirements apply, since this is defined by local or regional regulation.

Table 4.4-1 lists all requirements in the present specification that may be applied differently in different regions.

Table 4.4-1: List of regional requirements

| Clause number | Requirement | Comments |
| --- | --- | --- |
| 5.2 | *Operating bands* | Some NR *operating bands* may be applied regionally. |
| 6.2.3 | IAB output power:  Additional requirements | These requirements may be applied regionally as additional IAB output power requirements. |
| 6.6.2 | Occupied bandwidth | The requirement may be applied regionally. There may also be regional requirements to declare the occupied bandwidth according to the definition in present specification. |
| 6.6.4.2 | Operating band unwanted emission | Category A or Category B operating band unwanted emissions limits may be applied regionally. |
| 6.6.4.2.5.1 | Operating band unwanted emission | The IAB may have to comply with the additional requirements, when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer. |
| 6.6.5.2.1, | Tx spurious emissions, | Category A or Category B spurious emission limits, as defined in ITU-R Recommendation SM.329 [5], may apply regionally.  The emission limits for *IAB type 1-H* specified as the *basic limit* + X (dB) are applicable, unless stated differently in regional regulation. |
| 6.6.5.2.2, | Tx spurious emissions: additional requirements,  OTA Tx spurious emissions: additional requirements | These requirements may be applied for the protection of system operating in frequency ranges other than the IAB *operating band*. |
| 6.7.2.1 | Transmitter intermodulation, | Interfering signal positions that are partially or completely outside of any downlink *operating band* of the IAB are not excluded from the requirement in Japan in Band n77, n78, n79. |
| 7.6.2,  7.6.3 | Rx spurious emissions, | The emission limits for IAB *type 1-H* specified as the *basic limit* + X (dB) are applicable, unless stated differently in regional regulation. |

## 4.5 IAB configurations

### 4.5.1 *IAB type 1-H*

#### 4.5.1.1 Transmit configurations

Unless otherwise stated, the conducted transmitter characteristics in clause 6 are specified at the *transceiver array boundary* at the *TAB connector(s)* with a full complement of transceiver units for the configuration in normal operating conditions.



Figure 4.5.1.1-1: Transmitter test ports

Unless otherwise stated, for the tests in clause 6 of the present document, the requirement applies for each transmit *TAB connector.*

#### 4.5.1.2 Receive configurations

Unless otherwise stated, the conducted receiver characteristics in clause 7 are specified at the *TAB connector* with a full complement of transceiver units for the configuration in normal operating conditions.



Figure 4.5.1.2-1: Receiver test ports

For the tests in clause 7 of the present document, the requirement applies at each receive *TAB connector*.

Conducted receive requirements are tested at the *TAB connector*, with the remaining receiver units(s) disabled or their *TAB connector*(s) being terminated.

#### 4.5.1.3 Power supply options

If the *IAB type 1-H* is supplied with a number of different power supply configurations, it may not be necessary to test RF parameters for each of the power supply options, provided that it can be demonstrated that the range of conditions over which the equipment is tested is at least as great as the range of conditions due to any of the power supply configurations.

### 4.5.2 IAB with integrated Iuant BS modem

Unless otherwise stated, for the tests in the present document, the integrated Iuant BS modem shall be switched OFF. Spurious emissions according to clauses 6.6.5 and 7.6 shall be measured only for frequencies above 20 MHz with the integrated Iuant BS modem switched ON.

## 4.6 Manufacturer declarations

The following *IAB type 1-H* declarations listed in table 4.6-1, when applicable to the IAB-DU or IAB-MT under test, are required to be provided by the manufacturer for the conducted requirements testing of the *IAB type 1-H*. Declarations may be provided independently for IAB-MT and IAB-DU.

For the *IAB type 1-H* declarations required for the radiated requirements testing, refer to TS 38.176-2 [3].

Table 4.6-1 Manufacturer declarations for *IAB-type 1-H* conducted test requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Declaration identifier | Declaration | Description | Applicability | |
| *IAB-DU type*  *1-H* | *IAB-MT type*  *1-H* |
| D.1 | IAB requirements set | Declaration of one of the IAB requirement's set as defined for *IAB type 1-H*. | x | x |
| D.2 | IAB class | IAB class of the IAB, declared as Wide Area IAB, Medium Range IAB, or Local Area IAB. | 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 IAB-DU or IAB-MT and if applicable, frequency range(s) within the *operating band(s)* that the IAB can operate in.  Declarations shall be made per *TAB connector* for *IAB type 1-H*. | x | x |
| D.4 | Spurious emission category | Declare the IAB-DU or IAB-MT 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 IAB-DU or IAB-MT under test is intended to operate in geographic areas where the additional operating band unwanted emission limits defined in clause 6.6.4..5 apply. | x | x |
| D.6 | Co-existence with other systems | The manufacturer shall declare whether the IAB-DU or IAB-MT 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 IAB | The manufacturer shall declare whether the IAB-DU or IAB-MT under test is intended to operate co-located with IAB 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 | void | void |  |  |
| D.11 | Maximum *IAB RF Bandwidth* | Maximum *IAB RF Bandwidth* in the *operating band* for single-band operation. Declared per supported *operating band,* per *TAB connector* for *IAB type 1-H.* (Note 2) | x | x |
| D.12 | Maximum *IAB RF Bandwidth* for multi-band operation | Maximum *IAB RF Bandwidth* for multi-band operation. Declared per supported *operating band,* per *TAB connector* for *IAB 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 *TAB connector* for *IAB 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 *TAB connector* for *IAB 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 *TAB connector* for *IAB type 1-H.* | x | x |
| D.17 | Maximum number of supported carriers per operating band in single band operation | Maximum number of supported carriers per supported *operation band* in single band operation*.* Declared per supported *operating band*, per *TAB connector* for *IAB type 1-H.* (Note 2) | x | x |
| D.18 | Maximum number of supported carriers per operating band in multi-band operation | Maximum number of supported carriers per supported *operation band* in multi-band operation. (Note 2) | x | x |
| D.19 | Total maximum number of supported carriers in multi-band operation | Maximum number of supported carriers for all supported *operating bands* in multi-band operation*.* 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 *TAB connector* for *IAB 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 *TAB connector* for *IAB 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 IAB in a particular *operating band* with transmission on all *TAB connectors* supporting the *operating band*. | x | x |
| D.25 | Maximum supported power difference between carriers | Maximum supported power difference between carriers. Declared per supported *operating band*, per *TAB connector* for *IAB type 1-H.* (Note 3). | 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 IAB. Declared per *TAB connector* for *IAB type 1-H.* | x | x |
| D.28 | void | void |  |  |
| 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 | x |
| D.30 | Intra-system interfering signal level | The interfering signal level in dBm. Declared per supported *operating band*, per *TAB connector* for *IAB type 1-H* covered by D.29. | x | 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 *TAB connector* of *IAB type 1-H*, which have been declared equivalent.  Equivalent connectors imply that the *TAB connector* of *IAB 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 *TAB connector* of *IAB type 1-H* are identical and the transmitter unit and/or receiver unit driving the *TAB connector* of *IAB 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 *IAB type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. | X | 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 *IAB type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. | x | x |
| D.35 | void | void |  |  |
| 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 | 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 *TAB connector* for *IAB 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 or *TAB connector* for *IAB type 1-H.*. | x | x |
| D.41 | void | void |  |  |
| D.42 | void | void |  |  |
| D.43 | void | void |  |  |
| D.IAB-1 | Same RF implementation. | Declaration whether IAB-MT and IAB-DU have same RF implementation.] | x | x |
| NOTE 1: If an IAB-DU or IAB-MT 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. When separately declared, they shall still use the same declaration identifier.  NOTE 3: The power difference is declared at highest rated output power. | | | | |

## 4.7 Test configurations

4.7.1 General

The test configurations shall be constructed using the methods defined below, subject to the parameters declared by the manufacturer for the supported RF configurations as listed in clause 4.6. The test configurations to use for conformance testing are defined for each supported RF configuration in clauses 4.8.3 and 4.8.4.

The applicable test models for generation of the carrier transmit test signal are defined in clause 4.9.

NOTE: If required, carriers are shifted to align with the channel raster.

4.7.2 Test signal used to build Test Configurations

The signal's channel bandwidth and subcarrier spacing used to build IAB Test Configurations shall be selected according to table 4.7.2-1.

**Table 4.7.2-1: Signal to be used to build IAB TCs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating Band characteristics** | | **FDL\_high – FDL\_low <100 MHz** | **FDL\_high – FDL\_low ≥ 100 MHz** |
| TC signal | BWchannel | 10 MHz (Note 1) | 20 MHz (Note 1) |
| characteristics | Subcarrier spacing | Smallest supported subcarrier spacing | |
| NOTE 1: If this channel bandwidth is not supported, the narrowest supported channel bandwidth shall be used. | | | |

4.7.3 IABTC1: Contiguous spectrum operation

The purpose of test configuration IABTC1 is to test all IAB requirements excluding CA occupied bandwidth.

For IABTC1 used in receiver tests only the two outermost UL carriers and two outermost DL carriers within each supported operating band need to be generated by the test equipment;

4.7.3.1 IABTC1 generation

IABTC1 shall be constructed on a per band basis using the following method:

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

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

- For transmitter tests, select as many IAB carriers (according to 4.7.2) that the IAB supports within an *operating band* and fit in the rest of the declared maximum IAB RF Bandwidth (D.11). Place the carriers adjacent to each other starting from the upper IAB RF Bandwidth edge. The nominal channel spacing defined in TS 38.174 [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 IAB and are transmitted using the same *TAB connector*. All configured component carriers are transmitted simultaneously in the tests where the transmitter should be ON.

4.7.3.2 IABTC1 power allocation

Set the power spectral density of each carrier to the same level so that the sum of the carrier powers equals the rated total output power (Prated,t,AC, or Prated,t,TABC, D.22) for IAB according to the manufacturer's declaration in clause 4.6.

4.7.4 IABTC2: Contiguous CA occupied bandwidth

IABTC2 in this clause is used to test CA occupied bandwidth.

4.7.4.1 IABTC2 generation

The CA specific test configuration should be constructed on a per band basis using the following method:

- All component carrier combinations supported by the IAB, which have different sum of channel bandwidth of component carrier, shall be tested. For all component carrier combinations which have the same sum of channel bandwidth of component carriers, only one of the component carrier combinations shall be tested.

- Of all component carrier combinations which have same sum of channel bandwidth of component carrier, select those with the narrowest carrier with the smallest supported subcarrier spacing at the lower IAB RF Bandwidth edge.

- Of the combinations selected in the previous step, select one with the narrowest carrier with the smallest supported subcarrier spacing at the upper IAB RF Bandwidth edge.

- If there are multiple combinations fulfilling previous steps, select the one with the smallest number of component carrier.

- If there are multiple combinations fulfilling previous steps, select the one with the widest carrier with the smallest supported subcarrier spacing being adjacent to the lowest carrier.

- If there are multiple combinations fulfilling previous steps, select the one with the widest carrier with the smallest supported subcarrier spacing being adjacent to the highest carrier.

- If there are multiple combinations fulfilling previous steps, select the one with the widest carrier with the smallest supported subcarrier spacing being adjacent to the carrier which has been selected in the previous step.

- If there are multiple combinations fulfilling previous steps, repeat the previous step until there is only one combination left.

- The nominal channel spacing defined in TS 38.174 [2], clause 5.4.1 shall apply.

4.7.4.2 IABTC2 power allocation

Set the power spectral density of each carrier to be the same level so that the sum of the carrier powers equals the rated total output power (Prated,t,AC, or Prated,t,TABC, D.22) for IAB according to the manufacturer's declaration in clause 4.6.

4.7.5 IABTC3: Non-contiguous spectrum operation

The purpose of IABTC3 is to test all IAB requirements excluding CA occupied bandwidth.

For IABTC3 used in receiver tests, outermost DL and UL carriers for each sub-block need to be generated by the test equipment; other supported carriers are optional to be generated.

4.7.5.1 IABTC3 generation

IABTC3 is constructed on a per band basis using the following method:

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

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

- 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 IAB 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 38.174 [2], clause 5.4.1 shall apply.

- The sub-block edges adjacent to the sub-block gap shall be determined using the specified Foffset\_high and Foffset\_low for the carriers adjacent to the sub-block gap.

4.7.5.2 IABTC3 power allocation

Set the power of each carrier to the same level so that the sum of the carrier powers equals the rated total output power (Prated,t,AC, or Prated,t,TABC, D.22) for IAB according to the manufacturer's declaration in clause 4.6.

4.7.6 IABTC4: Multi-band test configuration for full carrier allocation

The purpose of IABTC4 is to test multi-band operation aspects considering maximum supported number of carriers.

4.7.6.1 IABTC4 generation

IABTC4 is based on re-using the previously specified test configurations (IABTC1, IABTC2 and IABTC3) applicable per band involved in multi-band operation. It is constructed using the following method:

- The IAB RF Bandwidth of each supported operating band shall be the declared maximum IAB RF Bandwidth in multi-band operation (D.12).

- The number of carriers of each supported *operating band* shall be the declared maximum number of supported carriers per operating band in multi-band operation (D. 18). Carriers shall be selected according to 4.7.2 and shall first be placed at the outermost edges of the declared maximum Radio Bandwidth. Additional carriers shall next be placed at the IAB RF Bandwidths edges, if possible.

- The allocated IAB RF Bandwidth of the outermost bands shall be located at the outermost edges of the declared maximum Radio Bandwidth.

- Each concerned band shall be considered as an independent band and the carrier placement in each band shall be according to IABTC1, where the declared parameters for multi-band operation shall apply. The mirror image of the single-band test configuration shall be used in each alternate band(s) and in the highest band being.

- If only three carriers are supported, two carriers shall be placed in one band according to the relevant test configuration while the remaining carrier shall be placed at the edge of the maximum *Radio Bandwidth* in the other band.

- If the sum of the maximum IAB RF Bandwidths of each supported *operating bands* is larger than the declared *Total RF Bandwidth* BWtot (D.13) of transmitter and receiver for the declared band combinations of the IAB, repeat the steps above for test configurations where the IAB RF Bandwidth of one of the operating band shall be reduced so that the *Total RF Bandwidth* of transmitter and receiver is not exceeded and vice versa.

- If the sum of the maximum number of supported carriers per operating band in multi-band operation (D.18) is larger than the declared total maximum number of supported carriers in multi-band operation (D. 19), repeat the steps above for test configurations where in each test configuration the number of carriers of one of the operating band shall be reduced so that the total number of supported carriers is not exceeded and vice versa.

4.7.6.2 IABTC4 power allocation

Unless otherwise stated, set the power of each carrier in all supported *operating bands* to the same power so that the sum of the carrier powers equals the rated total output power (Prated,t,AC or Prated,t,TABC, D.22) according to the manufacturer's declaration.

If the allocated power of a supported *operating band(s)* exceeds the declared rated total output power of the *operating band(s)* in multi-band operation, the exceeded part shall, if possible, be reallocated into the other band(s). If the power allocated for a carrier exceeds the rated output power declared for that carrier, the exceeded power shall, if possible, be reallocated into the other carriers.

4.7.7 IABTC5: Multi-band test configuration with high PSD per carrier

The purpose of IABTC5 is to test multi-band operation aspects considering higher PSD cases with reduced number of carriers and non-contiguous operation (if supported) in multi-band mode.

4.7.7.1 IABTC5 generation

IABTC5 is based on re-using the existing test configuration applicable per band involved in multi-band operation. It is constructed using the following method:

- The IAB RF Bandwidth of each supported *operating band* shall be the declared maximum IAB RF Bandwidth in multi-band operation (D.12).

- The allocated IAB RF Bandwidth of the outermost bands shall be located at the outermost edges of the declared Maximum Radio Bandwidth.

- The maximum number of carriers is limited to two per band. Carriers shall be selected according to 4.7.2 and shall first be placed at the outermost edges of the declared Maximum Radio Bandwidth for outermost bands and at the IAB RF Bandwidths edges for middle band(s) if any. Additional carriers shall next be placed at the IAB RF Bandwidths edges, if possible.

- Each concerned band shall be considered as an independent band and the carrier placement in each band shall be according to IABTC3, where the declared parameters for multi-band operation shall apply. Narrowest supported NR channel bandwidth and smallest subcarrier spacing shall be used in the test configuration.

- If only one carrier can be placed for the concerned band(s), the carrier(s) shall be placed at the outermost edges of the declared maximum radio bandwidth for outermost band(s) and at one of the outermost edges of the supported frequency range within the IAB RF Bandwidths for middle band(s) if any.

- If the sum of the maximum IAB RF Bandwidth of each supported operating bands is larger than the declared *Total RF Bandwidth* BWtot (D.13) of transmitter and receiver for the declared band combinations of the IAB, repeat the steps above for test configurations where the IAB RF Bandwidth of one of the operating band shall be reduced so that the *Total RF Bandwidth* BWtot of transmitter and receiver is not exceeded and vice versa.

4.7.7.2 IABTC5 power allocation

Unless otherwise stated, set the power of each carrier in all supported *operating bands* to the same power so that the sum of the carrier powers equals the total rated output power (Prated,t,AC or Prated,t,TABC, D.22) according to the manufacturer's declaration.

If the allocated power of a supported *operating band(s)* exceeds the declared rated total output power of the *operating band(s)* in multi-band operation, the exceeded part shall, if possible, be reallocated into the other band(s). If the power allocated for a carrier exceeds the rated output power declared for that carrier, the exceeded power shall, if possible, be reallocated into the other carriers.

## 4.8 Applicability of requirements

4.8.1 General

4.8.2 Requirement set applicability

In table 4.8.2-1, the requirement applicability for each requirement set of IAB-DU and IAB-MT is defined. For each requirement, the applicable requirement clause in the specification is identified. Requirements not included in a requirement set is marked not applicable (NA).

**Table 4.8.2-1: Requirement set applicability for IAB-DUs and IAB-MTs**

| **Requirement** | **IAB-DU Requirement set** | **IAB-MT Requirement set** |
| --- | --- | --- |
| Output power | 6.2 | 6.2 |
| Output power dynamics | 6.3 | 6.3 |
| Transmit ON/OFF power | 6.4 | 6.4 |
| Transmitted signal quality | 6.5 | 6.5 |
| Occupied bandwidth | 6.6.2 | 6.6.2 |
| ACLR | 6.6.3 | 6.6.3 |
| Operating band unwanted  emissions | 6.6.4 | 6.6.4 |
| Transmitter spurious emissions | 6.6.5 | 6.6.5 |
| Transmitter intermodulation | 6.7.5 | 6.7.5 |
| Reference sensitivity level | 7.2 | 7.2 |
| Dynamic range | 7.3 | NA |
| In-band selectivity and blocking | 7.4 | 7.4 |
| Out-of-band blocking | 7.5 | 7.5 |
| Receiver spurious emissions | 7.6 | 7.6 |
| Receiver intermodulation | 7.7 | 7.7 |
| In-channel selectivity | 7.8 | NA |
| Performance requirements | 8 | 8 |

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 an IAB node capable of single carrier, multi-carrier and/or CA operation in both contiguous and non-contiguous spectrum in single band.

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

For an IAB node declared 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 an IAB node declared 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 an IAB node declared 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 IAB capable of multi-carrier and/or CA in a single band**

|  |  |  |  |
| --- | --- | --- | --- |
| **IAB test case** | **Contiguous spectrum capable IAB** | **C and NC capable IAB with identical parameters** | **C and NC capable IAB with different parameters** |
| Output power | IABTC1 | IABTC1 | IABTC1, IABTC3 |
| RE Power control dynamic range (only applied to IAB-DU) | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Total power dynamic range | SC | SC | SC |
| Transmit ON/OFF power (only applied to NR TDD IAB) | IABTC1 | IABTC1 | IABTC1, IABTC3 |
| Frequency error | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Error Vector Magnitude | IABTC1 | IABTC1 | IABTC1, IABTC3 |
| Time alignment error (only applied to IAB-DU) | IABTC1 | IABTC1 | IABTC1, IABTC3 |
| Occupied bandwidth | SC, IABTC2 (Note 1) | SC, IABTC2 (Note 1) | SC, IABTC2 (Note 1) |
| Adjacent Channel Leakage power Ratio (ACLR) | IABTC1 | IABTC3 | IABTC1, IABTC3 |
| Cumulative ACLR requirement in non-contiguous spectrum | - | IABTC3 | IABTC3 |
| Operating band unwanted emissions | IABTC1, SC (Note 2) | IABTC1, IABTC3, SC (Note 2) | IABTC1, IABTC3, SC (Note 2) |
| Transmitter spurious emissions | IABTC1 | IABTC3 | IABTC1, IABTC3 |
| Transmitter intermodulation | IABTC1 | IABTC1, IABTC3 | IABTC1, IABTC3 |
| Reference sensitivity level | SC | SC | SC |
| Dynamic range | SC | SC | SC |
| Adjacent Channel Selectivity (ACS) | IABTC1 | IABTC3 | IABTC1, IABTC3 |
| In-band blocking | IABTC1 | IABTC3 | IABTC1, IABTC3 |
| Out-of-band blocking | IABTC1 | IABTC3 | IABTC1, IABTC3 |
| Receiver spurious emissions | IABTC1 | IABTC3 | IABTC1, IABTC3 |
| Receiver intermodulation | IABTC1 | IABTC3 | IABTC1, IABTC3 |
| In-channel selectivity (only applied to IAB-DU) | SC | SC | SC |
| Note 1: IABTC2 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. | | | |

4.8.4 Applicability of test configurations for multi-bandoperation

For an IAB node 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 IAB capable of multi-band operation**

|  |  |  |
| --- | --- | --- |
| **IAB test case** | **Test configuration** | |
|  | **Common connector** | **Separate connectors** |
| Output power | IABTC1/3 (Note 1), IABTC4 | IABTC1/3 (Note 1), IABTC4 |
| RE Power control dynamic range (only applied to IAB-DU) | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Total power dynamic range | SC | SC |
| Transmit ON/OFF power (only applied to NR TDD IAB) | IABTC4 | IABTC4 |
| Frequency error | Tested with Error Vector Magnitude | Tested with Error Vector Magnitude |
| Error Vector Magnitude | IABTC1/3 (Note 1), IABTC4 | IABTC1/3 (Note 1), IABTC4 |
| Time alignment error (only applied to IAB-DU) | IABTC1/3 (Note 1), IABTC5 (Note 2) | IABTC1/3 (Note 1), IABTC5 (Note 2) |
| Occupied bandwidth | SC, IABTC2 (Note 3) | SC, IABTC2 (Note 3) |
| Adjacent Channel Leakage power Ratio (ACLR) | IABTC1/3 (Note 1), IABTC5 (Note 4) | IABTC1/3 (Note 1, 5), IABTC5 (Note 4, 5) |
| Cumulative ACLR requirement in non-contiguous spectrum | IABTC3 (Note 1), IABTC5 (Note 4) | IABTC3 (Note 1, 5) |
| Operating band unwanted emissions | IABTC1/3 (Note 1), IABTC5, SC (Note 7) | IABTC1/3 (Note 1, 5), IABTC5 (Note 5),  SC(Note 7) |
| Transmitter spurious emissions | IABTC1/3 (Note 1), IABTC5 | IABTC1/3 (Note 1, 5), IABTC5 (Note 5) |
| Transmitter intermodulation | IABTC1/3 (Note 1) | IABTC1/3 (Note 1, 5) |
| Reference sensitivity level | SC | SC |
| Dynamic range | SC | SC |
| Adjacent Channel Selectivity (ACS) | IABTC5 | IABTC1/3 (Note 1), IABTC5 (Note 6) |
| In-band blocking | IABTC5 | IABTC1/3 (Note 1), IABTC5 (Note 6) |
| Out-of-band blocking | IABTC5 | IABTC1/3 (Note 1), IABTC5 (Note 6) |
| Receiver spurious emissions | IABTC1/3 (Note 1), IABTC5 | IABTC1/3 (Note 1, 5), IABTC5 (Note 5) |
| Receiver intermodulation | IABTC5 | IABTC1/3 (Note 1), IABTC5 (Note 6) |
| In-channel selectivity (only applied to IAB-DU) | SC | SC |
| Note 1: IABTC1 and/or IABTC3 shall be applied in each supported operating band.  Note 2: IABTC5 is only applicable when inter-band CA is supported.  Note 3: IABTC2 is only applicable when contiguous CA is supported.  Note 4: IABTC5 may be applied for Inter RF Bandwidth gap only.  Note 5: For single-band operation test, other TAB connector(s) is (are) terminated.  Note 6: IABTC5 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. | | |

## 4.9 RF channels and test models

### 4.9.1 RF channels

For the single carrier testing many tests in this TS are performed with appropriate frequencies in the bottom, middle and top channels of the supported frequency range of the IAB. These are denoted as RF channels B (bottom), M (middle) and T (top).

Unless otherwise stated, the test shall be performed with a single carrier at each of the RF channels B, M and T.

Many tests in this TS are performed with the maximum IAB RF Bandwidth located at the bottom, middle and top of the supported frequency range in the operating band. These are denoted as BRFBW (bottom), MRFBW (middle) and TRFBW (top).

Unless otherwise stated, the test shall be performed at BRFBW, MRFBW and TRFBW defined as following:

- BRFBW: maximum IAB RF Bandwidth located at the bottom of the supported frequency range in the operating band.

- MRFBW: maximum IAB RF Bandwidth located in the middle of the supported frequency range in the operating band.

- TRFBW: maximum IAB RF Bandwidth located at the top of the supported frequency range in the operating band.

Occupied bandwidth test in this TS is performed with the *aggregated IAB channel bandwidth* and sub-block bandwidths located at the bottom, middle and top of the supported frequency range in the operating band. These are denoted as BBW Channel CA(bottom), MBW Channel CA (middle) and TBW Channel CA (top) for contiguous spectrum operation.

Unless otherwise stated, the test for contiguous spectrum operation shall be performed at BBW Channel CA, MBW Channel CA and TBW Channel CA defined as following:

- BBW Channel CA: *aggregated IAB channel bandwidth* located at the bottom of the supported frequency range in each operating band;

- MBW Channel CA: *aggregated IAB channel bandwidth* located close in the middle of the supported frequency range in each operating band;

- TBW Channel CA: *aggregated IAB channel bandwidth* located at the top of the supported frequency range in each operating band.

For IAB capable of multi-band operation, unless otherwise stated, the test shall be performed at BRFBW\_T'RFBW and B'RFBW\_TRFBW defined as following:

- BRFBW\_T'RFBW: the *IAB RF Bandwidths* located at the bottom of the supported frequency range in the lowest operating band and at the highest possible simultaneous frequency position, within the Maximum Radio Bandwidth, in the highest operating band.

- B'RFBW\_TRFBW: the *IAB RF Bandwidths* located at the top of the supported frequency range in the highest operating band and at the lowest possible simultaneous frequency position, within the Maximum Radio Bandwidth, in the lowest operating band.

NOTE: BRFBW\_T'RFBW = B'RFBW\_TRFBW = BRFBW\_TRFBW when the declared Maximum Radio Bandwidth spans all operating bands. BRFBW\_TRFBW means the *IAB RF Bandwidths* are located at the bottom of the supported frequency range in the lower operating band and at the top of the supported frequency range in the upper operating band.

When a test is performed by a test laboratory, the position of B, M and T for single carrier, BRFBW, MRFBW and TRFBW for single band operation, BBW Channel CA, MBW Channel CA and TBW Channel CA forcontiguous spectrum operation in each supported operating band, the position of BRFBW\_T'RFBW and B'RFBW\_TRFBW in the supported operating band combinations shall be specified by the laboratory. The laboratory may consult with operators, the manufacturer or other bodies.

### 4.9.2 Test models

#### 4.9.2.1 General

The following clauses will describe the FR1 test models needed for *IAB type 1-H*. Note that the NR FR1 test models are also applicable to *IAB type 1-O* conformance testing in TS 38.176-2 [3].

#### 4.9.2.2 FR1 test models for IAB-DU

FR1 test model in clause 4.9.2.2 in TS 38.141-1[13] applies to IAB-DU as below:

NR-FR1-TM1.1 applies to IAB-DU-FR1-TM1.1

NR-FR1-TM1.2 applies to IAB-DU-FR1-TM1.2

NR-FR1-TM2 applies to IAB-DU-FR1-TM2

NR-FR1-TM2a applies to IAB-DU-FR1-TM2a

NR-FR1-TM3.1 applies to IAB-DU-FR1-TM3.1

NR-FR1-TM3.1a applies to IAB-DU-FR1-TM3.1a

NR-FR1-TM3.2 applies to IAB-DU-FR1-TM3.2

NR-FR1-TM3.3 applies to IAB-DU-FR1-TM3.3

Testing models applying to NB-IoT operation in clause 4.9.2.2 in TS 38.141-1[13] are not applicable to IAB-DU.

#### 4.9.2.3 FR1 test models for IAB-MT

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

The following general parameters are used by all IAB-MT test models:

- Duration is 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 clause 5.3.2 in TS 38.174[2].

- Normal CP

- Virtual resource blocks of localized type

IAB-MT test models are derived based on the uplink/downlink configuration as shown in the table 4.9.2.3-1 using information element *TDD-UL-DL-ConfigCommon* as defined in TS 38.331 [14].

Table 4.9.2.3-1: Configurations of TDD for *IAB 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 |

Common physical channel parameters for all IAB-MT FR1 test models are specified in table 4.9.2.3-2 and table 4.9.2.3-3 for PUSCH. Specific physical channel parameters for IAB-MT FR1 test models are described in clauses 4.9.2.3.1 to 4.9.2.3.8.

Table 4.9.2.3-2: Common physical channel parameters for PUSCH for *IAB type 1-H* test models

|  |  |
| --- | --- |
| Parameter | Value |
| Mapping type | PUSCH mapping type A |
| *dmrs-TypeA-Position* for the first DM-RS symbol | pos2 |
| *dmrs-AdditionalPosition* for additional DM-RS symbol(s) | Pos1 |
| *dmrs-Type* for comb pattern | Configuration type 1 |
| *maxLength* | 1 |
| Ratio of PUSCH EPRE to DM-RS EPRE | 0 dB |

Table 4.9.2.3-3: Common physical channel parameters for PUSCH by RNTI for *IAB type 1-H* test models

|  |  |
| --- | --- |
| Parameter | Value |
| PUSCH | |

##### 4.9.2.3.1 FR1 test model 1.1 (IAB-MT-FR1-TM1.1)

This model shall be used for tests on:

- IAB output power

- Transmit ON/OFF power

- Unwanted emissions

- Occupied bandwidth

- ACLR

- Operating band unwanted emissions

- Transmitter spurious emissions

- Transmitter intermodulation

- Receiver spurious emissions

Common physical channel parameters are defined in clause 4.9.2.3. Specific physical channel parameters for IAB-MT-FR1-TM1.1 are defined in table 4.9.2.3.1-1.

Table 4.9.2.3.1-1: Specific physical channel parameters of IAB-MT-FR1-TM1.1

|  |  |
| --- | --- |
| Parameter | Value |
| # of PRBs PUSCH | NRB |
| Modulation PUSCH | QPSK |

##### 4.9.2.3.2 FR1 test model 2 (IAB-MT-FR1-TM2)

This model shall be used for tests on:

- Total power dynamic range (at lower PSD TX power limit at min power)

- Transmitted signal quality

- EVM of single 64QAM PRB allocation (at lower PSD TX power limit at min power)

- Frequency error (at min power)

Common physical channel parameters are defined in clause 4.9.2.3. Specific physical channel parameters for IAB-MT-FR1-TM2 are defined in table 4.9.2.3.2-1.

Table 4.9.2.3.2-1: Specific physical channel parameters of IAB-MT-FR1-TM2

|  |  |
| --- | --- |
| Parameter | Value |
| # of 64QAM PUSCH PRBs | 1 |
| Level of boosting (dB) | 0 |
| Location of 64QAM PRB | |  |  |  | | --- | --- | --- | | Slot | RB | n | | 3*n* | 0 |  | | 3*n*+1 |  |  | | 3*n*+2 |  |  | |
| # of PUSCH PRBs which are not allocated |  |

##### 4.9.2.3.3 FR1 test model 3.1 (IAB-MT-FR1-TM3.1)

This model shall be used for tests on:

- Output power dynamics

- Total power dynamic range (upper TX PSD power limit at max power with all 64QAM PRBs allocated)

- Transmitted signal quality

- Frequency error (at max power)

- EVM for 64QAM modulation (at max power)

Common physical channel parameters are defined in clause 4.9.2.3. Physical channel parameters are defined in table 4.9.2.3.1-1 with all QPSK PUSCH PRBs replaced by 64QAM PUSCH PRBs.

##### 4.9.2.3.4 FR1 test model 3.1 (IAB-MT-FR1-TM3.1a)

This model shall be used for tests on:

- Output power dynamics

- Total power dynamic range (upper TX PSD power limit at max power with all 256QAM PRBs allocated)

- Transmitted signal quality

- Frequency error (at max power)

- EVM for 256QAM modulation (at max power)

Common physical channel parameters are defined in clause 4.9.2.3. Physical channel parameters are defined in table 4.9.2.3.1-1 with all QPSK PUSCH PRBs replaced by 256QAM PUSCH PRBs.

#### 4.9.2.3 Data content of Physical channels and Signals for IAB-MT-FR1-TM

Randomisation of the data content is obtained by utilizing a PN sequence generator and the length-31 Gold sequence scrambling of TS 38.211 [9], clause 5.2.1 which is invoked by all physical channels prior to modulation and mapping to the RE grid.

Initialization of the scrambler and RE-mappers as defined in TS 38.211 [9] use the following additional parameters:

- , Physical layer cell identity = 1 is used as the default physical layer cell identity

- *q* = 0 (single code word)

- Rank 1, single layer

##### 4.9.2.3.2 PUSCH

- Generate the required amount of bits from the output of the PN23 sequence generator [15]. The PN sequence generator is initialized with a starting seed of "all ones" in the first allocated slot of each frame. The PN sequence is continuous over the slot boundaries.

- Perform user specific scrambling according to TS 38.211 [9], clause 6.3.1.1.

- Perform modulation of the scrambled bits with the modulation scheme defined for each user according to TS 38.211 [9], clause 6.3.1.2

-

- Perform mapping of the complex-valued symbols to layer according to TS 38.211 [9], clause 6.3.1.3.

- Perform PUSCH mapping according to TS 38.211 [9] using parameters listed in table 4.9.2.3-2.

- DM-RS sequence generation according to TS 38.211 [9], clause 6.4.1.1.1 where *l* is the OFDM symbol number within the slot with the symbols indicated by table 4.9.2.2-3.

-

-

- DM-RS mapping according to TS 38.211 [9], clause 6.4.1.1.3 using parameters listed in table 4.9.2.2-3.

## 4.10 Requirements for contiguous and non-contiguous spectrum

A spectrum allocation where an IAB-DU or IAB-MT operates can either be contiguous or non-contiguous. Unless otherwise stated, the requirements in the present specification apply for IAB-DU and IAB-MT configured for both *contiguous spectrum* operation and *non-contiguous spectrum* operation.

For IAB-DU or IAB-MT operation in *non-contiguous spectrum*, some requirements apply both at the *IAB RF Bandwidth edges* and inside the *sub-block gaps*. For each such requirement, it is stated how the limits apply relative to the *IAB RF Bandwidth edges* and the *sub-block* edges respectively.

## 4.11 Requirements for IAB capable of multi-band operation

For *multi-band connector* the conducted test requirements in clause 6 and 7 apply separately to each supported *operating band* unless otherwise stated. For some requirements, it is explicitly stated that specific additions or exclusions to the requirement apply at *multi-band connector(s)* as detailed in the requirement clause. For *IAB-DU* or *IAB-MT* capable of multi-band operation, various structures in terms of combinations of different transmitter and receiver implementations (multi-band or single band) with mapping of transceivers to one or more *TAB connectors* for *IAB type 1-H* in different ways are possible. For *multi-band connector(s)* the exclusions or provisions for multi-band apply. For *single-band connector(s)*, the following applies:

- Single-band transmitter spurious emissions, *operating band* unwanted emissions, ACLR, transmitter intermodulation and receiver spurious emissions requirements apply to this *connector* that is mapped to single-band.

- If the IAB-DU or IAB-MT is configured for single-band operation, single-band requirements shall apply to this *connector* configured for single-band operation and no exclusions or provisions for multi-band capable *IAB-DU* or *IAB-MT* are applicable. Single-band requirements are tested separately at the *connector* configured for single-band operation, with all other *TAB connectors* terminated.

An *IAB type 1-H* may be capable of supporting operation in multiple *operating bands* with one of the following implementations of *TAB connectors* in the *transceiver array boundary*:

- All *TAB connectors* are *single-band connectors*.

- Different sets of *single-band connectors* support different *operating bands*, but each *TAB connector* supports only operation in one single *operating band*.

- Sets of *single-band connectors* support operation in multiple *operating bands* with some *single-band connectors* supporting more than one *operating band*.

- All *TAB connectors* are multi-band *connectors*.

- A combination of single-band sets and multi-band sets of *TAB connectors* provides support of the type *IAB type 1-H* capability of operation in multiple *operating bands*.

Unless otherwise stated all requirements specified for an *operating band* apply only to the set of *TAB connectors* supporting that *operating band*.

In the case of an *operating band* being supported only by *single-band connectors* in a *TAB connector TX min cell group* or a *TAB connector RX min cell group*, *single-band requirements* apply to that set of *TAB connectors*.

In the case of an *operating band* being supported only by *multi-band connector*s supporting the same *operating band* combination in a *TAB connector TX min cell group* or a *TAB connector RX min cell group*, *multi-band requirements* apply to that set of *TAB connectors*.

For multi-band connectors supporting the bands for TDD, the RF requirements in the present specification assume no simultaneous uplink and downlink occur between the bands.

NOTE 1: The case of an operating band being supported by both multi-band connectors and single-band connectors in a TAB connector TX min cell group or a TAB connector RX min cell group is not covered by the present release of this specification.

NOTE 2: The case of an operating band being supported by multi-band connectors which are not all supporting the same operating band combination in a TAB connector TX min cell group or a TAB connector RX min cell group is not covered by the present release of this specification.

## 4.12 Format and interpretation of tests

Each test has a standard format:

**X Title**

All tests are applicable to all equipment within the scope of the present document, unless otherwise stated.

**X.1 Definition and applicability**

This clause gives the general definition of the parameter under consideration and specifies whether the test is applicable to all equipment or only to a certain subset. Required manufacturer declarations may be included here.

**X.2 Minimum requirement**

This clause contains the reference to the clause to the 3GPP reference (or core) specification which defines the minimum requirement.

**X.3 Test purpose**

This clause defines the purpose of the test.

**X.4 Method of test**

**X.4.1 General**

In some cases there are alternative test procedures or initial conditions. In such cases, guidance for which initial conditions and test procedures can be applied are stated here. In the case only one test procedure is applicable, that is stated here.

**X.4.2y First test method**

**X.4.2y.1 Initial conditions**

This clause defines the initial conditions for each test, including the test environment, the RF channels to be tested and the basic measurement set-up.

**X.4.2y.2 Procedure**

This clause describes the steps necessary to perform the test and provides further details of the test definition like domain (e.g. frequency-span), range, weighting (e.g. bandwidth), and algorithms (e.g. averaging). The procedure may comprise data processing of the measurement result before comparison with the test requirement (e.g. average result from several measurement positions).

**X.4.3y Alternative test method (if any)**

If there are alternative test methods, each is described with its initial conditions and procedures.

**X.5 Test requirement**

This clause defines the pass/fail criteria for the equipment under test, see clause 4.1.3 (Interpretation of measurement results). Test requirements for every minimum requirement referred in clause X.2 are listed here. Cases where minimum requirements do not apply need not be mentioned.

## 4.13 Test efficiency optimization

When manufacture declares the same RF implementation for IAB-MT and IAB-DU (D.IAB-1) and the declarations in table 4.13-1 are the same for IAB-DU and IAB-MT, it is sufficient to test only IAB-MT or IAB-DU with the test requirement applicability according to Table 4.13-2 for Tx requirements and Table 4.13-3 for Rx requirements.

For *IAB type 1-H* it is required that the DUT selection between requirements follows following rules:

* Out of maximum output transmit power, modulation quality and ACLR, operating band unwanted emissions and transmitter general spurious emissions, IAB-DU and IAB-MT are required to be the DUT at least once,
* Out of receiver requirements of reference sensitivity, receiver spurious, receiver intermodulation, IAB-DU and IAB-MT are required to be the DUT at least once.

In some cases, the test requirements are the same but the MU for the IAB-MT is larger than for the IAB-DU. In cases where the test efficiency optimization is applicable the lower MU value should be used.

[Table 4.13-1: Declarations required to be the same for IAB-DU and IAB-MT for test efficiency optimization to apply]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Declaration identifier | Declaration | Additional conditions | Applicability | |
|  |  |  | *IAB-DU type*  *1-H* | *IAB-MT type*  *1-H* |
| D.2 | IAB class |  | x | x |
| D.3 | *Operating bands* and frequency ranges |  | x | x |
| D.11 | Maximum *IAB RF Bandwidth* |  | x | x |
| D.12 | Maximum *IAB RF Bandwidth* for multi-band operation |  | x | x |
| D.13 | Total RF bandwidth (BWtot) |  | x | x |
| D.14 | NR supported channel bandwidths and SCS |  | x | x |
| D.15 | CA only operation |  | x | x |
| D.16 | Single or multiple carrier |  | x | x |
| D.17 | Maximum number of supported carriers per operating band in single band operation |  | x | x |
| D.18 | Maximum number of supported carriers per operating band in multi-band operation |  | x | x |
| D.19 | Total maximum number of supported carriers in multi-band operation |  | x | x |
| D.20 | Other band combination multi-band restrictions |  | x | x |
| D.21 | Rated carrier output power(Prated,c,AC, or Prated,c,TABC) |  | x | x |
| D.22 | R*ated total output power* (Prated,t,AC, or Prated,t,TABC) |  | x | x |
| D.23 | Rated multi-band total output power, Prated,MB,TABC |  | x | x |
| NOTE 1: Manufacturer declarations applicable per IAB *requirement set* were marked as "x". Manufacturer declarations not applicable per IAB *requirement set* were marked as "n/a". | | | | |

Table 4.13-2: Test requirement applicability for TX requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Tx requirement | | Test efficiency optimization applicable | Test requirement applicability  (Note 1) |
| Maximum output power | | Yes |  |
| Output power dynamics (only for IAB-DU) | | No |  |
| Output power dynamics (only for IAB-MT) | | No |  |
| Transmitter OFF power | | Yes |  |
| Transient period | | Yes |  |
| IAB-DU Frequency Error | | No |  |
| IAB-MT Frequency Error | | No |  |
| Modulation quality | | Yes |  |
| Time alignment error (only for IAB-DU) | | No |  |
| Occupied bandwidth | | Yes |  |
| ACLR | | Yes |  |
| Operating band unwanted emission | | Yes |  |
| Transmitter spurious emission | General requirement | Yes |  |
|  | Additional spurious emissions | Yes |  |
|  | Co-location with other base stations | Yes |  |
| OTA transmitter intermodulation | | Yes |  |
| Note 1: Test requirement applicability defines how to select whether IAB-DU or IAB-MT test requirement is applied. In case no applicability definition is provided or despite the applicability definition test requirement is the same for IAB-DU and IAB-MT, either can apply. | | | |

Table 4.13-3: Test requirement applicability for receiver requirements

|  |  |  |  |
| --- | --- | --- | --- |
| **Rx requirement** | | Test efficiency optimization applicable | **Test requirement applicability (Note 1)** |
| Reference sensitivity | | Yes |  |
| Dynamic range (only for IAB-DU) | | No | n/a |
| Adjacent channel selectivity | | Yes | IAB-MT |
| In-band blocking | | Yes | IAB-MT |
| Out-of-band blocking | General requirement | Yes | IAB-MT |
|  | Co-location requirement | Yes |  |
| Receiver spurious emissions | | Yes |  |
| Receiver intermodulation | | Yes |  |
| In-channel selectivity (only for IAB-DU) | | No | n/a |
| Note 1: Test requirement applicability defines how to select whether IAB-DU or IAB-MT test requirement is applied. In case no applicability definition is provided or despite the applicability definition test requirement is the same for IAB-DU and IAB-MT, either can apply. | | | |

# 5 Operating bands and channel arrangement

For the IAB operation in NR operating bands specification, their channel bandwidth configurations, channel spacing and raster, as well as synchronization raster specification, refer to TS 38.174 [2], clause 5 and its relevant clauses.

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

# 6 Conducted transmitter characteristics (IAB-DU and IAB-MT)

## 6.1 General

General test conditions for conducted transmitter tests are given in clause 4, including interpretation of measurement results and configurations for testing. IAB configurations for the tests are defined in clause 4.5.

If a number of *single-band connectors*, or *multi-band connectors* have been declared equivalent (D.32), only a representative one is necessary to be tested to demonstrate conformance.

In clause 6.6.3.5.3, if representative *TAB connectors* are used then per connector criteria (i.e. option 2) shall be applied.

For *IAB-DU* and *IAB-MT* the manufacturer shall declare the minimum number of supported geographical cells (i.e. geographical areas covered by beams). The declaration is done separately for IAB-DU and IAB-MT. The minimum number of supported geographical cells (Ncells, D.24) relates to the setting with the minimum amount of cell splitting supported with transmission on all *TAB connectors* supporting the *operating band*, or with minimum amount of transmitted beams.

For *IAB-DU* and *IAB-MT* manufacturer shall also declare *TAB connector TX min cell groups* (D.34). The declaration is done separately for IAB-DU and IAB-MT. Every *TAB connector* of the *IAB type 1-H* supporting transmission in an *operating band* shall map to one *TAB connector* *TX min cell group* supporting the same *operating band*,where mapping of *TAB connector*s to cells/beams is implementation dependent.

The number of *active transmitter units* that are considered when calculating the conducted TX emissions limits (NTXU,counted) for *IAB-DU and IAB-MT* is calculated as follows:

NTXU,counted = *min(NTXU,active , 8×Ncells)*

NTXU,countedpercell is used for scaling of *basic limits* and is derived as NTXU,countedpercell = NTXU,counted / Ncells

NOTE: NTXU,active depends on the actual number of *active transmitter unit*s and is independent to the declaration of Ncells.

## 6.2 IAB output power

### 6.2.1 General

The IAB type 1-H conducted output power requirement is at *TAB connector* for *IAB type 1-H*.

The *rated carrier output power* of the *IAB type 1-H* shall be as specified in table 6.2.1-1 for *IAB-DU* and in table 6.2.1-2 for *IAB-MT*.

Table 6.2.1-1: *IAB type 1-H* rated output power limits for IAB-DU classes

| IAB-DU class | Prated,c,sys | Prated,c,TABC |
| --- | --- | --- |
| Wide Area IAB-DU | (Note) | (Note) |
| Medium Range IAB-DU | ≤ 38 dBm +10log(NTXU,counted) | ≤ 38 dBm |
| Local Area IAB-DU | ≤ 24 dBm +10log(NTXU,counted) | ≤ 24 dBm |
| NOTE: There is no upper limit for the Prated,c,sys or Prated,c,TABC of the Wide Area IAB-DU. | | |

Table 6.2.1-2: *IAB type 1-H* rated output power limits for IAB-MT classes

| IAB-MT class | Prated,c,sys | Prated,c,TABC |
| --- | --- | --- |
| Wide Area IAB-MT | (Note) | (Note) |
| Local Area IAB-MT | ≤ 24 dBm +10log(NTXU,counted) | ≤ 24 dBm |
| NOTE: There is no upper limit for the Prated,c,sys or Prated,c,TABC of the Wide area IAB-MT. | | |

### 6.2.2 Minimum requirement

The minimum requirement *IAB type 1-H* applies per *single-band connector*, or per *multi-band connector* supporting transmission in the *operating band*.

The minimum requirement for *IAB-DU* is defined in TS 38.174 [2], clause 6.2.2.

The minimum requirement for *IAB-MT* is defined in TS 38.174 [2], clause 6.2.2.

### 6.2.3 Test purpose

The test purpose is to verify the accuracy of the *maximum carrier output power* across the frequency range and under normal and extreme conditions.

### 6.2.4 Method of test

#### 6.2.4.1 Initial conditions

Test environment:

- Normal, see annex B.2,

- Extreme, see annexes B.3 and B.5.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1

*IAB RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- BRFBW, MRFBW and TRFBW for *single-band connector(s)*, see clause 4.9.1.

- BRFBW\_T'RFBW and B'RFBW\_TRFBW for *multi-band connector(s)*, see clause 4.9.1.

Under extreme test environment, it is sufficient to test on one NR-ARFCN or one RF bandwidth position, and with one applicable test configuration defined in clauses 4.7 and 4.8. Testing shall be performed under extreme power supply conditions, as defined in Annex B.5.

NOTE: Tests under extreme power supply conditions also test extreme temperatures.

#### 6.2.4.2 Procedure

For *IAB 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. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect the power measuring equipment to *single-band connector(s)* or to *multi-band connector(s)* under test as shown in annex D.1.1 for *IAB type 1-H*. All connectors not under test shall be terminated.

2) For single carrier set the connector under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models or set of physical channels in clause 4.9.2 at *rated carrier output power* Prated,c,TABC for *IAB 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.

3) Measure the *maximum carrier output power* (Pmax,c,TABC for *IAB type 1-H* ) for each carrier at each connector under test.

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

4) 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*.

### 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,TABC for *IAB type 1-H* (D.21):

Table 6.2.5-1: Test requirement for conducted IAB-DU and IAB-MT output power

|  |  |  |
| --- | --- | --- |
|  | Normal test environment | Extreme test environment |
| *IAB-DU,* | f ≤ 3.0 GHz: ± 2.7 dB | f ≤ 3.0 GHz: ± 3.2 dB |
| *IAB-MT* | 3.0 GHz < f ≤ 6.0 GHz: ± 3.0 dB | 3.0 GHz < f ≤ 6.0 GHz: ± 3.5 dB |

## 6.3 Output power dynamics

### 6.3.1 IAB-DU Output Power Dynamics

#### 6.3.1.1 General

The requirements in clause 6.3.1 apply during the *transmitter ON period*. Transmit signal quality requirements (as specified in clause 6.5) shall be maintained for the output power dynamics requirements of this clause.

#### 6.3.1.2 RE power control dynamic range

##### 6.3.1.2.1 Definition and applicability

The RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS at *maximum carrier output power* (Pmax,c,TABC, or Pmax,c,AC) for a specified reference condition.

For *IAB type 1-H* this requirement shall apply at each *TAB connector* supporting transmission in the *operating band*.

##### 6.3.1.2.2 Minimum requirement

The minimum requirement applies per *single-band connector*, or per *multi-band connector* supporting transmission in the *operating band*.

The minimum requirement for *IAB type 1-H* is defined in TS 38.174 [2], clause 6.3.1.2.

##### 6.3.1.2.3 Test purpose

No specific test or test requirements are defined for conducted RE power control dynamic range. The Error Vector Magnitude (EVM) test, as described in clause 6.5.3 provides sufficient test coverage for this requirement.

#### 6.3.1.3 Total power dynamic range

##### 6.3.1.3.1 Definition and applicability

The IAB-DU total power dynamic range is the difference between the maximum and the minimum transmit power of an OFDM symbol for a specified reference condition.

For *IAB type 1-H* this requirement shall apply at each *TAB connector* supporting transmission in the *operating band*.

NOTE: The upper limit of the dynamic range is the OFDM symbol power for a BS when transmitting on all RBs at maximum output power. The lower limit of the total power dynamic range is the average power for single RB transmission. The OFDM symbol shall carry PDSCH and not contain RS or SSB.

##### 6.3.1.3.2 Minimum requirement

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

The minimum requirement for *IAB-DU* is in TS 38.174 [2], clause 6.3.1.3.

##### 6.3.1.3.3 Test purpose

The test purpose is to verify that the total power dynamic range is within the limits specified by the minimum requirement.

##### 6.3.1.3.4 Method of test

###### 6.3.1.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

Set the channel set-up of the connector under as shown in annex D.1 for *IAB type 1-H*.

###### 6.3.1.3.4.2 Procedure

For *IAB 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. 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(s)* under test as shown in annex D.1.1 for *IAB type 1-H*. All connectors not under test shall be terminated.

2) Set each connector under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models in clause 4.9.2 at Prated,c,TABC for *IAB type 1-H* (D.21).

3) For *IAB type 1-H*, set the BS to transmit a signal according to:

- NR-FR1-TM3.1a if 256QAM is supported without power back off, or

- NR-FR1-TM3.1 if 256QAM is supported with power back off, or

- NR-FR1-TM3.1 if 256QAM is not supported by IAB-DU.

4) Measure the OFDM symbol TX power (OSTP) as defined in the annex H.

5) For *IAB type 1-H*, set to transmit a signal according to:

NR-FR1-TM2a if 256QAM is supported, or

NR-FR1-TM2 if 256QAM is not supported ;

6) Measure the OFDM symbol TX power (OSTP) as defined in the annex H.

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

7) 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*.

##### 6.3.1.3.5 Test requirements

The downlink (DL) total power dynamic range for each NR carrier shall be larger than or equal to the level in table 6.3.1.4.5-1.

Table 6.3.1.3.5-1: IAB-DU total power dynamic range

|  |  |  |  |
| --- | --- | --- | --- |
| NR channel | Total power dynamic range (dB) | | |
| bandwidth (MHz) | 15 kHz SCS | 30 kHz SCS | 60 kHz SCS |
| 10 | 16.7 | 13.4 | 10 |
| 15 | 18.5 | 15.3 | 12.1 |
| 20 | 19.8 | 16.6 | 13.4 |
| 25 | 20.8 | 17.7 | 14.5 |
| 30 | 21.6 | 18.5 | 15.3 |
| 40 | 22.9 | 19.8 | 16.6 |
| 50 | 23.9 | 20.8 | 17.7 |
| 60 | N/A | 21.6 | 18.5 |
| 70 | N/A | 22.3 | 19.2 |
| 80 | N/A | 22.9 | 19.8 |
| 90 | N/A | 23.4 | 20.4 |
| 100 | N/A | 23.9 | 20.9 |

NOTE: Additional test requirements for the EVM at the lower limit of the dynamic range are defined in clause 6.5.3.

**--- Next change ---**

### 6.3.2 IAB-MT Output Power Dynamics

#### 6.3.2.1 Total power dynamic range

##### 6.3.2.1.1 Definition and applicability

The IAB-MT total power dynamic range is the difference between the maximum and the minimum controlled transmit power in the channel bandwidth for a specified reference condition. The maximum and minimum output powers are defined as the mean power in at least one sub-frame 1ms.

NOTE: The specified reference condition(s) are specified in the conformance specification Changes in the controlled transmit power in the channel bandwidth due to changes in the specified reference condition are not include as part of the dynamic range.

##### 6.3.2.1.2 Minimum requirement

The IAB-MT total power dynamic range is defined in TS 38.174 [2], clause 6.3.2.1.2

##### 6.3.2.1.3 Test purpose

The test purpose is to verify that the IAB-MT total power dynamic range is within the limits specified by the minimum requirement.

##### 6.3.2.1.4 Method of test

###### 6.3.2.1.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

Set the channel set-up of the connector under as shown in annex D.1 for *IAB type 1-H*.

###### 6.3.2.1.4.2 Procedure

For *IAB 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. 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(s)* under test as shown in annex D.1.1 for *IAB type 1-H*. All connectors not under test shall be terminated.

2) Set each connector under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models in clause 4.9.2 at Prated,c,TABC for *IAB type 1-H* (D.21).

3) Set the IAB-DU to transmit a signal according to IAB-MT-FR1-TM3.1

4) Measure the power over 1ms

5) Set to transmit a signal according to IAB-MT-FR1-TM2.

6) Measure the power over 1ms

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

7) 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*.

##### 6.3.2.1.5 Test requirements

The ΔP between the power measured in step 4 and step 6 of clause 6.3.2.1.4.2 shall be:

Table 6.3.2.1.5: IAB-MT Output power dynamics test requirements.

|  |  |  |
| --- | --- | --- |
| IAB-MT Type | IAB-MT channel bandwidth | Requirement |
| Wide area | ≤40MHz | 10 log(Maximum RB) -1.2 > ΔP ≥ 10 log(Maximum RB) + 11.2 |
| 40MHz < BW ≤ 100MHz | 10 log(Maximum RB) -1.5 > ΔP ≥ 10 log(Maximum RB) + 11.5 |
| Local area | ≤40MHz | 10 log(Maximum RB) +3.8 > ΔP ≥ 10 log(Maximum RB) + 15.2 |
| 40MHz < BW ≤ 100MHz | 10 log(Maximum RB) +3.5 > ΔP ≥ 10 log(Maximum RB) + 16.5 |

#### 6.3.2.2 Relative power tolerance for local area IAB-MT

##### 6.3.2.2.1 Definition and applicability

The relative power tolerance is the ability of the transmitter to set its output power in a target sub-frame (1 ms) relatively to the power of the most recently transmitted reference sub-frame (1 ms) if the transmission gap between these sub-frames is less than or equal to 20 ms.

##### 6.3.2.2.2 Minimum requirement

The IAB-MT total power dynamic range is defined in TS 38.174 [2], clause 6.3.3.1

##### 6.3.2.2.3 Test purpose

No specific test or test requirements are defined for Relative power tolerance. The Total power dynamic range test, as described in clause 6.3.2.1 provides sufficient test coverage for this requirement.

#### 6.3.2.3 Aggregate power tolerance for local area IAB-MT

##### 6.3.2.3.1 Definition and applicability

The aggregate power control tolerance is the ability of the transmitter to maintain its power in a sub-frame (1 ms) during non-contiguous transmissions within [21 ms] in response to 0 dB commands with respect to the first transmission and all other power control parameters as specified in 3GPP TS 38.213 [12] kept constant.

##### 6.3.2.3.2 Minimum requirement

The IAB-MT Aggregate power tolerance is defined in TS 38.174 [2], clause 6.3.3.2

##### 6.3.2.3.3 Test purpose

No specific test or test requirements are defined for IAB-MT Aggregate power tolerance.

## 6.4 Transmit ON/OFF power

### 6.4.1 Transmitter OFF power

#### 6.4.1.1 Definition and applicability

Transmit OFF power requirements apply to TDD operation of IAB-DU and TDD operation of IAB-MT.

Transmitter OFF power is defined as the mean power measured over 70/N us filtered with a square filter of bandwidth equal to the *transmission bandwidth configuration* of the IAB (BWConfig) centred on the assigned channel frequency during the *transmitter OFF period*. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

For *IAB type 1-H*, for *multi-band connectors* and for *single band connectors* supporting transmission in multiple *operating bands*, the requirement is only applicable during the *transmitter OFF period* in all supported *operating bands*.

For *IAB type 1-H* supporting intra-band contiguous CA, the transmitter OFF power is defined as the mean power measured over 70/N us filtered with a square filter of bandwidth equal to the *aggregated IAB channel bandwidth* BWChannel\_CA centred on (Fedge,high+Fedge,low)/2 during the *transmitter OFF period*. N = SCS/15, where SCS is the smallest supported Sub Carrier Spacing in kHz in the *aggregated IAB channel bandwidth*.

#### 6.4.1.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* is in TS 38.174 [2], clause 6.4.1.3.

For *IAB-MT* is in TS 38.174 [2], clause 6.4.1.4.

#### 6.4.1.3 Test purpose

The purpose of this test is to verify the transmitter OFF power is within the limits of the minimum requirements.

#### 6.4.1.4 Method of test

Requirement is tested together with transmitter transient period, as described in clause 6.4.2.4.

#### 6.4.1.5 Test requirements

The conformance testing of transmit OFF power is included in the conformance testing of transmitter transient period; therefore, see clause 6.4.2.5 for test requirements.

### 6.4.2 Transmitter transient period

#### 6.4.2.1 Definition and applicability

Transmitter transient period requirements apply to TDD operation of IAB-DU and TDD operation of IAB-MT.

The transmitter transient period is the time period during which the transmitter is changing from the transmitter OFF period to the transmitter ON period or vice versa. The transmitter transient period is illustrated in figure 6.4.2.1-1 for IAB-DU and IAB-MT.



Figure 6.4.2.1-1: Example of relations between transmitter ON period, transmitter OFF period and transmitter transient period for IAB-DU and IAB-MT

For IAB type 1-H, this requirement shall be applied at each TAB connector supporting transmission in the operating band.

#### 6.4.2.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* is in TS 38.174 [2], clause 6.4.2.2.

For *IAB-MT* is in TS 38.174 [2], clause 6.4.2.3.

#### 6.4.2.3 Test purpose

The purpose of this test is to verify the transmitter transient periods are within the limits of the minimum requirements.

#### 6.4.2.4 Method of test

##### 6.4.2.4.1 Initial conditions

Test environment:

* normal; see annex B.2.

RF channels to be tested for single carrier:

* M; see clause 4.9.1.

RF bandwidth positions to be tested for multi-carrier and/or CA:

* MRFBW in single-band operation, see clause 4.9.1;
* BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

##### 6.4.2.4.2 Procedure

The minimum requirement is applied to all *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 *IAB type 1-H*. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) Connect *TAB connector* to measurement equipment as shown in annex D.1.1 for *IAB type 1-H*. All *TAB 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.

2) For single carrier set the *TAB connector* under test to transmit according to the applicable test configuration in clause 4.8 using the corresponding test models or set of physical channels in clause 4.9.2 at manufacturers declared *rated carrier output power* per *TAB connector* (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) Measure the mean power spectral density over 70/N μs filtered with a square filter of bandwidth equal to the RF bandwidth of the *TAB connector* centred on the central frequency of the RF bandwidth. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period – 10 μs. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

4) For a *TAB connector* supporting contiguous CA, measure the mean power spectral density over 70/N μs filtered with a square filter of bandwidth equal to the *aggregated IAB channel bandwidth* BWChannel\_CA centred on (Fedge\_high+Fedge\_low)/2. 70/N μs average window centre is set from 35/N μs after end of one transmitter ON period + 10 μs to 35/N μs before start of next transmitter ON period – 10 μs. N = SCS/15, where SCS is the smallest supported Sub Carrier Spacing in kHz in the *aggregated IAB channel bandwidth*.

In addition, for *multi-band connector(s)*, the following steps shall apply:

5) For *multi-band connectors* 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.

#### 6.4.2.5 Test requirements

The measured mean power spectral density according to clause 6.4.2.4.2 shall be less than -83 dBm/MHz for carrier frequency f ≤ 3.0 GHz.

The measured mean power spectral density according to clause 6.4.2.4.2 shall be less than -82.5 dBm/MHz for carrier frequency 3.0 GHz < f ≤ 6.0 GHz.

For *multi-band connector*, the requirement is only applicable during the transmitter OFF period in all supported operating bands.

## 6.5 Transmitted signal quality

### 6.5.1 General

Unless otherwise stated, the requirements in clause 6.5 apply during the *transmitter ON period*.

### 6.5.2 Frequency error

#### 6.5.2.1 IAB-DU frequency error

##### 6.5.2.1.1 Definition and applicability

For IAB-DU, frequency error is the measure of the difference between the actual IAB-DU transmit frequency and the assigned frequency. The same source shall be used for RF frequency and data clock generation.

It is not possible to verify by testing that the data clock is derived from the same frequency source as used for RF generation. This may be confirmed by the manufacturer's declaration.

For *IAB type 1-H* this requirement shall be applied at each *TAB connector* supporting transmission in the *operating band.*

##### 6.5.2.1.2 Minimum Requirement

For IAB-DU, the minimum requirement is in TS 38.174 [2], clause 6.5.1.1.

##### 6.5.2.1.3 Test purpose

The test purpose is to verify that frequency error is within the limit specified by the minimum requirement.

##### 6.5.2.1.4 Method of test

Requirement is tested together with modulation quality test, as described in clause 6.5.3.

##### 6.5.2.1.5 Test Requirements

For IAB-DU, the modulated carrier frequency of each NR carrier configured by the IAB-DU shall be accurate to within the accuracy range given in table 6.5.2.1.5-1 observed over 1 ms.

**Table 6.5.2.1.5-1: Frequency error test requirement for IAB-DU**

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

#### 6.5.2.2 IAB-MT frequency error

##### 6.5.2.2.1 Definition and applicability

For IAB-MT, frequency error is the measure of the difference between actual IAB-MT transmit frequency and the carrier frequency received from the parent node.

For *IAB type 1-H* this requirement shall be applied at each *TAB connector* supporting transmission in the *operating band.*

##### 6.5.2.2.2 Minimum Requirement

For IAB-MT, the minimum requirement is in TS 38.174 [2], clause 6.5.1.2.

##### 6.5.2.2.3 Test purpose

The test purpose is to verify that frequency error is within the limit specified by the minimum requirement.

##### 6.5.2.2.4 Method of test

Requirement is tested together with modulation quality test, as described in clause 6.5.3.

##### 6.5.2.2.5 Test Requirements

For IAB-MT, the mean value of basic measurements of IAB-MT modulated carrier frequency shall be accurate to within the accuracy range given in table 6.6.2.2.5-1 observed over 1 ms cumulated measurement intervals compared to the carrier frequency received from the parent node.

**Table 6.5.2.2.5-1: Frequency error test requirement for IAB-MT**

|  |  |
| --- | --- |
| **IAB-MT frequency range** | **Accuracy** |
| f ≤ 3.0GHz | ±(0.1 ppm + 15 Hz) |
| f > 3.0GHz | ±(0.1 ppm + 36 Hz) |

### 6.5.3 Modulation quality

#### 6.5.3.1 Definition and applicability

Modulation quality is defined by the difference between the measured carrier signal and an ideal signal. Modulation quality can e.g. be expressed as Error Vector Magnitude (EVM). The Error Vector Magnitude is a measure of the difference between the ideal symbols and the measured symbols after the equalization. This difference is called the error vector.

For *IAB type 1-H* this requirement shall be applied at each *TAB connector* supporting transmission in the *operating band.*

#### 6.5.3.2 Minimum Requirement

For IAB-DU, the minimum requirement is in TS 38.174 [2], clause 6.5.2.1.

For IAB-MT, the minimum requirement is in TS 38.174 [2], clause 6.5.2.2.

#### 6.5.3.3 Test purpose

The test purpose is to verify that modulation quality is within the limit specified by the minimum requirement.

#### 6.5.3.4 Method of test

##### 6.5.3.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1.

RF bandwidth positions to be tested for multi-carrier and/or CA:

- BRFBW, MRFBW and TRFBW in single-band operation, see clause 4.9.1;

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

##### 6.5.3.4.2 Procedure for IAB-DU

For IAB-DU, the minimum requirement is applied to all *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 *IAB type 1-H*. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) For a *TAB connector* declared to be capable of single carrier operation only (D.16), set the *TAB connector* under test to transmit a signal according to the applicable test configuration in clause 4.8 using the corresponding test models:

- IAB-DU-FR1-TM3.1a if 256QAM is supported by IAB-DU without power back off, or

- IAB-DU-FR1-TM3.1a at manufacturer's declared rated output power if 256QAM is supported by IAB-DU with power back off, and IAB-DU-FR1-TM3.1 at maximum power, or

- IAB-DU-FR1-TM3.1 if highest modulation order supported by IAB-DU is 64QAM, or

- IAB-DU-FR1-TM3.2 if highest modulation order supported by IAB-DU is 16QAM, or

- IAB-DU-FR1-TM3.3 if highest modulation order supported by IAB-DU is QPSK.

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

- IAB-DU-FR1-TM 3.1a if 256QAM is supported by IAB-DU without power back off, or

- IAB-DU-FR1-TM3.1a at manufacturer's declared rated output power if 256QAM is supported by IAB node with power back off, and IAB-DU-FR1-TM3.1 at maximum power, or

- IAB-DU-FR1-TM3.1 if highest modulation order supported by IAB-DU is 64QAM, or

- IAB-DU-FR1-TM3.2 if highest modulation order supported by IAB-DU is 16QAM, or

- IAB-DU-FR1-TM3.3 if highest modulation order supported by IAB-DU is QPSK.

For IAB-DU-FR1-TM3.1a, power back-off shall be applied if it is declared.

2) Measure the EVM and frequency error as defined in annex H.

3) Repeat steps 1 and 2 for IAB-DU-FR1-TM2 if 256QAM is not supported by IAB-DU or for IAB-DU-FR1-TM2a if 256QAM is supported by IAB-DU. For IAB-DU-FR1-TM2 and IAB-DU-FR1-TM2a the OFDM symbol TX power (OSTP) shall be at the lower limit of the dynamic range according to the test procedure in clause 6.3.3.4 and test requirements in clause 6.3.3.5.

In addition, for *multi-band connector(s)*, the following steps shall apply:

4) For *multi-band connectors* 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.

##### 6.5.3.4.3 Procedure for IAB-MT

For IAB-MT, the minimum requirement is applied to all *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 *IAB type 1-H*. Whichever method is used the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested.

1) For a *TAB connector* declared to be capable of single carrier operation only (D.16), set the *TAB connector* under test to transmit a signal according to the applicable test configuration in clause 4.8 using the corresponding test models:

- IAB-MT-FR1-TM3.1a if 256QAM is supported by IAB-MT without power back off, or

- IAB-MT-FR1-TM3.1a at manufacturer's declared rated output power if 256QAM is supported by IAB-MT with power back off, and IAB-MT-FR1-TM3.1 at maximum power, or

- IAB-MT-FR1-TM3.1 if highest modulation order supported by IAB-MT is 64QAM, or

- IAB-MT-FR1-TM3.2 if highest modulation order supported by IAB-MT is 16QAM, or

- IAB-MT-FR1-TM3.3 if highest modulation order supported by IAB-MT is QPSK.

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

- IAB-MT-FR1-TM3.1a if 256QAM is supported by IAB-MT without power back off, or

- IAB-MT-FR1-TM3.1a at manufacturer's declared rated output power if 256QAM is supported by IAB-MT with power back off, and IAB-MT-FR1-TM3.1 at maximum power, or

- IAB-MT-FR1-TM3.1 if highest modulation order supported by IAB-MT is 64QAM, or

- IAB-MT-FR1-TM3.2 if highest modulation order supported by IAB-MT is 16QAM, or

- IAB-MT-FR1-TM3.3 if highest modulation order supported by IAB-MT is QPSK.

For IAB-MT-FR1-TM3.1a, power back-off shall be applied if it is declared.

2) Measure the EVM and frequency error as defined in annex H.

3) Repeat steps 1 and 2 for IAB-MT-FR1-TM2 if 256QAM is not supported by IAB-MT or for IAB-MT-FR1-TM2a if 256QAM is supported by IAB-MT. For IAB-MT-FR1-TM2 and IAB-MT-FR1-TM2a the OFDM symbol TX power (OSTP) shall be at the lower limit of the dynamic range according to the test procedure in clause 6.3.3.4 and test requirements in clause 6.3.3.5.

In addition, for *multi-band connector(s)*, the following steps shall apply:

4) For *multi-band connectors* 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.

#### 6.5.3.5 Test requirements

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

**Table 6.5.3.5-1: EVM requirements for *IAB type 1-H***

|  |  |
| --- | --- |
| **Modulation scheme for PDSCH or PUSCH** | **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 for IAB-DU or uplink slots for IAB-MT. 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 for IAB-DU or uplink slots for IAB-MT 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 *IAB type 1-H*.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth (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)** |
|  |  |  |  |  |
| 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**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth (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)** |
|  |  |  |  |  |
| 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**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth (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. | | | | |

### 6.5.4 Time alignment error

#### 6.5.4.1 Definition and applicability

For IAB-DU, this requirement applies to frame timing in MIMO transmission, carrier aggregation and their combinations. There’s no time alignment error requirement for IAB-MT.

Frames of the NR signals present at the IAB-DU transmitter *TAB connectors* are not perfectly aligned in time and may experience certain timing differences in relation to each other.

For *IAB type 1-H*, the TAE is defined as the largest timing difference between any two signals belonging to *TAB connectors* belonging to different transmitter groups at the *transceiver array boundary*, where transmitter groups are associated with the *TAB connectors* in the transceiver unit array corresponding to MIMO transmission, *carrier aggregation* for a specific set of signals/transmitter configuration/transmission mode.

#### 6.5.4.2 Minimum requirement

The minimum requirements for *IAB-DU* are in TS 38.174 [2], clause 6.5.3.1.

#### 6.5.4.3 Test purpose

To verify that the time alignment error is within the limit specified by the minimum requirement.

#### 6.5.4.4 Method of test

##### 6.5.4.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

RF bandwidth positions to be tested for multi-carrier and/or CA:

- MRFBW in single-band operation, see clause 4.9.1.

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

##### 6.5.4.4.2 Procedure

For *IAB type 1-H* *TAB connectors* to be tested are identified from the declared sets of *TAB connector beam forming groups* in the TAE groups declaration (D.31).

Compliance is to be demonstrated between all pairs of *single-band connectors and/or multi-band connectors*, however it is not required to exhaustively measure TAE between every combination of pairs of representative connectors. Compliance can be demonstrated by comparison of a reduced set of representative measurement results.

1) Conducted measurement setup:

- For *IAB type 1-H*: Connect two representative *TAB connectors* one from separate TAE group (D.31) to the measurement equipment according to annex D.1.4. Terminate any unused *TAB connector(s).*

2) Set the connectors under test to transmit IAB-DU-FR1-TM 1.1 or any DL signal using MIMO transmission or carrier aggregation.

NOTE: For MIMO transmission, different ports may be configured in IAB-DU-FR1-TM 1.1 (using *PDSCH DMRS ports 1000 and 1001*).

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 using the corresponding test models in clause 4.9.2 at *rated carrier output power* (Prated,c,AC, or Prated,c,TABC, D.21).

If the connector under test supports intra band contiguous or non-contiguous CA, set the representative connectors to transmit using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8.

If the IAB-DU supports inter band CA, set the representative connectors to transmit, for each band, a single carrier or all carriers, using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8.

For a connector declared to be capable of multi-carrier operation (D.15), set the IAB-DU to transmit according to the applicable test signal configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test model in clause 4.9.2 on all carriers configured.

4) Measure the time alignment error between the different PDSCH demodulation reference signals on different antenna ports belonging to different connectorson the carrier(s) from the representative connectors under test.

5) Repeat step 1 - 4 for any other configuration of connectors, which could be required to demonstrate compliance.

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*.

#### 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.

## 6.6 Unwanted emissions

### 6.6.1 General

Unwanted emissions consist of out-of-band emissions and spurious emissions according to ITU definitions in recommendation ITU-R SM.329 [5]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.

The out-of-band emissions requirement for the IAB-DU and IAB-MT transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and *operating band* unwanted emissions (OBUE).

The maximum offset of the *operating band* unwanted emissions mask from the *operating band* edge is ΔfOBUE. The Operating band unwanted emissions define all unwanted emissions in each supported downlink *operating band* of IAB-DU and uplink *operating band* of IAB-MT, plus the frequency ranges ΔfOBUE above and ΔfOBUE below each band. Unwanted emissions outside of this frequency range are limited by a spurious emissions requirement.

The values of ΔfOBUE are defined in tables 6.6.1-1 and 6.6.1-2 for the NR *operating bands*.

Table 6.6.1-1: Maximum offset of OBUE outside the downlink *operating band* of *IAB-DU*

|  |  |  |
| --- | --- | --- |
| IAB-DU type | *Operating band* characteristics | ΔfOBUE (MHz) |
| *IAB type 1-H* | FDL,high – FDL,low < 100 MHz | 10 |
|  | 100 MHz ≤ FDL,high – FDL,low ≤ 900 MHz | 40 |

Table 6.6.1-2: Maximum offset of OBUE outside the uplink *operating band* of *IAB-MT*

|  |  |  |
| --- | --- | --- |
| IAB-MT type | *Operating band* characteristics | ΔfOBUE (MHz) |
| *IAB type 1-H* | FUL,high – FUL,low < 100 MHz | 10 |
|  | 100 MHz ≤ FUL,high – FUL,low ≤ 900 MHz | 40 |

For *IAB type 1-H* the unwanted emission requirements are applied per the *TAB connector TX min cell groups* for all the supported configurations. The *basic limits* and corresponding emissions scaling are defined in each relevant clause.

There is in addition a requirement for occupied bandwidth.

### 6.6.2 Occupied bandwidth

#### 6.6.2.1 General

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage /2 of the total mean transmitted power. See also Recommendation ITU-R SM.328 [6].

The value of /2 shall be taken as 0.5%.

The occupied bandwidth requirement shall apply during the *transmitter ON period* for a single transmitted carrier. The minimum requirement below may be applied regionally. There may also be regional requirements to declare the occupied bandwidth according to the definition in the present clause.

For *IAB type 1-H* this requirement shall be applied at each *TAB connector* supporting transmission in the *operating band.*

#### 6.6.2.2 Minimum Requirements

The minimum requirement for *IAB type 1-H* is in TS 38.174 [2] clause 6.6.2

#### 6.6.2.3 Test purpose

The test purpose is to verify that the emission at the *TAB connector* does not occupy an excessive bandwidth for the service to be provided and is, therefore, not likely to create interference to other users of the spectrum beyond undue limits.

#### 6.6.2.4 Method of test

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

1) Connect the measurement device to *TAB connector* as shown in annex D.1.1 for *IAB type 1-H*.

2) For a IAB 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 IAB-FR1-TM1.1 at manufacturer's declared rated output power (Prated,c,TABC, D.21).

For an IAB declared to be capable of contiguous CA operation, set the IAB to transmit according to IAB-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.

##### 6.6.2.4.2 Procedure

1) Measure the spectrum emission of the transmitted signal using at least the number of measurement points, and across a span, as listed in table 6.6.2.4.2-1. The selected resolution bandwidth (RBW) filter of the analyser shall be 30 kHz or less.

Table 6.6.2.4.2-1: Span and number of measurement points for OBW measurements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bandwidth | *IAB-DU channel bandwidth* or *IAB-MT channel bandwidth*  BWChannel (MHz) | | | | *Aggregated IAB channel bandwidth* BWChannel\_CA（MHz） |
|  | 10 | 15 | 20 | > 20 | > 20 |
| Span (MHz) | 20 | 30 | 40 |  |  |
| Minimum number of measurement points | 400 | 400 | 400 |  |  |

NOTE: The detection mode of the spectrum analyzer will not have any effect on the result if the statistical properties of the out-of-OBW power are the same as those of the inside-OBW power. Both are expected to have the Rayleigh distribution of the amplitude of Gaussian noise. In any case where the statistics are not the same, though, the detection mode must be power responding. The analyser may be set to respond to the average of the power (root-mean-square of the voltage) across the measurement cell.

2) Compute the total of the power, P0, (in power units, not decibel units) of all the measurement cells in the measurement span. Compute P1, the power outside the occupied bandwidth on each side. P1 is half of the total power outside the bandwidth. P1 is half of (100 % - (occupied percentage)) of P0. For the occupied percentage of 99 %, P1 is 0.005 times P0.

3) Determine the lowest frequency, f1, for which the sum of all power in the measurement cells from the beginning of the span to f1 exceeds P1.

4) Determine the highest frequency, f2, for which the sum of all power in the measurement cells from f2 to the end of the span exceeds P1.

5) Compute the occupied bandwidth as f2 - f1.

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

6) For multi-band capable IAB and single band tests, repeat the steps above per involved band where single carrier test models shall apply, with no carrier activated in the other band. In addition, when contiguous CA is supported, single band test configurations and test models shall apply with no carrier activated in the other band.

#### 6.6.2.5 Test requirements

The occupied bandwidth for each carrier shall be less than the channel bandwidth as defined in TS 38.174 [2], table 5.3.5-1. For contiguous CA, the occupied bandwidth shall be less than or equal to the *aggregated IAB channel bandwidth* as defined in TS 38.174 [2], clause 5.3A.

### 6.6.3 Adjacent Channel Leakage Power Ratio

#### 6.6.3.1 General

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 *IAB-DU RF Bandwidth, IAB-MT 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.

For an IAB- node 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 6.6.3.2-3, 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 6.6.3.2-3, 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 shall apply during the *transmitter ON period*.

#### 6.6.3.2 Minimum requirement

The minimum requirement applies per *single-band connector*, or per *multi-band connector* supporting transmission in the *operating band*.

The minimum requirement for *IAB type 1-H* is defined in TS 38.174 [2], clause 6.6.3.

#### 6.6.3.3 Test purpose

To verify that the adjacent channel leakage power ratio requirement shall be met as specified by the minimum requirement.

#### 6.6.3.4 Method of test

##### 6.6.3.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1.

*IAB RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- BRFBW, MRFBW and TRFBW in single-band operation; see clause 4.9.1.

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

##### 6.6.3.4.2 Procedure

For *IAB 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. 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 *IAB 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 IAB-FR1‑TM1.1 in clause 4.9.2 at *rated carrier output power* Prated,c,TABC for IAB 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.

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 IAB-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*.

#### 6.6.3.5 Test requirements

##### 6.6.3.5.1 General requirements

The ACLR requirements in clause 6.6.3.5.2 shall apply as described in clauses 6.6.3.5.3 or 6.6.3.5.4.

##### 6.6.3.5.2 Limits and *basic limits*

The ACLR is defined with a square filter of bandwidth equal to the transmission bandwidth configuration of the transmitted signal (BWConfig) centred on the assigned channel frequency and a filter centred on the adjacent channel frequency according to the tables below.

For operation in paired and unpaired spectrum, the ACLR shall be higher than the value specified in table 6.6.3.5.2‑1.

Table 6.6.3.5.2-1: IAB type 1-H ACLR limit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* and *IAB-MT channel bandwidth* of lowest/highest carrier transmitted BWChannel (MHz) | IAB-DU and IAB-MT adjacent channel centre frequency offset below the lowest or above the highest carrier centre frequency transmitted | Assumed adjacent channel carrier (informative) | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
| 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90,100 | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB |
|  | 2 x BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB |
|  | BWChannel /2 + 2.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 45 dB (Note 3) |
|  | BWChannel /2 + 7.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 45 dB (Note 3) |
| NOTE 1: BWChannel and BWConfig are the *IAB-DU channel bandwidth and IAB-MT channel bandwidth* and *transmission bandwidth configuration* of the *lowest/highest carrier* transmitted on the assigned channel frequency.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: The requirements are applicable when the band is also defined for E-UTRA or UTRA. | | | | |

The ACLR absolute *basic limit* is specified in table 6.6.3.5.2‑2.

Table 6.6.3.5.2-2: *IAB type 1-H* ACLR absolute basic limit

|  |  |
| --- | --- |
| IAB-DU and IAB-MT category / class | ACLR absolute *basic limit* |
| Category A Wide Area IAB-DU and Category A Wide Area IAB-MT | -13 dBm/MHz |
| Category B Wide Area IAB-DU and Category B Wide Area IAB-MT | -15 dBm/MHz |
| Medium Range IAB-DU | -25 dBm/MHz |
| Local Area IAB-DU and  Local Area IAB-MT | -32 dBm/MHz |

For operation in non-contiguous spectrum or multiple bands, the ACLR shall be higher than the value specified in Table 6.6.3.5.2‑3.

Table 6.6.3.5.2-3: *IAB type 1-H* ACLR limit in non-contiguous spectrum or multiple bands

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* and *IAB-MT channel bandwidth* of lowest/highest carrier transmitted BWChannel (MHz) | Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies (MHz) | IAB-DU and IAB-MT adjacent channel centre frequency offset below or above the sub-block or *IAB RF Bandwidth edge* (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
| 10, 15, 20 | Wgap ≥ 15 (Note 3)  Wgap ≥ 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
|  | Wgap ≥ 20 (Note 3)  Wgap ≥ 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | Wgap ≥ 60 (Note 4)  Wgap ≥ 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
|  | Wgap ≥ 80 (Note 4)  Wgap ≥ 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| NOTE 1: BWConfig is the transmission bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable in case the *IAB-DU channel bandwidth* or *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 10, 15, 20 MHz.  NOTE 4: Applicable in case the *IAB-DU channel bandwidth* or *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz. | | | | | |

The Cumulative Adjacent Channel Leakage power Ratio (CACLR) in a *sub-block gap* or the *Inter RF Bandwidth gap* is the ratio of:

a) the sum of the filtered mean power centred on the assigned channel frequencies for the two carriers adjacent to each side of the *sub-block gap* or the *Inter RF Bandwidth gap*, and

b) the filtered mean power centred on a frequency channel adjacent to one of the respective *sub-block* edges or *IAB RF Bandwidth edges*.

The assumed filter for the adjacent channel frequency is defined in table 6.6.3.2-4 and the filters on the assigned channels are defined in table 6.6.3.2-6.

For operation in *non-contiguous spectrum* or multiple bands, the CACLR for NR carriers located on either side of the *sub-block gap* or the *Inter RF Bandwidth gap* shall be higher than the value specified in table 6.6.3.2-4.

Table 6.6.3.5.2-4: *IAB type 1-H* CACLR limit

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* and *IAB-MT channel* bandwidth of lowest/highest carrier transmitted BWChannel (MHz) | Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies (MHz) | IAB-DU and IAB-MT adjacent channel centre frequency offset below or above the sub-block or  *IAB RF Bandwidth edge* (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | CACLR limit |
| 10, 15, 20 | 5 ≤Wgap< 15 (Note 3)  5 ≤Wgap< 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
|  | 10 < Wgap< 20 (Note 3)  10 ≤Wgap< 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 25, 30, 40, 50, 60, 70, 80,90, 100 | 20 ≤Wgap< 60 (Note 4)  20 ≤Wgap< 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
|  | 40 < Wgap< 80 (Note 4)  40 ≤Wgap< 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| NOTE 1: BWConfig is the transmission bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable in case the *IAB-DU* *channel bandwidth* or *IAB-MT* *channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 10, 15, 20 MHz.  NOTE 4: Applicable in case the *IAB-DU* *channel bandwidth* or *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz. | | | | | |

The CACLR absolute *basic limit* is specified in table 6.6.3.2‑5.

Table 6.6.3.2-5: *IAB type 1-H* CACLR absolute *basic limit*

|  |  |
| --- | --- |
| IAB-DU and IAB-MT category / class | CACLR absolute *basic limit* |
| Category A Wide Area IAB-DU and Category A Wide Area IAB-MT | -13 dBm/MHz |
| Category B Wide Area IAB-DU and Category B Wide Area IAB-MT | -15 dBm/MHz |
| Medium Range IAB-DU | -25 dBm/MHz |
| Local Area IAB-DU and Local Area IAB-MT | -32 dBm/MHz |

Table 6.6.3.5.2-6: Filter parameters for the assigned channel

|  |  |
| --- | --- |
| RAT of the carrier adjacent to the *sub-block* or *Inter RF Bandwidth gap* | Filter on the assigned channel frequency and corresponding filter bandwidth |
| NR | NR of same BW with SCS that provides largest *transmission bandwidth configuration* |

##### 6.6.3.5.3 *IAB type 1-H*

The ACLR absolute *basic limits* in table 6.6.3.5.2-2+ X (where X = 10log10(NTXU,countedpercell)) or the ACLR *limits* in table 6.6.3.5.2-1, or 6.6.3.5.2-3, whichever is less stringent, shall apply for each *TAB connector TX min cell group*.

The CACLR absolute *basic limits* in table 6.6.3.5.2-5 + X, (where X = 10log10(NTXU,countedpercell)) or the CACLR *limits* in table 6.6.3.5.2-4, whichever is less stringent, shall apply for each *TAB connector TX min cell group*.

Conformance to the *IAB type 1-H* ACLR (CACLR) limit can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer

1) The ratio of the sum of the filtered mean power measured on each *TAB connector* in the *TAB connector TX min cell group* at the assigned channel frequency to the sum of the filtered mean power measured on each *TAB connector* in the *TAB connector TX min cell group* at the adjacent channel frequency shall be greater than or equal to the ACLR (CACLR) limit of the IAB-MT or IAB-DU. This shall apply for each *TAB connector TX min cell group*.

Or

2) The ratio of the filtered mean power at the *TAB connector* centred on the assigned channel frequency to the filtered mean power at this *TAB connector* centred on the adjacent channel frequency shall be greater than or equal to the ACLR (CACLR) limit of the IAB-MT or IAB-DU for every *TAB connector* in the *TAB connector TX min cell group*, for each *TAB connector TX min cell group*.

In case the ACLR (CACLR) absolute *basic limit* of *IAB type 1-H* are applied, the conformance can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The sum of the filtered mean power measured on each *TAB connector* in the *TAB connector TX min cell group* at the adjacent channel frequency shall be less than or equal to the ACLR (CACLR) absolute ba*sic limit* + X (where X = 10log10(NTXU,countedpercell)) of the IAB-MT or IAB-DU. This shall apply to each *TAB* connector *TX min cell group.*

Or

2) The filtered mean power at each *TAB connector* centred on the adjacent channel frequency shall be less than or equal to the ACLR (CACLR) absolute *basic limit* of the IAB-MT or IAB-DU scaled by X -10log10(*n*) for every *TAB connector* in the *TAB connector TX min cell group*, for each *TAB connector TX min cell group*, where *n* is the number of *TAB connectors* in the *TAB connector TX min cell group.*

### 6.6.4 Operating band unwanted emissions

#### 6.6.4.1 Definition and applicability

Unless otherwise stated, the operating band unwanted emission (OBUE) limits for IAB-DU 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*.

Unless otherwise stated, the operating band unwanted emission (OBUE) limits for IAB-MT in FR1 are defined from ΔfOBUE below the lowest frequency of each supported uplink *operating band* up to ΔfOBUE above the highest frequency of each supported uplink *operating band*. The values of ΔfOBUE are defined in table 6.6.1‑2 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 IAB-DU and IAB-MT operating in *non-contiguous spectrum*, the requirements apply inside any *sub-block gap*. In addition, for a IAB-MT or IAB-DU operating in multiple bands, the requirements apply inside any *Inter RF Bandwidth gap*.

*Basic limits* are specified in the tables below, where:

- Δf is the separation between the *channel edge* frequency and the nominal -3dB 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* of IAB-DU and uplink *operating band* of IAB-MT, where ΔfOBUE is defined in tables 6.6.1-1 and 6.6.1-2.

- 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 *IAB RF Bandwidth edges* on each side of the *Inter RF Bandwidth gap*. The *basic limit* for *IAB RF Bandwidth edge* is specified in clauses 6.6.4.2.1 to 6.6.4.2.4 below, where in this case:

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

- f\_offset is the separation from the *IAB RF Bandwidth edge* frequency to 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* of IAB-DU, the operating band unwanted emission limits apply also in a supported downlink *operating band* without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported downlink *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 limits* 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 *multi-band connector* of IAB-MT, the operating band unwanted emission limits apply also in a supported uplink *operating band* without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported uplink *operating band*. In this case, no cumulative *basic limit* is applied in the *inter-band gap* between a supported uplink *operating band* with carrier(s) transmitted and a supported uplink *operating band* without any carrier transmitted and

- In case the inter-band gap between a supported uplink operating band with carrier(s) transmitted and a supported uplink 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 uplink operating bands and the operating band unwanted emission basic limits of the band where there are carriers transmitted, as defined in the tables of the present clause, shall apply across both uplink 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 uplink 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 clauses 6.6.4.2.1 to 6.6.4.2.4 below, 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 IAB-DU and Wide Area IAB-MT, the requirements of either clause 6.6.4.2.1 (Category A limits) or clause 6.6.4.2.2 (Category B limits) shall apply.

For Medium Range IAB-DU, the requirements in clause 6.6.4.2.3 shall apply (Category A and B).

For Local Area IAB-DU and Local Area IAB-MT, the requirements of clause 6.6.4.2.4 shall apply (Category A and B).

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.

#### 6.6.4.2 Minimum requirement

The minimum requirement applies per single-band connector, or per multi-band connector supporting transmission in the operating band.

The minimum requirement for *IAB type 1-H* are defined in TS 38.174 [2], clause 6.6.4.2.

#### 6.6.4.3 Test purpose

This test measures the emissions close to the assigned channel bandwidth of the wanted signal, while the transmitter is in operation.

#### 6.6.4.4 Method of test

##### 6.6.4.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1.

*IAB RF Bandwidth* positions to be tested for multi-carrier:

- BRFBW, MRFBW and TRFBW in single-band operation; see clause 4.9.1.

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

##### 6.6.4.4.2 Procedure

For *IAB 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. 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 *IAB 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,TABC (D.21). Channel set-up shall be according to IAB-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.

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 IAB-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*.

#### 6.6.4.5 Test requirements

##### 6.6.4.5.1 General requirements

##### 6.6.4.5.2 Basic limits for Wide Area IAB-DU and IAB-MT (Category A)

Table 6.6.4.2.1-1: Wide Area IAB-DU and Wide Area IAB-MT *operating band* unwanted emission limits   
(NR bands above 1 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -13 dBm (Note 3) | 1MHz |
| NOTE 1: For an IAB-DU and IAB-MT supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*, where the contribution from the far-end *sub-block* shall be scaled according to the *measurement bandwidth* of the near-end *sub-block*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be ‑13 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*, where the contribution from the far-end *sub-block* or RF Bandwidth shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

##### 6.6.4.5.3 Basic limits for Wide Area IAB-DU and Wide Area IAB-MT (Category B)

For Category B Operating band unwanted emissions, the *basic limits* in clause 6.6.4.5.3.1 shall be applied.

###### 6.6.4.5.3.1 Category B requirements

For IAB-DU and IAB-MT operating in Bands n41, n77, n78, n79 *basic limits* are specified in tables 6.6.4.5.3.1-1:

Table 6.6.4.5.3.1-1: Wide Area IAB-DU and IAB-MT operating band unwanted emission limits   
for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -15 dBm (Note 3) | 1MHz |
| NOTE 1: For an IAB-DU and IAB-MT supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*, where the contribution from the far-end *sub-block* shall be scaled according to the *measurement bandwidth* of the near-end *sub-block*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*, where the contribution from the far-end *sub-block* or RF Bandwidth shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

##### 6.6.4.5.4 *Basic limits* for Medium Range IAB-DU (Category A and B)

For Medium Range IAB-DU, *basic limits* are specified in table 6.6.4.5.4-1 and table 6.6.4.5.4-2.

For the tables in this clause for *IAB type 1-H* Prated,x = Prated,c,cell – 10\*log10(NTXU,countedpercell),

Table 6.6.4.5.4-1: Medium Range IAB-DU *operating band* unwanted emission limits, 31< Prated,x ≤ 38 dBm

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | Prated,x - 60dB | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | Min(Prated,x - 60dB, -25dBm) (Note 3) | 100 kHz |
| NOTE 1: For an IAB-DU supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be Min(Prated,x -60dB, ‑25dBm)/100kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.6.4.5.4-2: Medium Range IAB-DU operating band unwanted emission limits, Prated,x ≤ 31 dBm

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -29 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -29 dBm (Note 3) | 100 kHz |
| NOTE 1: For an IAB-DU supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be -29dBm/100kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

##### 6.6.4.5.5 *Basic limits* for Local Area IAB-DU and Local Area IAB-MT (Category A and B)

For Local Area IAB-DU and Local Area IAB-MT, *basic limits* are specified in table 6.6.4.5.4-1.

Table 6.6.4.5.4-1: Local Area IAB-DU and Local Area IAB-MT operating band unwanted emission limits

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -37 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -37 dBm (Note 10) | 100 kHz |
| NOTE 1: For an IAB-DU and IAB-MT supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be -37dBm/100kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

##### 6.6.4.5.5 *Basic limits* for additional requirements

###### 6.6.4.5.5.1 Limits in FCC Title 47

In addition to the requirements in clauses 6.6.4.2.1, 6.6.4.2.2, 6.6.4.2.3 and 6.6.4.2.4, the IAB-DU and IAB-MT may have to comply with the applicable emission limits established by FCC Title 47 [7], when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer.

##### 6.6.4.5.6 *IAB type 1-H*

The operating band unwanted emissions requirements for *IAB type 1-H* are that for each *TAB connector TX min cell group* and each applicable *basic limit* in clause 6.6.4.2, the power summation emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed a limit specified as the *basic limit* + X, where X = 10log10(NTXU,countedpercell).

NOTE: Conformance to the *IAB type 1-H* operating band unwanted emission requirement can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The sum of the emissions power measured on each *TAB connector* in the *TAB connector TX min cell group* shall be less than or equal to the limit as defined in this clause for the respective frequency span.

Or

2) The unwanted emissions power at each *TAB connector* shall be less than or equal to the *type 1-H* limit as defined in this clause for the respective frequency span, scaled by -10log10(n), where n is the number of *TAB connectors* in the *TAB connector TX min cell group*.

### 6.6.5 Transmitter spurious emissions

#### 6.6.5.1 Definition and applicability

For IAB-DU, 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 6.6.1-1. 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 IAB-MT, 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 uplink *operating band*, up to ΔfOBUE above the highest frequency of each supported uplink *operating band*, where the ΔfOBUE is defined in table 6.6.1-2. For some *operating bands*, the upper limit is higher than 12.75 GHz in order to comply with the 5th harmonic limit of the uplink *operating band*, as specified in ITU-R recommendation SM.329 [5].

For a *multi-band connector*, for 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.

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

#### 6.6.5.2 Minimum requirement

The minimum requirement applies per *single-band connector*, or per *multi-band connector* supporting transmission in the *operating band*.

The minimum requirement for *IAB type 1-H*  are defined in TS 38.174 [2], clause 6.6.5.

#### 6.6.5.3 Test purpose

This test measures conducted spurious emissions while the transmitter is in operation.

#### 6.6.5.4 Method of test

##### 6.6.5.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier:

- B when testing the spurious emissions below FDL\_low - ΔfOBUE,

- T when testing the spurious emissions above FDL\_high + ΔfOBUE; see clause 4.9.1.

*IAB RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- BRFBW when testing the spurious frequencies below FDL\_low - ΔfOBUE; TRFBW when testing the spurious frequencies above FDL\_high + ΔfOBUE in single-band operation; see clause 4.9.1.

- BRFBW\_T'RFBW when testing the spurious frequencies below FDL\_low - ΔfOBUE of the lowest operating band; B'RFBW\_TRFBW when testing the spurious frequencies above FDL\_high + ΔfOBUE of the highest operating band in multi-band operation, see clause 4.9.1.

##### 6.6.5.4.2 Procedure

For *IAB 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.13.1. 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. 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 IAB-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.

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*.

#### 6.6.5.5 Test requirements

##### 6.6.5.5.1 Basic limits

###### 6.6.5.5.1.1 Tx spurious emissions

The *basic limits* of either table 6.6.5.2.1-1 (Category A limits) or table 6.6.5.2.1-2 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for operating band unwanted emissions in clause 6.6.4.

Table 6.6.5.2.1-1: General IAB-DU and IAB-MT transmitter spurious emission limits in FR1, Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | *Basic limit* | *Measurement bandwidth* | Notes |
| 9 kHz – 150 kHz | -13 dBm | 1 kHz | Note 1, Note 4 |
| 150 kHz – 30 MHz |  | 10 kHz | Note 1, Note 4 |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz 12.75 GHz |  | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz |  | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: For IAB-DU, this spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the DL *operating band* is reaching beyond 12.75 GHz. For IAB-MT, this spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the UL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: This spurious frequency range applies only to *IAB type 1-H*. | | | |

Table 6.6.5.2.1-2: General IAB-DU and IAB-MT transmitter spurious emission limits in FR1, Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | *Basic limit* | *Measurement bandwidth* | Notes |
| 9 kHz – 150 kHz | -36 dBm | 1 kHz | Note 1, Note 4 |
| 150 kHz – 30 MHz |  | 10 kHz | Note 1, Note 4 |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz | -30 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz |  | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: For IAB-DU, this spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the DL *operating band* is reaching beyond 12.75 GHz. For IAB-MT, this spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the UL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: This spurious frequency range applies only to *IAB type 1-H*. | | | |

##### 6.6.5.2.2 Additional spurious emissions requirements

These requirements may be applied for the protection of system operating in other frequency ranges. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the IAB-node, or they may be set by local or regional regulation as a mandatory requirement for an NR *operating band*. It is in some cases not stated in the present document whether a requirement is mandatory or under what exact circumstances that a limit applies, since this is set by local or regional regulation. An overview of regional requirements in the present document is given in clause 4.5.

Some requirements may apply for the protection of specific equipment (UE, MS and/or BS) or equipment operating in specific systems (GSM, CDMA, UTRA, E-UTRA, NR, etc.) as listed below.

The spurious emission *basic limits* are provided in table 6.6.5.2.2-1 where requirements for co-existence with the system listed in the first column apply for IAB-MT and IAB-DU. For a *multi-band connector*, the exclusions and conditions in the Note column of table 6.6.5.2.2-1 apply for each supported *operating band*.

Table 6.6.5.2.2-1: IAB-DU and IAB-MT spurious emissions *basic* *limits* for co-existence with systems operating in other frequency bands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System type to co-exist with | Frequency range for co-existence requirement | *Basic limits* | *Measurement bandwidth* | Note |
| GSM900 | 921 – 960 MHz | -57 dBm | 100 kHz |  |
|  | 876 – 915 MHz | -61 dBm | 100 kHz |  |
| DCS1800 | 1805 – 1880 MHz | -47 dBm | 100 kHz |  |
|  | 1710 – 1785 MHz | -61 dBm | 100 kHz |  |
| PCS1900 | 1930 – 1990 MHz | -47 dBm | 100 kHz |  |
|  | 1850 – 1910 MHz | -61 dBm | 100 kHz |  |
| GSM850 or | 869 – 894 MHz | -57 dBm | 100 kHz |  |
| CDMA850 | 824 – 849 MHz | -61 dBm | 100 kHz |  |
| UTRA FDD | 2110 – 2170 MHz | -52 dBm | 1 MHz |  |
| Band I or  E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD | 1930 – 1990 MHz | -52 dBm | 1 MHz |  |
| Band II or  E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD | 1805 – 1880 MHz | -52 dBm | 1 MHz |  |
| Band III or  E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band IV or  E-UTRA Band 4 | 2110 – 2155 MHz | -52 dBm | 1 MHz |  |
|  | 1710 – 1755 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band V or  E-UTRA Band 5 or NR Band n5 | 869 – 894 MHz | -52 dBm | 1 MHz |  |
|  | 824 – 849 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD | 860 – 890 MHz | -52 dBm | 1 MHz |  |
| Band VI, XIX or | 815 – 830 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 6, 18, 19 or NR Band n18 | 830 – 845 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band VII or  E-UTRA Band 7 or NR Band n7 | 2620 – 2690 MHz | -52 dBm | 1 MHz |  |
|  | 2500 – 2570 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band VIII or  E-UTRA Band 8 or NR Band n8 | 925 – 960 MHz | -52 dBm | 1 MHz |  |
|  | 880 – 915 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band IX or  E-UTRA Band 9 | 1844.9 – 1879.9 MHz | -52 dBm | 1 MHz |  |
|  | 1749.9 – 1784.9 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band X or  E-UTRA Band 10 | 2110 – 2170 MHz | -52 dBm | 1 MHz |  |
|  | 1710 – 1770 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XI or XXI or  E-UTRA Band 11 or 21 | 1475.9 – 1510.9 MHz | -52 dBm | 1 MHz |  |
|  | 1427.9 – 1447.9 MHz | -49 dBm | 1 MHz |  |
|  | 1447.9 – 1462.9 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 729 – 746 MHz | -52 dBm | 1 MHz |  |
|  | 699 – 716 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 746 – 756 MHz | -52 dBm | 1 MHz |  |
|  | 777 – 787 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XIV or  E-UTRA Band 14 or NR band n14 | 758 – 768 MHz | -52 dBm | 1 MHz |  |
|  | 788 – 798 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 17 | 734 – 746 MHz | -52 dBm | 1 MHz |  |
|  | 704 – 716 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 791 – 821 MHz | -52 dBm | 1 MHz |  |
|  | 832 – 862 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3510 – 3590 MHz | -52 dBm | 1 MHz | This requirement does not apply to IAB-DU and IAB-MT operating in band n77 or n78. |
|  | 3410 – 3490 MHz | -49 dBm | 1 MHz | This requirement does not apply to IAB-DU and IAB-MT operating in band n77 or n78. |
| E-UTRA Band 24 | 1525 – 1559 MHz | -52 dBm | 1 MHz |  |
|  | 1626.5 – 1660.5 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR band n25 | 1930 – 1995 MHz | -52 dBm | 1 MHz |  |
|  | 1850 – 1915 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XXVI or  E-UTRA Band 26 or NR Band n26 | 859 – 894 MHz | -52 dBm | 1 MHz |  |
|  | 814 – 849 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 27 | 852 – 869 MHz | -52 dBm | 1 MHz |  |
|  | 807 – 824 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 28 or NR Band n28 | 758 – 803 MHz | -52 dBm | 1 MHz |  |
|  | 703 – 748 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 29 or NR Band n29 | 717 – 728 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 30 or NR Band n30 | 2350 – 2360 MHz | -52 dBm | 1 MHz |  |
|  | 2305 – 2315 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 31 | 462.5 – 467.5 MHz | -52 dBm | 1 MHz |  |
|  | 452.5 – 457.5 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD band XXXII or E-UTRA band 32 | 1452 – 1496 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 41 or NR Band n41, n90 | 2496 – 2690 MHz | -52 dBm | 1 MHz | This is not applicable IAB-DU and IAB-MT operating in Band n41. |
| E-UTRA Band 42 | 3400 – 3600 MHz | -52 dBm | 1 MHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78. |
| E-UTRA Band 43 | 3600 – 3800 MHz | -52 dBm | 1 MHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78. |
| E-UTRA Band 44 | 703 – 803 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 45 | 1447 – 1467 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 46 | 5150 – 5925 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 47 | 5855 – 5925 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 48 or NR Band n48 | 3550 – 3700 MHz | -52 dBm | 1 MHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78. |
| E-UTRA Band 50 or NR band n50 | 1432 – 1517 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 53 or NR Band n53 | 2483.5 - 2495 MHz | -52 dBm | 1 MHz | This is not applicable to IAB-DU and IAB-MT operating in Band n41. |
| E-UTRA Band 65 or NR Band n65 | 2110 – 2200 MHz | -52 dBm | 1 MHz |  |
|  | 1920 – 2010 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 66 or NR Band n66 | 2110 – 2200 MHz | -52 dBm | 1 MHz |  |
|  | 1710 – 1780 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 67 | 738 – 758 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 68 | 753 -783 MHz | -52 dBm | 1 MHz |  |
|  | 698-728 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 69 | 2570 – 2620 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 70 or NR Band n70 | 1995 – 2020 MHz | -52 dBm | 1 MHz |  |
|  | 1695 – 1710 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 71 or NR Band n71 | 617 – 652 MHz | -52 dBm | 1 MHz |  |
|  | 663 – 698 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 72 | 461 – 466 MHz | -52 dBm | 1 MHz |  |
|  | 451 – 456 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 74 or NR Band n74 | 1475 – 1518 MHz | -52 dBm | 1 MHz |  |
|  | 1427 – 1470 MHz | -49 dBm | 1MHz |  |
| E-UTRA Band 75 or NR Band n75 | 1432 – 1517 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 76 or NR Band n76 | 1427 – 1432 MHz | -52 dBm | 1 MHz |  |
| NR Band n77 | 3.3 – 4.2 GHz | -52 dBm | 1 MHz | This requirement does not apply to IAB-DU and IAB-MT operating in Band n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -52 dBm | 1 MHz | This requirement does not apply to IAB-DU and IAB-MT operating in Band n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -52 dBm | 1 MHz | This requirement does not apply to IAB-DU and IAB-MT operating in Band n79 |
| NR Band n80 | 1710 – 1785 MHz | -49 dBm | 1 MHz |  |
| NR Band n81 | 880 – 915 MHz | -49 dBm | 1 MHz |  |
| NR Band n82 | 832 – 862 MHz | -49 dBm | 1 MHz |  |
| NR Band n83 | 703 – 748 MHz | -49 dBm | 1 MHz |  |
| NR Band n84 | 1920 – 1980 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 85 | 728 – 746 MHz | -52 dBm | 1 MHz |  |
|  | 698 – 716 MHz | -49 dBm | 1 MHz |  |
| NR Band n86 | 1710 – 1780 MHz | -49 dBm | 1 MHz |  |
| NR Band n89 | 824 – 849 MHz | -49 dBm | 1 MHz |  |
| NR Band n91 | 1427 – 1432 MHz | -52 dBm | 1 MHz |  |
|  | 832 – 862 MHz | -49 dBm | 1 MHz |  |
| NR Band n92 | 1432 – 1517 MHz | -52 dBm | 1 MHz |  |
|  | 832 – 862 MHz | -49 dBm | 1 MHz |  |
| NR Band n93 | 1427 – 1432 MHz | -52 dBm | 1 MHz |  |
|  | 880 – 915 MHz | -49 dBm | 1 MHz |  |
| NR Band n94 | 1432 – 1517 MHz | -52 dBm | 1 MHz |  |
|  | 880 – 915 MHz | -49 dBm | 1 MHz |  |
| NR Band n95 | 2010 – 2025 MHz | -52 dBm | 1 MHz |  |

NOTE 1: As defined in the scope for spurious emissions in this clause the co-existence requirements in table 6.6.5.2.2-1 do not apply for the ΔfOBUE frequency range immediately outside the downlink *operating band* (see table 5.2-1). Emission limits for this excluded frequency range may be covered by local or regional requirements.

NOTE 2: Table 6.6.5.2.2-1 assumes that two *operating bands*, where the frequency ranges in table 5.2-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

##### 6.6.5.2.3 Co-location with base stations and IAB-nodes

These requirements may be applied for the protection of other BS, IAB-DU or IAB-MT receivers when GSM900, DCS1800, PCS1900, GSM850, CDMA850, UTRA FDD, UTRA TDD, E-UTRA, NR BS, IAB-DU or IAB-MT are co-located with IAB-MT and/or IAB-DU.

The requirements assume a 30 dB coupling loss between transmitter and receiver and are based on co-location with same class.

The *basic limits* are in table 6.6.5.2.3-1 for an IAB-DU and IAB-MT. Requirements for co-location with a system listed in the first column apply, depending on the declared IAB-DU and IAB-MT class. For a *multi-band connector*, the exclusions and conditions in the Note column of table 6.6.5.2.3-1 shall apply for each supported *operating band*.

Table 6.6.5.2.3-1: IAB-DU and IAB-MT spurious emissions *basic* limits for co-location with BS or IAB-node

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Co-located system | Frequency range for | *Basic limits* | | | Measurement | Note |
|  | co-location requirement | WA IAB-DU and WA IAB-MT | MR IAB-DU | LA IAB-DU and LA IAB-MT | bandwidth |  |
| GSM900 | 876 – 915 MHz | -98 dBm | -91 dBm | -70 dBm | 100 kHz |  |
| DCS1800 | 1710 – 1785 MHz | -98 dBm | -91 dBm | -80 dBm | 100 kHz |  |
| PCS1900 | 1850 – 1910 MHz | -98 dBm | -91 dBm | -80 dBm | 100 kHz |  |
| GSM850 or CDMA850 | 824 – 849 MHz | -98 dBm | -91 dBm | -70 dBm | 100 kHz |  |
| UTRA FDD Band I or E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band II or E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band III or E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band IV or E-UTRA Band 4 | 1710 – 1755 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band V or E-UTRA Band 5 or NR Band n5 | 824 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VI, XIX or E-UTRA Band 6, 19 | 830 – 845 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VII or E-UTRA Band 7 or NR Band n7 | 2500 – 2570 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VIII or E-UTRA Band 8 or NR Band n8 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band IX or E-UTRA Band 9 | 1749.9 – 1784.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band X or E-UTRA Band 10 | 1710 – 1770 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XI or E-UTRA Band 11 | 1427.9 –1447.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 699 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 777 – 787 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XIV or  E-UTRA Band 14 or NR Band n14 | 788 – 798 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 17 | 704 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 18 or NR Band n18 | 815 – 830 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXI or E-UTRA Band 21 | 1447.9 – 1462.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3410 – 3490 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78 |
| E-UTRA Band 23 | 2000 – 2020 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 24 | 1626.5 – 1660.5 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR Band n25 | 1850 – 1915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXVI or  E-UTRA Band 26 or NR Band n26 | 814 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 27 | 807 – 824 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 28 or NR Band n28 | 703 – 748 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 30 or NR Band n30 | 2305 – 2315 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 31 | 452.5 – 457.5 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 41 or NR Band n41, n90 | 2496 – 2690 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n41 |
| E-UTRA Band 42 | 3400 – 3600 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78 |
| E-UTRA Band 43 | 3600 – 3800 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78 |
| E-UTRA Band 44 | 703 – 803 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 45 | 1447 – 1467 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 46 | 5150 – 5925 MHz | N/A | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 48 or NR Band n48 | 3550 – 3700 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78 |
| E-UTRA Band 50 or NR Band n50 | 1432 – 1517 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | N/A | N/A | -88 dBm | 100 kHz |  |
| E-UTRA Band 53 or NR Band n53 | 2483.5 – 2495 MHz | N/A | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n41 |
| E-UTRA Band 65 or NR Band n65 | 1920 – 2010 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 66 or NR Band n66 | 1710 – 1780 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 68 | 698 – 728 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 70 or NR Band n70 | 1695 – 1710 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 71 or NR Band n71 | 663 – 698 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 72 | 451 – 456 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 74 or NR Band n74 | 1427 – 1470 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n77 | 3.3 – 4.2 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to IAB-DU and IAB-MT operating in Band n79 |
| NR Band n80 | 1710 – 1785 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n81 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n82 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n83 | 703 – 748 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n84 | 1920 – 1980 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 85 | 698 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n86 | 1710 – 1780 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n89 | 824 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n91 | 832 – 862 MHz | N/A | N/A | -88 dBm | 100 kHz |  |
| NR Band n92 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n93 | 880 – 915 MHz | N/A | N/A | -88 dBm | 100 kHz |  |
| NR Band n94 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n95 | 2010 – 2025 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |

NOTE 1: As defined in the scope for spurious emissions in this clause, the co-location requirements in table 6.6.5.2.3-1 do not apply for the frequency range extending ΔfOBUE immediately outside the transmit frequency range of a IAB-MT and IAB-DU. The current state-of-the-art technology does not allow a single generic solution for co-location with other system on adjacent frequencies for 30dB antenna to antenna minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [8].

NOTE 2: Table 6.6.5.2.3-1 assumes that two *operating bands*, where the corresponding transmit and receive frequency ranges in table 5.2-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-location requirements may apply that are not covered by the 3GPP specifications.

#### 6.6.5.3 *IAB type 1-H*

The Tx spurious emissions requirements for *IAB type 1-H* are that for each *TAB connector TX min cell group* and each applicable *basic limit* in clause 6.6.5.2, the power summation of emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed a limit specified as the *basic limit* + X, where X = 10log10(NTXU,countedpercell), unless stated differently in regional regulation.

NOTE: Conformance to the *IAB type 1-H* spurious emission requirement can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The sum of the emissions power measured on each *TAB connector* in the *TAB connector TX min cell group* shall be less than or equal to the limit as defined in this clause for the respective frequency span.

Or

2) The unwanted emissions power at each *TAB connector* shall be less than or equal to the *type 1-H* limit as defined in this clause for the respective frequency span, scaled by -10log10(n), where n is the number of *TAB connectors* in the *TAB connector TX min cell group*.

## 6.7 Transmitter intermodulation

### 6.7.1 Definition and applicability

The transmitter intermodulation requirement is a measure of the capability of the transmitter unit to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit via the antenna, RDN and antenna array. The requirement shall apply during the transmitter ON period and the *transmitter transient period*.

For *IAB type 1-H*, the transmitter intermodulation level is the power of the intermodulation products when an interfering signal is injected into the *TAB connector*.

For *IAB type 1-H*, there are two types of transmitter intermodulation cases captured by the transmitter intermodulation requirement:

1) Co-location transmitter intermodulation in which the interfering signal is from a co-located base station.

2) Intra-system transmitter intermodulation in which the interfering signal is from other transmitter units within the *IAB type 1-H*.

For *IAB type 1-H*, the co-location transmitter intermodulation requirement is considered sufficient if the interference signal for the co-location requirement is higher than the declared interference signal for intra-system transmitter (D.30) intermodulation requirement.

### 6.7.2 Minimum requirement

The minimum requirement applies per *single-band connector*, or per *multi-band connector* supporting transmission in the *operating band*.

The minimum requirement for *IAB type 1-H* is defined in TS 38.174 [2], clause 6.7.2.

### 6.7.3 Test purpose

The test purpose is to verify the ability of the transmitter units associated with the *single-band connectors* or *multi-band connector* under test to restrict the generation of intermodulation products in its nonlinear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna to below specified levels.

### 6.7.4 Method of test

#### 6.7.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

*IAB RF Bandwidth* positions to be tested for multi-carrier and/or CA:

- MRFBW in single-band operation; see clause 4.9.1.

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

NOTE: When testing in M (or MRFBW), if the interferer is fully or partially located outside the supported frequency range, then the test shall be done instead in B (or BRFBW) and T (or TRFBW), and only with the interferer located inside the supported frequency range.

#### 6.7.4.2 Procedure

For *IAB 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. 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 *IAB 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,TABC for *IAB type 1-H* (D.21). Channel set-up shall be according to IAB-DU-FR1-TM 1.1 for IAB-DU and IAB-MT-FR1-TM 1.1 for IAB-MT.

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 IAB-DU and in clause 4.9.x for IAB-MT.

1. For IAB 1-H, generate the interfering signal according to IAB-DU-FR1-TM 1.1for IAB-DU and IAB-MT-FR1-TM 1.1 for IAB-MT, 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 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 *IAB 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 *IAB 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.

### 6.7.5 Test requirements

#### 6.7.5.1 *IAB type 1-H*

##### 6.7.5.1.1 Co-location minimum requirements

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.

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

For *TAB connectors* supporting operation 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 *multi-band connector*, the requirement shall apply relative to the *IAB RF Bandwidth* *edges* of each operating band. In case the inter RF Bandwidth gap is less than 3\*BWChannel MHz (where BWChannel is the minimal *IAB-DU channel bandwidth* and *IAB-MT 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.

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 |
| Interfering signal type | NR signal, the minimum *IAB-DU channel bandwidth* (BWChannel) or *IAB-MT channel bandwidth* (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5. |
| Interfering signal level | Rated total output power per *TAB connector* (Prated,t,TABC) 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 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 TAB connector 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. | |

##### 6.7.5.1.2 Intra-system minimum requirements

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3 and 6.6.4 in the presence of an NR interfering signal according to table 6.7.5.1.2-1.

Table 6.7.5.1.2-1: Interfering and wanted signals for intra-system transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal type | NR signal |
| Interfering signal type | NR signal of the same *IAB-DU channel bandwidth or IAB-MT channel bandwidth* and SCS as the wanted signal (Note 1). |
| Interfering signal level | Power level declared by the IAB manufacturer (Note 2). |
| Frequency offset between interfering signal and wanted signal | 0 MHz |
| NOTE 1: The interfering signal shall be incoherent with the wanted signal.  NOTE 2: The declared interfering signal power level at each *TAB connector* is the sum of the co-channel leakage power coupled via the combined RDN and Antenna Array from all the other *TAB connectors*, but does not comprise power radiated from the Antenna Array and reflected back from the environment. The power at each of the interfering *TAB connectors* is Prated,c,TABC. | |

##### 6.7.5.1.3 Additional requirements

For Band n41 operation in Japan, 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 6.7.5.1.3-1.

Table 6.7.5.1.3-1 Interfering and wanted signals for the additional transmitter intermodulation requirement for Band n41

|  |  |
| --- | --- |
| Parameter | Value |
| Wanted signal | NR single carrier (NOTE) |
| Interfering signal type | NR signal of 10 MHz *channel bandwidth* |
| Interfering signal level | Rated total output power in the operating band – 30 dB |
| Interfering signal centre frequency offset from the lower/upper carrier centre frequency of the wanted signal | ± 5 MHz  ± 15 MHz  ± 25 MHz |
| NOTE: This requirement applies for NR carriers allocated within 2545-2645 MHz. | |

# 7 Conducted receiver characteristics (IAB-DU and IAB-MT)

## 7.1 General

## 7.2 Reference sensitivity level

### 7.2.1 Definition and applicability

The reference sensitivity power level PREFSENS is the minimum mean power received at the *TAB connector* for *IAB type 1-H* at which a throughput requirement shall be met for a specified reference measurement channel.

### 7.2.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* is in TS 38.174 [2], clause 7.2.1.

For *IAB-MT* is in TS 38.174 [2], clause 7.2.2.

### 7.2.3 Test purpose

To verify that for each *IAB type 1-H* *TAB connector* at the reference sensitivity level the throughput requirement shall be met for a specified reference measurement channel.

### 7.2.4 Method of test

#### 7.2.4.1 Initial conditions

Test environment:

- Normal; see annex B.2.

- Extreme, see annexes B.3 and B.5.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1.

Under extreme test environment, the test shall be performed on each of B, M and T under extreme power supply conditions as defined in annex B.5.

NOTE: Tests under extreme power supply conditions also test extreme temperatures.

#### 7.2.4.2 Procedure

The minimum requirement is applied to all connectors under test.

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.

2) Start the signal generator for the wanted signal to transmit the Fixed Reference Channels for reference sensitivity in clause 7.2.5 and according to annex A.1.

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

4) Measure the throughput according to annex A.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.

### 7.2.5 Test requirements

#### 7.2.5.1 Test requirements for *IAB-DU*

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 7.2.5.1-1 for Wide Area IAB-DU, in table 7.2.5.1-2 for Medium Range IAB-DU and in table 7.2.5.1-3 for Local Area OAB-DU.

Table 7.2.5.1-1: NR Wide Area IAB-DU reference sensitivity levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel* | Sub-carrier | Reference | Reference sensitivity power level, PREFSENS (dBm) | | |
| *bandwidth* (MHz) | spacing (kHz) | measurement channel | f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 10, 15 | 15 | G-FR1-A1-1 (Note 1) | -101 | -100.7 | -100.5 |
|  |  |  |  |  |  |
| 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, | 15 | G-FR1-A1-4 (Note 1) | -94.6 | -94.3 | -94.1 |
| 50 |  |  |  |  |  |
| 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 *IAB-DU channel bandwidth*. | | | | | |

Table 7.2.5.1-2: NR Medium Range IAB-DU reference sensitivity levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel* | Sub-carrier | Reference | Reference sensitivity power level, PREFSENS (dBm) | | |
| *bandwidth* (MHz) | spacing (kHz) | measurement channel | f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 10, 15 | 15 | G-FR1-A1-1 (Note 1) | -96 | -95.7 | -95.5 |
|  |  |  |  |  |  |
| 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, | 15 | G-FR1-A1-4 (Note 1) | -89.6 | -89.3 | -89.1 |
| 50 |  |  |  |  |  |
| 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 *IAB-DU channel bandwidth*. | | | | | |

Table 7.2.5.1-3: NR Local Area IAB-DU reference sensitivity levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel* | Sub-carrier | Reference | Reference sensitivity power level, PREFSENS (dBm) | | |
| *bandwidth* (MHz) | spacing (kHz) | measurement channel | f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz |
| 10, 15 | 15 | G-FR1-A1-1 (Note 1) | -93 | -92.7 | -92.5 |
|  |  |  |  |  |  |
| 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, | 15 | G-FR1-A1-4 (Note 1) | -86.6 | -86.3 | -86.1 |
| 50 |  |  |  |  |  |
| 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 *IAB-DU channel bandwidth*. | | | | | |

#### 7.2.5.2 Test requirements for *IAB-MT*

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 7.2.5.2-1 for Wide Area IAB-MT and in table 7.2.5.2-2 for Local Area IAB-MT.

Table 7.2.5.2-1: Wide Area IAB-MT reference sensitivity levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| IAB-MT 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 |
| 10, 15 | 30 | G-FR1-A1-22 (Note 1) | -101.3 | -101 | -100.8 |
| 10, 15 | 60 | G-FR1-A1-23 (Note 1) | -98.3 | -98 | -97.8 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-25 (Note 1) | -94.7 | -94.4 | -94.2 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-26 (Note 1) | -94.9 | -94.6 | -94.4 |
| 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 *IAB-MT channel bandwidth*. | | | | | |

Table 7.2.5.2-2: Local Area IAB-MT reference sensitivity levels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| IAB-MT 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 |
| 10, 15 | 30 | G-FR1-A1-22 (Note 1) | -93.3 | -93 | -92.8 |
| 10, 15 | 60 | G-FR1-A1-23 (Note 1) | -90.3 | -90 | -89.8 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-25 (Note 1) | -86.7 | -86.4 | -86.2 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-26 (Note 1) | -86.9 | -86.6 | -86.4 |
| 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 *IAB-MT channel bandwidth*. | | | | | |

## 7.3 Dynamic range

### 7.3.1 Definition and applicability

The dynamic range is specified as a measure of the capability of the receiver to receive a wanted signal in the presence of an interfering signal at the *TAB connector* for *IAB-DU* inside the received *IAB-DU channel bandwidth*. In this condition, a throughput requirement shall be met for a specified reference measurement channel. The interfering signal for the dynamic range requirement is an AWGN signal.

### 7.3.2 Minimum requirement

The minimum requirement for *IAB type 1-H* for *IAB-DU* is in TS 38.174 [2], clause 7.3.1.

### 7.3.3 Test purpose

To verify that the IAB *type 1-H* *TAB connector* receiver dynamic range, the relative throughput shall fulfil the specified limit.

### 7.3.4 Method of test

#### 7.3.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

#### 7.3.4.2 Procedure

The minimum requirement is applied to all connectors under test.

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 .

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 IAB class.

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 IAB class.

4) Measure the throughput according to annex A.2.

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 IAB-DU, in table 7.3.2-2 for Medium Range IAB-DU and in table 7.3.2-3 for Local Area IAB-DU.

Table 7.3.5-1: Wide Area IAB-DU dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 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 *IAB-DU channel bandwidth*. | | | | | |

Table 7.3.5-2: Medium Range IAB-DU dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 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 *IAB-DU channel bandwidth*. | | | | | |

Table 7.3.5-3: Local Area IAB-DU dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 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 *IAB-DU channel bandwidth*. | | | | | |

## 7.4 In-band selectivity and blocking

### 7.4.1 Adjacent Channel Selectivity (ACS)

#### 7.4.1.1 Definition and applicability

Adjacent channel selectivity (ACS) is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency at the *TAB connector* for *IAB type 1-H* in the presence of an adjacent channel signal with a specified centre frequency offset of the interfering signal to the band edge of a victim system.

#### 7.4.1.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* are in TS 38.174 [2], clause 7.4.1.2.

For *IAB-MT* are in TS 38.174 [2], clause 7.4.1.3.

#### 7.4.1.3 Test purpose

The test purpose is to verify the ability of the IAB receiver filter to suppress interfering signals in the channels adjacent to the wanted channel.

#### 7.4.1.4 Method of test

##### 7.4.1.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

*IAB RF Bandwidth p*ositions to be tested for multi-carrier (MC):

- MRFBW for *single-band connector(s)*, see clause 4.9.1,

- BRFBW\_T'RFBW and B'RFBW\_TRFBW for *multi-band connector(s),* see clause 4.9.1.

##### 7.4.1.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *IAB 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 *IAB type 1-H*.

2) For IAB-DU, set the signal generator for the wanted signal to transmit as specified in table 7.4.1.5.1-1.

For IAB-MT, set the signal generator for the wanted signal to transmit as specified in table 7.4.1.5.2-1.

3) For IAB-DU, set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.1.5.1-1 and 7.4.1.5.1-2.

For IAB-MT, set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.1.5.2-1 and 7.4.1.5.2-2.

4) Measure the throughput according to annex A.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.

#### 7.4.1.5 Test requirements

##### 7.4.1.5.1 Test requirements for IAB-DU

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

For IAB, the wanted and the interfering signal coupled to the *IAB type 1-H* *TAB connector* are specified in table 7.4.1.5.1-1 and the frequency offset between the wanted and interfering signal in table 7.4.1.5.1-2 for ACS. The reference measurement channel for the wanted signal is identified in table 7.2.5.1-1, 7.2.5.1-2 and 7.2.5.1-3 for each channel bandwidth and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex F.

The ACS requirement is applicable outside the IAB RF Bandwidth or Radio Bandwidth. The interfering signal offset is defined relative to the *IAB RF Bandwidth edges* or Radio Bandwidth edges.

For a IAB 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 7.4.1.5.1-2. 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 7.4.1.5.1‑2. The interfering signal offset is defined relative to the *IAB RF Bandwidth edges* inside the Inter RF Bandwidth gap

Conducted requirement is defined at the *TAB connector* for *IAB type 1-H.*

Table 7.4.1.5.1-1: IAB ACS requirement

|  |  |  |
| --- | --- | --- |
| *IAB-DU channel bandwidth* of the lowest/highest carrier received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 10, 15, 20,  25, 30, 40, 50, 60, 70, 80, 90, 100  (Note 1) | PREFSENS + 6 dB | Wide Area IAB-DU: -52  Medium Range IAB-DU: -47  Local Area IAB-DU: -44 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the IAB for that bandwidth.  NOTE 2: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *IAB-DU channel bandwidth* as specified in TS 38.174 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. | | |

Table 7.4.1.5.1-2: IAB ACS interferer frequency offset values

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

##### 7.4.1.5.2 Test requirements for IAB-MT

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

For IAB-MT, the wanted and the interfering signal coupled to the *IAB type 1-H* *TAB connector* are specified in table 7.4.1.5.1-1 and the frequency offset between the wanted and interfering signal in table 7.4.1.5.2-2 for ACS. The reference measurement channel for the wanted signal is identified in table 7.2.5.2-1 and 7.2.5.2-2 for each *IAB-MT channel bandwidth* and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex F.

The ACS requirement is applicable outside the *IAB-MT RF Bandwidth* or *Radio Bandwidth*. The interfering signal offset is defined relative to the *IAB-MT RF Bandwidth* edges or *Radio Bandwidth* edges.

For IAB-MT 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 7.4.1.5.2-2. 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 7.4.1.5.2‑2. The interfering signal offset is defined relative to the *IAB-MT RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Minimum conducted requirement is defined at the *TAB connector* for *IAB type 1-H.*

Table 7.4.1.5.2-1: ACS requirement for IAB-MT

|  |  |  |
| --- | --- | --- |
| *IAB-MT channel bandwidth* of the lowest/*highest carrier* received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 10, 15, 20,  25, 30, 40, 50, 60, 70, 80, 90, 100  (Note 1) | PREFSENS + 6 dB | Wide Area IAB-MT: -52  Local Area IAB-MT: -44 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the IAB-MT for that bandwidth. | | |

Table 7.4.1.5.2-2: IAB-MT ACS interferer frequency offset values

|  |  |  |
| --- | --- | --- |
| *IAB-MT channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering signal centre frequency offset from the lower/upper IAB-MT *RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap* (MHz) | Type of interfering signal |
| 10 | ±2.5075 | 5 MHz CP-OFDM NR signal  15 kHz SCS, 25 RBs |
| 15 | ±2.5125 |  |
| 20 | ±2.5025 |  |
| 25 | ±9.4675 | 20 MHz CP-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 |  |

### 7.4.2 In-band blocking

#### 7.4.2.1 Definition and applicability

The in-band blocking characteristics is a measure of the receiver's ability to receive a wanted signal at its assigned channel at the *TAB connector* for *IAB type 1-H* in the presence of an unwanted interferer, which is an NR signal for general blocking or an NR signal with one resource block for narrowband blocking.

#### 7.4.2.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* are in TS 38.174 [2], clause 7.4.2.2.

For *IAB-MT* are in TS 38.174 [2], clause 7.4.2.3.

#### 7.4.2.3 Test purpose

The test purpose is to verify the ability of the IAB receiver to withstand high-levels of in-band interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.

#### 7.4.2.4 Method of test

##### 7.4.2.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier (SC): M; see clause 4.9.1

*IAB RF Bandwidth p*ositions to be tested for multi-carrier (MC) and/or CA:

- MRFBW for *single-band connector(s)*, see clause 4.9.1,

- BRFBW\_T'RFBW and B'RFBW\_TRFBW for *multi-band connector(s),* see clause 4.9.1.

NOTE: When testing in M (or MRFBW), if the interferer is fully or partially located outside the supported frequency range, then the test shall be done instead in B (or BRFBW) and T (or TRFBW), and only with the interferer located inside the supported frequency range.

##### 7.4.2.4.2 Procedure for general blocking

The minimum requirement is applied to all connectors under test.

For *IAB 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 *IAB type 1-H*.

2) For IAB-DU, set the signal generator for the wanted signal to transmit as specified in table 7.4.2.5.1-1.

For IAB-MT, set the signal generator for the wanted signal to transmit as specified in table 7.4.2.5.2-1**.**

3) For IAB-DU, set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.2.5.1-1. 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 7.4.2.5.1-1.

For IAB-MT, set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.2.5.2-1. 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 7.4.2.5.2-1.

4) Measure the throughput according to annex A.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.

##### 7.4.2.4.3 Procedure for narrowband blocking

The minimum requirement is applied to all connectors under test.

For *IAB 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 *IAB type 1-H*.

2) For IAB-DU, set the signal generator for the wanted signal to transmit as specified in table 7.4.2.5.1-2.

For IAB-MT, set the signal generator for the wanted signal to transmit as specified in table 7.4.2.5.2-2.

3) For IAB-DU, set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.2.5.1-2 and 7.4.2.5.1-3. Set-up and sweep the interfering RB centre frequency offset to the channel edge of the wanted signal according to table 7.4.2.5.1-3.

For IAB-MT, set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.4.2.5.2-2 and 7.4.2.5.2-3. Set-up and sweep the interfering RB centre frequency offset to the channel edge of the wanted signal according to table 7.4.2.5.2-3.

4) Measure the throughput according to annex A.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.

#### 7.4.2.5 Test requirements

##### 7.4.2.5.1 Test requirements for IAB-DU

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *IAB type 1‑H* *TAB connector* using the parameters in tables 7.4.2.5.1-1, 7.4.2.5.1-2 and 7.4.2.5.1-3 for general blocking and narrowband blocking requirements. The reference measurement channel for the wanted signal is identified in clause 7.2.5.1 for each channel bandwidth and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex E.

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

For *IAB 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 *IAB type 1-H* is defined in table 7.4.2.5.1-0.

Minimum conducted requirement is defined at the *TAB connector* for *IAB type 1-H.*

Table 7.4.2.5.1-0: ΔfOOB offset for NR *operating bands*

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

For a IAB 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 7.4.2.5.1-1. 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 7.4.2.5.1-1.

For a IAB 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 7.4.2.5.1-3. 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 7.4.2.5.1-3. The interfering signal offset is defined relative to the *IAB RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 7.4.2.5.1-1: IAB general blocking requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *IAB-DU 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 IAB-DU RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz) | Type of interfering signal |
| 10, 15, 20 | PREFSENS + 6 dB | Wide Area IAB-DU: -43  Medium Range IAB-DU: -38  Local Area IAB-DU: -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 IAB-DU: -43  Medium Range IAB-DU: -38  Local Area IAB-DU: -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 *IAB-DU channel bandwidth* as specified in TS 38.174 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. | | | | |

Table 7.4.2.5.2-2: IAB-DU narrowband blocking requirement

|  |  |  |
| --- | --- | --- |
| *IAB-DU channel bandwidth* of the lowest/highest carrier received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  (Note 1) | PREFSENS + 6 dB | Wide Area IAB-DU: -49  Medium Range IAB-DU: -44  Local Area IAB-DU: -41 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the IAB-DU for that *IAB-DU channel bandwidth*  NOTE 2: PREFSENS depends on the *IAB-DU channel bandwidth* as specified in TS 38.174 [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 7.4.2.5.1-3: IAB-DU narrowband blocking interferer frequency offsets

|  |  |  |
| --- | --- | --- |
| *IAB-DU channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering RB centre frequency offset to the lower/upper IAB-DU RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz)  (Note 2) | Type of interfering signal |
| 10 | ±(355+m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 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 *IAB-DU 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. | | |

##### 7.4.2.5.2 Test requirements for IAB-MT

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *IAB type 1‑H* *TAB connector* using the parameters in tables 7.4.2.5.2-1, 7.4.2.5.2-2 and 7.4.2.5.2-3 for general blocking and narrowband blocking requirements. The reference measurement channel for the wanted signal is identified in clause 7.2.2 for each *IAB-MT channel bandwidth* and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex E.

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

The in-band blocking requirement shall apply from FDL,low - ΔfOOB to FDL,high + ΔfOOB. The ΔfOOB for *wide area IAB-MT* is defined in table 7.4.2.5.2-0.

Minimum conducted requirement is defined at the *TAB connector* for *IAB-MT.*

**Table 7.4.2.5.2-0: ΔfOOB offset for NR *operating bands***

|  |  |  |
| --- | --- | --- |
| **IAB-MT type** | ***Operating band* characteristics** | **ΔfOOB (MHz)** |
| *IAB type 1-H* | FDL,high – FDL,low < 100 MHz | 20 |
|  | 100 MHz ≤ FDL,high – FDL,low ≤ 900 MHz | 60 |

For an IAB-MT 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 7.4.2.5.2-1. 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 shall apply 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 7.4.2.5.2-1.

For an IAB-MT operating in *non-contiguous spectrum* within any *operating band*, the narrowband blocking requirement shall apply 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 7.4.2.5.2-3. 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 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 7.4.2.5.2-3. The interfering signal offset is defined relative to the *IAB-MT RF Bandwidth* edges inside the *Inter RF Bandwidth gap*.

**Table 7.4.2.5.2-1: IAB-MT general blocking requirement**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***IAB-MT 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 *IAB-MT RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap* (MHz)** | **Type of interfering signal** |
| 10, 15, 20 | PREFSENS + 6 dB | Wide Area IAB-MT: -43  Local Area IAB-MT: -35 | ±7.5 | 5 MHz CP-OFDM NR signal  15 kHz SCS, 25 RBs |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | PREFSENS + 6 dB | Wide Area IAB-MT: -43  Local Area IAB-MT: -35 | ±30 | 20 MHz CP-OFDM NR signal  15 kHz SCS, 100 RBs |
| NOTE: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the IAB-MT *channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2. | | | | |

**Table 7.4.2.5.2-2: IAB-MT narrowband blocking requirement**

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

**Table 7.4.2.5.2-3: IAB-MT narrowband blocking interferer frequency offsets**

|  |  |  |
| --- | --- | --- |
| ***IAB-MT channel bandwidth* of the *lowest/highest carrier* received (MHz)** | **Interfering RB centre frequency offset to the lower/upper IAB-MT *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 CP-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 | 3 |
| 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 IAB-MT *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. | | |

## 7.5 Out-of-band blocking

### 7.5.1 Definition and applicability

The out-of-band blocking characteristics is a measure of the receiver ability to receive a wanted signal at its assigned channel at the *TAB connector* for *IAB type 1-H* in the presence of an unwanted interferer out of the *operating band*, which is a CW signal for out-of-band blocking.

### 7.5.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* are defined in TS 38.174 [2], clause 7.5.3.

For *IAB-MT* are defined in TS 38.174 [2], clause 7.5.5.

Co-location minimum requirements for *IAB type 1-H*:

For *IAB-DU* are defined in TS 38.174 [2], clause 7.5.4.

For *IAB-MT* are defined in TS 38.174 [2], clause 7.5.6.

### 7.5.3 Test purpose

To verify the ability of the receiver to receive a wanted signal at its assigned channel at the *TAB connector* for *IAB type 1-H* in the presence of an unwanted interferer out of the *operating band*, which is a CW signal for out-of-band blocking.

### 7.5.4 Method of test

#### 7.5.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier (SC):

- M; see clause 4.9.1

*IAB RF Bandwidth p*ositions to be tested for multi-carrier (MC):

- MRFBW for *single-band connector(s)*, see clause 4.9.1,

- BRFBW\_T'RFBW and B'RFBW\_TRFBW for *multi-band connector(s),* see clause 4.9.1.

In addition, for a multi-band *connector:*

- For BRFBW\_T'RFBW, out-of-band blocking testing above the highest operating band may be omitted.

- For B'RFBW\_TRFBW, out-of-band blocking testing below the lowest operating band may be omitted.

#### 7.5.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *IAB 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 *IAB type 1-H*.

2) For IAB-DU, 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.

For IAB-MT, set the signal generator for the wanted signal as defined in clause 7.5.5 to transmit as specified in table 7.5.5.3-2 and 7.5.5.4-1.

3) For IAB-DU, 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.

For IAB-MT, set the Signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.5.5.3-2 and 7.5.5.4-1. 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.

4) Measure the throughput according to annex A.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.

### 7.5.5 Test requirements

#### 7.5.5.1 General requirements for IAB-DU

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *IAB 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.

For *IAB 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. The ΔfOOB for *IAB type 1-H* is defined in table 7.4.2.5.1-0.

Minimum conducted requirement is defined at the *TAB connector* for *IAB type 1-H.*

For a IAB 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 *IAB-DU channel bandwidth* as specified in TS 38.174 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3. | | |

#### 7.5.5.2 Co-location requirements for IAB-DU

This additional blocking requirement may be applied for the protection of NR IAB receivers when GSM, CDMA, UTRA, E-UTRA BS or NR IAB operating in a different frequency band are co-located with a NR IAB. The requirement is applicable to all channel bandwidths supported by the NR IAB.

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

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to IAB antenna input using the parameters in table 7.5.5.2-1 for all the IAB classes. The reference measurement channel for the wanted signal is identified in tables 7.2.5-1, 7.2.5-2 and 7.2.5-3 for each channel bandwidth and further specified in annex A.1.

For *IAB type 1-H* blocking requirement for co-location with IAB in other bands is applied for all operating bands for which co-location protection is provided.

Minimum conducted requirement is defined at the *TAB connector* for *IAB type 1-H.*

Table 7.5.5.2-1: Blocking performance requirement for NR IAB when co-located with BS/IAB in other frequency bands.

| Frequency range of interfering signal | Wanted signal mean power for WA IAB-DU (dBm) | Interfering signal mean power for WA IAB-DU (dBm) | Interfering signal mean power for MR IAB-DU (dBm) | Interfering signal mean power for LA IAB-DU (dBm) | Type of interfering signal |
| --- | --- | --- | --- | --- | --- |
| Frequency range of co-located downlink operating band | PREFSENS +6dB (Note 1) | +16 | +8 | x (Note 2) | CW carrier |
| NOTE 1: PREFSENS depends on the *IAB-DU channel bandwidth* as specified in TS 38.174 [2], table 7.2.2-1, 7.2.2-2 and 7.2.2-3.  NOTE 2: x = -7 dBm for NR IAB co-located with Pico GSM850 or Pico CDMA850 x = -4 dBm for NR IAB co-located with Pico DCS1800 or Pico PCS1900 x = -6 dBm for NR IAB co-located with UTRA bands or E-UTRA bands or NR bands  NOTE 3: The requirement does not apply when the interfering signal falls within any of the supported uplink operating band(s) or in ΔfOOB immediately outside any of the supported uplink operating band(s). | | | | | |

#### 7.5.5.3 General requirements for IAB-MT

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *IAB type 1-H* *TAB connector* using the parameters in table 7.5.5.3-2. The reference measurement channel for the wanted signal is identified in subclause 7.2.1 and subclause 7.2.2 for each *IAB-MT channel bandwidt*h and further specified in annex A.1.

The out-of-band blocking requirement apply from 1 MHz to FDL,low - ΔfOOB and from FDL,high + ΔfOOB up to 12750 MHz. The ΔfOOB for *IAB-MT* is defined in table 7.5.5.3-1.

Table 7.5.5.3-1: ΔfOOB offset for NR *operating bands*

|  |  |  |
| --- | --- | --- |
| IAB-MT type | *Operating band* characteristics | ΔfOOB (MHz) |
| *IAB type 1-H* | FDL,high – FDL,low < 100 MHz | 20 |
|  | 100 MHz ≤ FDL,high – FDL,low ≤ 900 MHz | 60 |

Minimum conducted requirement is defined and at the *TAB connector* for *IAB-MT type 1-H.*

For a *multi-band connector*, 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 7.4.2.2 shall be excluded from the out-of-band blocking requirement.

Table 7.5.5.3-2: Out-of-band blocking performance requirement for NR

|  |  |  |
| --- | --- | --- |
| Wanted Signal mean power (dBm) | Interfering Signal mean power (dBm) | Type of Interfering Signal |
| PREFSENS +6 dB (Note) | -15 | CW carrier |
| NOTE 1: For NR, PREFSENS depends also on the *IAB-MT channel bandwidth* as specified in subclause 7.2.1 and subclause 7.2.2. | | |

#### 7.5.5.4 Co-location requirements for IAB-MT

This additional blocking requirement may be applied for the protection of IAB-MT receivers when GSM, CDMA, UTRA, E-UTRA, NR BS or IAB-node operating in a different frequency band are co-located with an IAB-node. The requirement is applicable to all  *IAB-MT channel bandwidths* supported by the IAB-node.

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

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *IAB type 1-H* *TAB connector* input using the parameters in table 7.5.5.4-1 for all the IAB classes. The reference measurement channel for the wanted signal is identified in subclause 7.2.1 and subclause 7.2.2 for each *IAB-MT channel bandwidth* and further specified in annex A.1.

The blocking requirement for co-location with BS or IAB-node in other bands is applied for all *operating bands* for which co-location protection is provided.

Minimum conducted requirement is defined at the *TAB connector* for *IAB type 1-H.*

Table 7.5.5.4-1: Blocking performance requirement for the IAB node

| Frequency range of interfering signal | Wanted signal mean power (dBm) | Interfering signal mean power for WA IAB node (dBm) | Interfering signal mean power for LA IAB node (dBm) | Type of interfering signal |
| --- | --- | --- | --- | --- |
| Frequency range of co-located downlink *operating band* | PREFSENS +6dB (Note 1) | +16 | x (Note 2) | CW carrier |
| NOTE 1: PREFSENS depends on the *IAB-MT channel bandwidth* as specified in subclause 7.2.1 and subclause 7.2.2.  NOTE 2: x = -7 dBm for IAB-MT co-located with Pico GSM850 or Pico CDMA850 x = -4 dBm for IAB-MT co-located with Pico DCS1800 or Pico PCS1900 x = -6 dBm for IAB-MT co-located with UTRA bands or E-UTRA bands or NR bands  NOTE 3: The requirement does not apply when the interfering signal falls within any of the supported downlink *operating band(s)* or in ΔfOOB immediately outside any of the supported downlink *operating band(s)*. | | | | |

## 7.6 Receiver spurious emissions

### 7.6.1 Definition and applicability

The receiver spurious emissions power is the power of emissions generated or amplified in a receiver unit that appear at the *TAB connector* (for *IAB type 1-H*). The requirements apply to all IAB-DU and IAB-MT with separate RX and TX *TAB connectors*.

For *TAB connectors* supporting both RX and TX in TDD, the requirements apply during the *transmitter OFF period*.

For RX-only *multi-band* *connectors*, the spurious emissions requirements are subject to exclusion zones in each supported *operating band*. For *multi-band* *connectors* that both transmit and receive in *operating band* supporting TDD, RX spurious emissions requirements are applicable during the *TX OFF period*, and are subject to exclusion zones in each supported *operating band*.

For *IAB type 1-H* manufacturer shall declare *TAB connector RX min cell groups*. The declaration is done separately for IAB-DU and IAB-MT. Every *TAB connector* of *IAB type 1-H* supporting reception in an *operating band* shall map to one *TAB connector RX min cell group*, where mapping of *TAB connectors* to cells/beams is implementation dependent.

The number of active receiver units that are considered when calculating the conducted RX spurious emission limits (NRXU,counted) for IAB type 1-H is calculated as follows:

NRXU,counted = *min(NRXU,active , 8* *× Ncells)*

NRXU,countedpercell is used for scaling of *basic limits* and is derived as NRXU,countedpercell = NRXU,counted / Ncells, where Ncells is defined in clause 6.1.

NOTE: NRXU,active is the number of actually active receiver units and is independent to the declaration of Ncells.

### 7.6.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* are in TS 38.174 [2], clause 7.6.2.

For *IAB-MT* are in TS 38.174 [2], clause 7.6.3.

### 7.6.3 Test purpose

The test purpose is to verify the ability of the IAB to limit the interference caused by receiver spurious emissions to other systems.

### 7.6.4 Method of test

#### 7.6.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

*IAB RF Bandwidth* positions to be tested for multi-carrier:

- MRFBW in single-band operation, see clause 4.9.1,

- BRFBW\_T'RFBW and B'RFBW\_TRFBW in multi-band operation, see clause 4.9.1.

#### 7.6.4.2 Procedure

The minimum requirement is applied to all connectors under test,

For *IAB 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.2.4. 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.2.4 for *IAB type 1-H*.

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

3) For IAB-DU, set the measurement equipment parameters as specified in table 7.6.5.1-1.

For IAB-MT, set the measurement equipment parameters as specified in table 7.6.5.3-1.

4) For IAB-DU, measure the spurious emissions over each frequency range described in table 7.6.5.1-1.

For IAB-MT, measure the spurious emissions over each frequency range described in table 7.6.5.3-1.

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.

### 7.6.5 Test requirements

#### 7.6.5.1 Basic limits for IAB-DU

The receiver spurious emissions limits are provided in table 7.6.5.1-1.

Table 7.6.5.1-1: General receiver spurious emissions limits

| Spurious frequency range | *Basic limit* | Measurement bandwidth | Notes |
| --- | --- | --- | --- |
| 30 MHz – 1 GHz | -57 dBm | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz | -47 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the UL *operating band* in GHz | -47 dBm | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: Measurement bandwidths as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: This spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the UL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: The frequency range from ΔfOBUE below the lowest frequency of the IAB transmitter operating band to ΔfOBUE above the highest frequency of the IAB transmitter *operating band* may be excluded from the requirement. ΔfOBUE is defined in clause 6.6.1. For *multi-band* *connectors*, the exclusion applies for all supported *operating bands*.  NOTE 5: Void | | | |

#### 7.6.5.2 Test requirement for IAB-DU

The RX spurious emissions requirements for *IAB type 1-H* are that for each applicable *basic limit* specified in table 7.6.5.1-1 for each *TAB connector RX min cell group,* the power sum of emissions at respective *TAB connectors* shall not exceed the IAB limits specified as the *basic limit*s + X, where X = 10log10(NRXU,countedpercell), unless stated differently in regional regulation.

The RX spurious emission requirements are applied per the *TAB connector RX min cell group* for all the configurations supported by the IAB-DU.

NOTE: Conformance to the IAB-DU receiver spurious emissions requirement can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The sum of the spurious emissions power measured on each *TAB connector* in the *TAB connector RX min cell group* shall be less than or equal to the IAB-DU limit above for the respective frequency span.

Or

2) The spurious emissions power at each *TAB connector* shall be less than or equal to the IAB-DU limit as defined above for the respective frequency span, scaled by -10log10(*n*), where *n* is the number of *TAB connectors* in the *TAB connector RX min cell group*.

#### 7.6.5.3 Basic limits for IAB-MT

The IAB-MT receiver spurious emissions *basic limits* are provided in table 7.6.5.3-1.

**Table 7.6.5.3-1: General IAB-MT receiver spurious emissions limits**

| **Spurious frequency range** | ***Basic limits*** | ***Measurement bandwidth*** | **Note** |
| --- | --- | --- | --- |
| 30 MHz – 1 GHz | -57 dBm | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz | -47 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz | -47 dBm | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [5], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [5], s2.5 table 1.  NOTE 3: This spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the DL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: The frequency range from ΔfOBUE below the lowest frequency of the IAB-MT transmitter *operating band* to ΔfOBUE above the highest frequency of the IAB-MT transmitter *operating band* may be excluded from the requirement. ΔfOBUE is defined in clause [6.6.1]. For *multi-band* *connectors*, the exclusion applies for all supported *operating bands*. | | | |

#### 7.6.5.4 Test requirement for IAB-MT

The RX spurious emissions requirements for *IAB type 1-H* are that for each applicable *basic limit* specified in table 7.6.5.3-1 for each *TAB connector RX min cell group,* the power sum of emissions at respective *TAB connectors* shall not exceed the IAB-MT limits specified as the *basic limit*s + X, where X = 10log10(NRXU,countedpercell), unless stated differently in regional regulation.

The RX spurious emission requirements are applied per the *TAB connector RX min cell group* for all the configurations supported by the IAB-MT.

NOTE: Conformance to the IAB-MT receiver spurious emissions requirement can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The sum of the spurious emissions power measured on each *TAB connector* in the *TAB connector RX min cell group* shall be less than or equal to the IAB-MT limit above for the respective frequency span.

Or

2) The spurious emissions power at each *TAB connector* shall be less than or equal to the IAB-MT limit as defined above for the respective frequency span, scaled by -10log10(*n*), where *n* is the number of *TAB connectors* in the *TAB connector RX min cell group*.

## 7.7 Receiver intermodulation

### 7.7.1 Definition and applicability

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency at the *TAB connector* for *IAB type 1-H* in the presence of two interfering signals which have a specific frequency relationship to the wanted signal.

### 7.7.2 Minimum requirement

The minimum requirement for *IAB type 1-H*:

For *IAB-DU* are in TS 38.174 [2], clause 7.7.2.

For *IAB-MT* are in TS 38.174 [2], clause 7.7.3.

### 7.7.3 Test purpose

The test purpose is to verify the ability of the IAB node receiver to inhibit the generation of intermodulation products in its non-linear elements caused by the presence of two high-level interfering signals at frequencies with a specific relationship to the frequency of the wanted signal.

### 7.7.4 Method of test

#### 7.7.4.1 Initial conditions

Test environment: Normal; see annex B.2.

RF channels to be tested for single carrier (SC): M; see clause 4.9.1

*IAB RF Bandwidth p*ositions to be tested for multi-carrier (MC) and/or CA:

- MRFBW for *single-band connector(s)*, see clause 4.9.1,

- BRFBW\_T'RFBW and B'RFBW\_TRFBW for *multi-band connector(s),* see clause 4.9.1.

NOTE: When testing in M (or MRFBW), if the interferer is fully or partially located outside the supported frequency range, then the test shall be done instead in B (or BRFBW) and T (or TRFBW), and only with the interferer located inside the supported frequency range.

#### 7.7.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *IAB 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.2.6 for *IAB type 1-H*.

2) Set the signal generator for the wanted signal to transmit as specified in table 7.7.5.1-1 and 7.7.5.1-3 for IAB-DU and table 7.7.5.2-1 and 7.7.5.2-3 for IAB-MT.

3) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 7.7.5.1-2 and 7.7.5.1-4 for IAB-DU and table 7.7.5.2-2 and 7.7.5.2-4 for IAB-MT.

4) Measure the throughput according to annex A.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.

### 7.7.5 Test requirements

#### 7.7.5.1 *IAB-DU*

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 *IAB type 1-H* *TAB connector*, with the conditions specified in tables 7.7.5.1-1 and 7.7.5.1-2 for intermodulation performance and in tables 7.7.5.1-3, and 7.7.5.1-4 for narrowband intermodulation performance. The reference measurement channel for the wanted signal is identified in tables 7.2.5.1-1 to 7.2.5.1-3 for each channel bandwidth and further specified in annex A.1. 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 *IAB-DU channel bandwidth* <=20MHz, for which the subcarrier spacing of the interfering signal should be 30 kHz.

The receiver intermodulation requirement is applicable outside the *IAB-DU RF Bandwidth* or Radio Bandwidth edges. The interfering signal offset is defined relative to the *IAB-DU RF Bandwidth edges* or *Radio Bandwidth* edges.

For an IAB-DU 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 7.7.5.1-2 or 7.7.5.1-4. 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 *IAB-DU 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 7.7.5.1-2 and 7.7.5.1-4. The interfering signal offset is defined relative to the *IAB-DU RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 7.7.5.1-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| IAB-DU type | Wanted Signal mean power (dBm) | Mean power of interfering signals (dBm) | Type of interfering signals |
| Wide Area | PREFSENS + 6 dB | -52 |  |
| Medium Range | PREFSENS + 6 dB | -47 | See table 7.7.5.1-2 |
| Local Area | PREFSENS + 6 dB | -44 |  |
| NOTE: PREFSENS depends on the RAT and the IAB class. For NR, PREFSENS depends also on the IAB-DU *channel bandwidth* as specified inTS 38.174 [2], section 7.2.1.2. | | | |

Table 7.7.5.1-2: Interfering signals for intermodulation requirement

|  |  |  |
| --- | --- | --- |
| *IAB-DU channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering signal centre frequency offset from the lower/upper *IAB-DU RF Bandwidth edge* (MHz) | Type of interfering signal (Note 3) |
| 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 *IAB-DU RF Bandwidth edge*. | | |

Table 7.7.5.1-3: Narrowband intermodulation performance requirement in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| IAB-DU type | Wanted signal mean power (dBm)  (Note 1) | Mean power of interfering signals (dBm) | Type of interfering signal |
| Wide Area | PREFSENS + 6 dB | -52 |  |
| Medium Range | PREFSENS + 6 dB | -47 | See table 7.7.5.1-4 |
| Local Area | PREFSENS + 6 dB | -44 |  |
| NOTE: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *IAB-DU channel bandwidth* as specified in TS 38.174 [2], section 7.2.1.2. | | | |

Table 7.7.5.1-4: Interfering signals for narrowband intermodulation requirement in FR1

|  |  |  |
| --- | --- | --- |
| *IAB-DU channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering RB centre frequency offset from the lower/upper *IAB-DU RF Bandwidth edge* or sub-block edge inside a sub-block gap (kHz) (Note 3) | Type of interfering signals |
| 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 *IAB-DU channel bandwidth* of the interfering signal is located adjacently to the lower/upper I*AB-DU 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. | | |

#### 7.7.5.2 *IAB-MT*

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 *IAB type 1-H* *TAB connector*, with the conditions specified in tables 7.7.5.2-1 and 7.7.5.2-2 for intermodulation performance and in tables 7.7.5.2-3, and 7.7.5.2-4 for narrowband intermodulation performance. The reference measurement channel for the wanted signal is identified in tables 7.2.5.2-1 to 7.2.5.2-3 for each channel bandwidth and further specified in annex A.1. 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 *IAB-MT channel bandwidth* <=20MHz, for which the subcarrier spacing of the interfering signal should be 30 kHz.

The receiver intermodulation requirement is applicable outside the IAB-MT RF Bandwidth or Radio Bandwidth edges. The interfering signal offset is defined relative to the *IAB-MT RF Bandwidth edges* or Radio Bandwidth edges.

For an IAB-MT 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 7.7.5.2-2 or 7.7.5.2-4. 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 *IAB-MT 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 7.7.5.2-2 and 7.7.5.2-4. The interfering signal offset is defined relative to the *IAB-MT RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 7.7.5.2-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| IAB-MT type | Wanted Signal mean power (dBm) | Mean power of interfering signals (dBm) | Type of interfering signals |
| Wide Area | PREFSENS + 6 dB | -52 | See table 7.7.5.2-2 |
| Local Area | PREFSENS + 6 dB | -44 |  |
| NOTE: PREFSENS depends on the RAT and the IAB class. For NR, PREFSENS depends also on the *IAB-MT channel bandwidth* as specified inTS 38.174 [2], section 7.2.2.2. | | | |

Table 7.7.5.2-2: Interfering signals for intermodulation requirement

|  |  |  |
| --- | --- | --- |
| *IAB-MT channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering signal centre frequency offset from the lower/upper *IAB-MT RF Bandwidth edge* (MHz) | Type of interfering signal (Note 3) |
| 10 | ±7.465 | CW |
|  | ±17.5 | 5 MHz CP-OFDM NR signal, (Note 1) |
| 15 | ±7.43 | CW |
|  | ±17.5 | 5 MHz CP-OFDM NR signal, (Note 1) |
| 20 | ±7.395 | CW |
|  | ±17.5 | 5 MHz CP-OFDM NR signal, (Note 1) |
| 25 | ±7.465 | CW |
|  | ±25 | 20MHz CP-OFDM NR signal, (Note 2) |
| 30 | ±7.43 | CW |
|  | ±25 | 20 MHz CP-OFDM NR signal, (Note 2) |
| 40 | ±7.45 | CW |
|  | ±25 | 20 MHz CP-OFDM NR signal, (Note 2) |
| 50 | ±7.35 | CW |
|  | ±25 | 20 MHz CP-OFDM NR signal, (Note 2) |
| 60 | ±7.49 | CW |
|  | ±25 | 20 MHz CP-OFDM NR signal, (Note 2) |
| 70 | ±7.42 | CW |
|  | ±25 | 20 MHz CP-OFDM NR signal, (Note 2) |
| 80 | ±7.44 | CW |
|  | ±25 | 20 MHz CP-OFDM NR signal, (Note 2) |
| 90 | ±7.46 | CW |
|  | ±25 | 20 MHz CP-OFDM NR signal, (Note 2) |
| 100 | ±7.48 | CW |
|  | ±25 | 20 MHz CP-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 *IAB-MT RF Bandwidth edge*. | | |

Table 7.7.5.2-3: Narrowband intermodulation performance requirement in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| IAB-MT type | Wanted signal mean power (dBm)  (Note 1) | Mean power of interfering signals (dBm) | Type of interfering signal |
| Wide Area | PREFSENS + 6 dB | -52 | See table 7.7.5.2-4 |
| Local Area | PREFSENS + 6 dB | -44 |  |
| NOTE: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *IAB-MT channel bandwidth* as specified in TS 38.174 [2], section 7.2.2.2. | | | |

Table 7.7.5.2-4: Interfering signals for narrowband intermodulation requirement in FR1

|  |  |  |
| --- | --- | --- |
| *IAB-MT channel bandwidth* of the lowest/highest carrier received (MHz) | Interfering RB centre frequency offset from the lower/upper *IAB-MT RF Bandwidth edge* or sub-block edge inside a sub-block gap (kHz) (Note 3) | Type of interfering signals |
| 10 | ±370 | CW |
|  | ±1960 | 5 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 15 (Note 2) | ±380 | CW |
|  | ±1960 | 5 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 20 (Note 2) | ±390 | CW |
|  | ±2320 | 5 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 25 (Note 2) | ±325 | CW |
|  | ±2350 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 30 (Note 2) | ±335 | CW |
|  | ±2350 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 40 (Note 2) | ±355 | CW |
|  | ±2710 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 50 (Note 2) | ±375 | CW |
|  | ±2710 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 60 (Note 2) | ±395 | CW |
|  | ±2710 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 70 (Note 2) | ±415 | CW |
|  | ±2710 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 80 (Note 2) | ±435 | CW |
|  | ±2710 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 90 (Note 2) | ±365 | CW |
|  | ±2530 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| 100 (Note 2) | ±385 | CW |
|  | ±2530 | 20 MHz CP-OFDM NR signal, 1 RB (Note 1) |
| NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the *IAB-MT channel bandwidth* of the interfering signal is located adjacently to the lower/upper *IAB-MT 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. | | |

## 7.8 In-channel selectivity

### 7.8.1 Definition and applicability

In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations at the *TAB connector* for *IAB-DU* in the presence of an interfering signal received at a larger power spectral density. In this condition a throughput requirement shall be met for a specified reference measurement channel. The interfering signal shall be an NR signal which is time aligned with the wanted signal.

### 7.8.2 Minimum requirement

The minimum requirements for *IAB type 1-H* for *IAB-DU* are in TS 38.174 [2], clause 7.8.2.

### 7.8.3 Test purpose

The purpose of this test is to verify the IAB-DU receiver ability to suppress the IQ leakage.

### 7.8.4 Method of test

#### 7.8.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

#### 7.8.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *IAB 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 in sub-clause 7.8.5.

2) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in sub-clause 7.8.5.

3) Measure the throughput according to annex A.1.

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

#### 7.8.5.1 *IAB-DU*

For *IAB-DU* , 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 7.8.5.1-1 for Wide Area IAB-DU, in table 7.8.5.1-2 for Medium Range IAB-DU and in table 7.8.5.1-3 for Local Area IAB-DU. The characteristics of the interfering signal is further specified in annex E.

Table 7.8.5.1-1: Wide Area IAB-DU in-channel selectivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* | Subcarrier spacing | Reference measurement | Wanted signal mean power (dBm) | | | Interfering signal mean | Type of interfering signal |
| (MHz) | (kHz) | channel | f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz | power (dBm) |  |
| 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 |
| 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 *IAB-DU channel bandwidth* of the wanted signalaccording to the clause 5.4.2.2 in TS 38.174 [2]. The aggregated wanted and interferer signal shall be centred in the *IAB-DU channel bandwidth* of the wanted signal. | | | | | | | |

Table 7.8.5.1-2: Medium Range IAB-DU in-channel selectivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* | Subcarrier spacing | Reference measurement | Wanted signal mean power (dBm) | | | Interfering signal mean | Type of interfering signal |
| (MHz) | (kHz) | channel | f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz | power (dBm) |  |
| 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 |
| 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 *IAB-DU channel bandwidth* of the wanted signalaccording to the clause 5.4.2.2 in TS 38.174 [2]. The aggregated wanted and interferer signal shall be centred in the *IAB-DU channel bandwidth* of the wanted signal. | | | | | | | |

Table 7.8.5.1-3: Local area IAB-DU in-channel selectivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *IAB-DU channel bandwidth* | Subcarrier spacing | Reference measurement | Wanted signal mean power (dBm) | | | Interfering signal mean | Type of interfering signal |
| (MHz) | (kHz) | channel | f ≤ 3.0 GHz | 3.0 GHz < f ≤ 4.2 GHz | 4.2 GHz < f ≤ 6.0 GHz | power (dBm) |  |
| 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 |
| 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 *IAB-DU channel bandwidth* of the wanted signal according to the clause 5.4.2.2 in TS 38.174 [2]. The aggregated wanted and interferer signal shall be centred in the *IAB-DU channel bandwidth* of the wanted signal. | | | | | | | |

# 8 IAB-DU and IAB-MT conducted demodulation performance characteristics

Annex A [(normative)]: Reference measurement channels

# A.1 IAB-DU Reference measurement channels

{editors note: IAB-DU tables to be either reference or copied from 38.141-1}

# A.2 IAB-MT Reference measurement channels

## A.2.1 Fixed Reference Channels for reference sensitivity level, ACS, in-band blocking, out-of-band blocking and receiver intermodulation (QPSK, R=1/3)

The parameters for the reference measurement channels are specified in tables A.2.1-1 for FR1 reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation, OTA sensitivity, OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, and OTA receiver intermodulation.

**Table A2.1-1: FRC parameters for FR1 reference sensitivity level for IAB-MT.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reference channel** | **G-FR1-A1-22** | **G-FR1-A1-23** | **G-FR1-A1-25** | **G-FR1-A1-26** |
| Subcarrier spacing (kHz) | 30 | 60 | 30 | 60 |
| Allocated resource blocks | 11 | 11 | 51 | 24 |
| CP-OFDM Symbols per slot (Note 1) | 9 | 9 | 9 | 9 |
| Modulation | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 736 | 736 | 3368 | 1608 |
| Transport block CRC (bits) | 16 | 16 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits) (Note 3) | 752 | 752 | 3384 | 1624 |
| Total number of bits per slot | 2376 | 2376 | 11016 | 5184 |
| Total symbols per slot | 1188 | 1188 | 5508 | 2592 |
| NOTE 1:   *DL-DMRS-config-type* = 1 with *DL-DMRS-max-len* = 1, *DL-DMRS-add-pos* = pos2 with = 2, = 6 and 9 as per Table 7.4.1.1.2-3 of TS 38.211 [9].  NOTE 2:   MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity  NOTE 3:   Code block size including CRC (bits) equals to cid:image005.png@01D6459A.4A6FCF50 in sub-clause 5.2.2 of TS 38.212 [10]. | | | | |

Annex B [(normative)]: Environmental requirements for the IAB equipment

# B.1 General

For each test in the present document, the environmental conditions under which the IAB is to be tested are defined.

# B.2 Normal test environment

When a normal test environment is specified for a test, the test should be performed within the minimum and maximum limits of the conditions stated in table B.1.

**Table B.1: Limits of conditions for normal test environment**

|  |  |  |
| --- | --- | --- |
| **Condition** | **Minimum** | **Maximum** |
| Barometric pressure | 86 kPa | 106 kPa |
| Temperature | 15 °C | 30 °C |
| Relative humidity | 20 % | 85 % |
| Power supply | Nominal, as declared by the manufacturer | |
| Vibration | Negligible | |

The ranges of barometric pressure, temperature and humidity represent the maximum variation expected in the uncontrolled environment of a test laboratory. If it is not possible to maintain these parameters within the specified limits, the actual values shall be recorded in the test report.

NOTE: This may, for instance, be the case for measurements of radiated emissions performed on an open field test site.

# B.3 Extreme test environment

The manufacturer shall declare one of the following:

1) The equipment class for the equipment under test, as defined in the IEC 60 721-3-3 [17];

2) The equipment class for the equipment under test, as defined in the IEC 60 721-3-4 [18];

3) The equipment that does not comply with the mentioned classes, the relevant classes from IEC 60 721 [19] documentation for temperature, humidity and vibration shall be declared.

NOTE: Reduced functionality for conditions that fall outside of the standard operational conditions is not tested in the present document. These may be stated and tested separately.

## B.3.1 Extreme temperature

When an extreme temperature test environment is specified for a test, the test shall be performed at the standard minimum and maximum operating temperatures defined by the manufacturer's declaration for the equipment under test.

**Minimum temperature:**

The test shall be performed with the environment test equipment and methods including the required environmental phenomena into the equipment, conforming to the test procedure of IEC 60 068-2-1 [20].

**Maximum temperature:**

The test shall be performed with the environmental test equipment and methods including the required environmental phenomena into the equipment, conforming to the test procedure of IEC 60 068-2-2 [21].

NOTE: It is recommended that the equipment is made fully operational prior to the equipment being taken to its lower operating temperature.

# B.4 Vibration

When vibration conditions are specified for a test, the test shall be performed while the equipment is subjected to a vibration sequence as defined by the manufacturer's declaration for the equipment under test. This shall use the environmental test equipment and methods of inducing the required environmental phenomena in to the equipment, conforming to the test procedure of IEC 60 068-2-6 [22]. Other environmental conditions shall be within the ranges specified in annex B.2.

NOTE: The higher levels of vibration may induce undue physical stress in to equipment after a prolonged series of tests. The testing body should only vibrate the equipment during the RF measurement process.

# B.5 Power supply

When extreme power supply conditions are specified for a test, the test shall be performed at the standard upper and lower limits of operating voltage defined by manufacturer's declaration for the equipment under test.

**Upper voltage limit:**

The equipment shall be supplied with a voltage equal to the upper limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, to the methods described in IEC 60 068-2-1 [20] Test Ab/Ad and IEC 60 068-2-2 [21] Test Bb/Bd: Dry heat.

**Lower voltage limit:**

The equipment shall be supplied with a voltage equal to the lower limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, to the methods described in IEC 60 068-2-1 [20] Test Ab/Ad and IEC 60 068-2-2 [21] Test Bb/Bd: Dry heat.

# B.6 Measurement of test environments

The measurement accuracy of the IAB test environments defined in annex B shall be:

Pressure: 5 kPa

Temperature: 2 degrees

Relative humidity: 5 %

DC voltage: 1.0 %

AC voltage: 1.5 %

Vibration: 10 %

Vibration frequency: 0.1 Hz

The above values shall apply unless the test environment is otherwise controlled and the specification for the control of the test environment specifies the uncertainty for the parameter.

Annex C [(informative)]: Test tolerances and derivation of test requirements

# C.1 Measurement of transmitter

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

| Test | Minimum requirement in TS 38.174 [2] | Test Tolerance (TT) | Test requirement in the present document |
| --- | --- | --- | --- |
| 6.2 IAB output power | See TS 38.174 [2], clause 6.2 | Normal and extreme conditions:  0.7 dB, f ≤ 3.0 GHz  1.0 dB, 3.0 GHz < f ≤ 6GHz (Note) | Formula:  Upper limit + TT, Lower limit - TT |
| 6.3.1 IAB-DU Output power dynamics | See TS 38.174 [2], clause 6.3.1 | 0.4 dB | Formula:  Total power dynamic range – TT (dB) |
| 6.3.2 IAB-MT Total power dynamic range | See TS 38.174 [2], clause 6.3.2 | ±0.7 dB, BW ≤ 40MHz  ±1.0 dB, 40MHz < f ≤ 100MHz | Formula:  Total power dynamic range – TT (dB) |
|  |  |  |  |
| 6.4.1 Transmitter OFF power | See TS 38.174 [2], clause 6.4.1 | 2.0 dB, f ≤ 3.0 GHz  2.5 dB, 3.0 GHz < f ≤ 6 GHz  (Note) | Formula:  Minimum Requirement + TT |
| 6.4.2 Transient period | See TS 38.174 [2], clause 6.4.2 | N/A |  |
| 6.5.2.1 IAB-DU Frequency error | See TS 38.174 [2], clause 6.5.1.1 | 12 Hz | Formula:  Frequency Error limit + TT |
| 6.5.2.2 IAB-MT Frequency error | See TS 38.174 [2], clause 6.5.1.2 | ±15 Hz, f ≤ 3.0GHz  ±36 Hz, f > 3.0GHz | Formula:  Frequency Error limit + TT |
| 6.5.4 Modulation quality (EVM) | See TS 38.174 [2], clause 6.5.2 | 1% | Formula:  EVM limit + TT |
| 6.5.4 Time alignment error | See TS 38.174 [2], clause 6.5.3.1 | 25ns | Formula:  Time alignment error limit + TT+ TT |
| 6.6.2 Occupied bandwidth | See TS 38.174 [2], clause 6.6.2 | 0 Hz | Formula:  Minimum Requirement + TT |
| 6.6.3 Adjacent Channel Leakage Power Ratio (ACLR) | See TS 38.174 [2], clause 6.6.3 | ACLR/CACLR:  BW ≤ 20MHz:  0.8dB  BW > 20MHz:  1.2 dB  Absolute ACLR/CACLR:  0 dB | Formula:  ACLR Minimum Requirement - TT  Absolute limit +TT |
| 6.6.4 Operating band unwanted emissions | See TS 38.174 [2], clause 6.6.4 | Offsets < 10MHz  1.5 dB, f ≤ 3.0GHz  1.8 dB, 3.0GHz < f ≤ 6GHz  (Note)  Offsets ≥ 10MHz  0dB | Formula:  Minimum Requirement + TT |
| 6.6.5.5.1 General transmitter spurious emissions requirements  Category A | See TS 38.174 [2], clause 6.6.5.2.1 | 0dB | Formula:  Minimum Requirement + TT |
| 6.6.5.5.1 General transmitter spurious emissions requirements  Category B | See TS 38.174 [2], clause 6.6.5.2.1 | 0dB | Formula:  Minimum Requirement + TT |
| 6.6.5.5.2 Additional spurious emissions requirements | See TS 38.174 [2], clause 6.6.5.2.2 | 0dB | Formula:  Minimum Requirement + TT |
| 6.6.5.5.3 Co-location with other base stations | See TS 38.174 [2], clause 6.6.5.2.3 | 0dB | Formula:  Minimum Requirement + TT |
| 6.7 Transmitter intermodulation | See TS 38.174 [2], clause 6.7 | 0dB | Formula: Ratio + TT |
| NOTE 1: TT values for 4.2 GHz < f ≤ 6.0 GHz apply for IAB operates in licensed spectrum only.  NOTE 2: TT values are applicable for normal condition unless otherwise stated. | | | |

# C.2 Measurement of receiver

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

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Minimum requirement in TS 38.174 [2] | Test Tolerance  (TT) | Test requirement in the present document |
| 7.2 Reference sensitivity level | See TS 38.174 [2], clause 7.2 | Normal and extreme conditions:  0.7 dB, f ≤ 3.0 GHz  1.0 dB, 3.0 GHz < f ≤ 4.2 GHz  1.2 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula: Reference sensitivity power level + TT |
| 7.3 Dynamic range | See TS 38.174 [2], clause 7.3 | 0.3 dB | Formula: Wanted signal power + TT |
| 7.4 In-band selectivity and blocking | See TS 38.174 [2], clause 7.4 | 0dB | Formula: Wanted signal power + TT |
| 7.5 Out-of-band blocking | See TS 38.174 [2], clause 7.5 | 0dB | Formula: Wanted signal power + TT |
| 7.6 Receiver spurious emissions | See TS 38.174 [2], clause 7.6 | 0dB | Formula:  Minimum Requirement + TT |
| 7.7 Receiver intermodulation | See TS 38.174 [2], clause 7.7 | 0dB | Formula: Wanted signal power + TT |
| 7.8 In-channel selectivity | See TS 38.174 [2], clause 7.8 | 1.4 dB, f ≤ 3.0 GHz  1.8 dB, 3.0 GHz < f ≤ 4.2 GHz  2.1 dB, 4.2 GHz < f ≤ 6.0 GHz | Formula: Wanted signal power + TT |
| NOTE: TT values are applicable for normal condition unless otherwise stated. | | | |

# C.3 Measurement of performance requirements

*{Editor’s note: To be added after performance TT discussion.}*

Annex D [(informative)]: Measurement system set-up

# D.1 *IAB type 1-H* transmitter

## D.1.1 IAB output power, output power dynamics, transmitter ON/OFF power, frequency error, EVM, unwanted emissions for IAB type 1-H

*TAB connectors* may be connected to the measurement equipment singularly and tested one at a time (figure D.1.1-1), or may be tested simultaneously in groups (figure D.1.1-2) where the group size may range from two to all the *TAB connectors* which are subject to particular transmitter test in this test setup.

In all cases the measurement is per *TAB connector* but the measurement may be done in parallel.



Figure D.1.1-1: Measuring system set-up for *IAB type 1-H* output power, output power dynamics, transmitter ON/OFF power, frequency error, EVM, unwanted emissions for a single *TAB connector*



Figure D.1.1-2: Measuring system set-up for *IAB type 1-H* output power, output power dynamics, transmitter ON/OFF power, frequency error, EVM, unwanted emissions for multiple *TAB connectors*

## D.1.2 Transmitter intermodulation for IAB type 1-H



Figure D.3.2-1: Measuring system set-up for *IAB type 1-H* transmitter intermodulation

## D.1.3 Transmitter spurious emissions for IAB type 1-H

*TAB connectors* may be connected to the measurement equipment singularly and tested one at a time (figure D.1.3-1), or may be tested simultaneously in groups (figure D.1.3-2) where the group size may range from two to all the *TAB connectors* which are subject to transmitter spurious emissions test.

In all cases the measurement is per *TAB connector* but the measurement may be done in parallel.



Figure D.1.3-1: Measuring system set-up for transmitter spurious emissions for a single *TAB connector*



Figure D.1.3-2: Measuring system set-up for transmitter spurious emissions for multiple *TAB connectors* in parallel test

## D.1.4 Time alignment error for *IAB-DU*



Figure D.1.4-1: Measuring system set-up for *IAB-DU* test of time alignment error

# D.2 IAB type 1-H receiver

## D.2.1 Reference sensitivity level for IAB type 1-H



Figure D.2.1-1: Measuring system set-up for *IAB type 1-H* reference sensitivity level test

## D.2.2 Receiver dynamic range for IAB type 1-H



Figure D.2.2-1: Measuring system set-up for *IAB type 1-H* dynamic range test

## D.2.3 Receiver adjacent channel selectivity and narrowband blocking for IAB type 1-H



Figure D.2.3-1: Measuring system set-up for *IAB type 1-H* adjacent channel selectivity  
and narrowband blocking test

## D.2.4 Receiver spurious emissions

*TAB connector(s)* may be connected to the measurement equipment singularly and tested one at a time (figure D.2.2-1), or may be tested simultaneously in groups (figure D.2.2-2) where the group size may range from 2 to all the *TAB connectors*.

In all cases the measurement is per *TAB connector* but the measurement may be done in parallel.



Figure D.2.4-1: Measuring system set-up for *IAB type 1-H* receiver spurious emissions for a single *TAB connector*



Figure D.2.4-2: Measuring system set-up for *IAB type 1-H* receiver spurious emissions for multiple *TAB connectors*

## D.2.5 Receiver In-channel selectivity for IAB type 1-H



Figure D.2.5-1: Measuring system set-up for *IAB type 1-H* in-channel selectivity test

## D.2.6 Receiver intermodulation for IAB type 1-H



Figure D.2.6-1: Measuring system set-up for *IAB type 1-H* receiver intermodulation test

Annex E [(normative)]: Characteristics of interfering signals

# E.1 Characteristics of the interfering signals for IAB-DU

The Annex D in TS 38.104 [11] apply to FR1 IAB-DU.

# E.2 Characteristics of the interfering signals for IAB-MT

The interfering signal shall be configured with PDSCH and PDCCH containing data and DM-RS symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 7 of TS38.211 [9]. Mapping of PDSCH modulation to receiver requirement are specified in table E.2-1.

Table E.2-1: Modulation of the interfering signal

|  |  |
| --- | --- |
| Receiver requirement | Modulation |
| Adjacent channel selectivity and narrow-band blocking | QPSK |
| General blocking | QPSK |
| Receiver intermodulation | QPSK |

Annex F[(normative)]: Propagation conditions

Annex G[(normative)]: In-channel TX tests for IAB-DU

The Annex H in TS 38.141-1 [2] applies to FR1 IAB-DU.

Annex H[(normative)]: In-channel TX tests for IAB-MT

# H.0 Applicability

FR1 IAB-MT EVM can be determined by the process according to following alternatives:

Alternative 1: Annex E in TS 38.521-1 [16]. Only CP-OFDM waveform of PUSCH is measured for IAB-MT or

Alternative 2: from Annex H.1 to Annex H.7.

# H.1 General

The in-channel TX test enables the measurement of all relevant parameters that describe the in-channel quality of the output signal of the TX under test in a single measurement process.

The parameters describing the in-channel quality of a transmitter, however, are not necessarily independent. The algorithm chosen for description inside this annex places particular emphasis on the exclusion of all interdependencies among the parameters.

# H.2 Basic principles

The process is based on the comparison of the actual output signal of the TX under test, received by an ideal receiver, with an ideal signal, that is generated by the measuring equipment and represents an ideal error free received signal. All signals are represented as equivalent (generally complex) baseband signals.

The description below uses numbers and illustrations as examples only. These numbers are taken from a TDD frame structure with normal CP length, 30 kHz SCS and a transmission bandwidth configuration of 100 MHz (*N*RB = 273). The application of the text below, however, is not restricted to this parameter set.

## H.2.1 Output signal of the TX under test

The output signal of the TX under test is acquired by the measuring equipment and stored for further processsing. It is sampled at a sampling rate which is the product of the SCS and the *FFT size*, and it is named . The *FFT size* is determined by the transmission bandwidth in table 6.5.3.5-2 for 15 kHz SCS, table 6.5.3.5-3 for 30 kHz SCS and table 6.5.3.5-4 for 60 kHz SCS. In the time domain, it comprises at least 10 ms. It is modelled as a signal with the following parameters:

- demodulated data content,

- carrier frequency,

- amplitude and phase for each subcarrier.

For the example in the annex, the *FFT size* is 4096 based on table 6.5.3.5-3. The sampling rate of 122.88 Msps is the product of the *FFT size* and SCS.

## H.2.2 Ideal signal

Two types of ideal signals are defined:

The first ideal signal is constructed by the measuring equipment according to the relevant TX specifications, using the following parameters:

- demodulated data content,

- nominal carrier frequency,

- nominal amplitude and phase for each subcarrier.

It is represented as a sequence of samples at the sampling rate determined from annex H.2.1 in the time domain. The structure of the signal is described in the test models.

The second ideal signal is constructed by the measuring equipment according to the relevant TX specifications, using the following parameters:

- nominal demodulation reference signals (all other modulation symbols are set to 0 V),

- nominal carrier frequency,

- nominal amplitude and phase for each applicable subcarrier,

- nominal timing.

It is represented as a sequence of samples at the sampling rate determined from annex H.2.1 in the time domain.

## H.2.3 Measurement results

The measurement results, achieved by the in-channel TX test are the following:

- Carrier frequency error

- EVM

- Resource element TX power

- OFDM symbol TX power (OSTP)

Other side results are: residual amplitude- and phase response of the TX chain after equalisation.

## H.2.4 Measurement points

The resource element TX power is measured after the FFT box as described in figure H.2.4-1. The EVM shall be measured at the point after the FFT and a zero-forcing (ZF) equalizer in the receiver, as depicted for FR1 in figure H.2.4-1. The FFT window of *FFT size* samples out of (*FFT size* + cyclic prefix length) samples in the time domain is selected in the "Remove CP" box. The *FFT size* and the cyclic prefix length are obtained from table 6.5.3.5-2 for 15 kHz SCS, table 6.5.3.5-3 for 30 kHz SCS and table 6.5.3.5-4 for 60 kHz SCS.

In one subframe, there are two symbols with the length of the cyclic prefix larger than the values listed in tables 6.5.3.5-2, 6.5.3.5-3 and 6.5.3.5-4. Table H.2.4-1 lists the slot number and the symbol number and the formula how to compute the length of cyclic prefix for those two symbols according to the sampling rate.

Table H.2.4-1: Slot number and symbol number identifying the longer CP length for normal CP

|  |  |  |  |
| --- | --- | --- | --- |
| SCS (kHz) | # slots in subframe | Symbol # and slot # with longer CP | Longer CP length |
| 15 | 1 | (symbol 0, slot 0)  (symbol 7, slot 0) | CP length + *FFT size* / 128 |
| 30 | 2 | (symbol 0, slot 0) (symbol 0, slot 1) | CP length + *FFT size* / 64 |
| 60 | 4 | (symbol 0, slot 0) (symbol 0, slot 2) | CP length + *FFT size* / 32 |

For the example used in the annex, the "Remove CP" box selects 4096 samples out of 4384 samples. Symbol 0 has 64 more samples in the cyclic prefix than the other 13 symbols in the slot (the longer CP length = 352).



Figure H.2.4-1: Reference point for FR1 EVM measurements

# H.3 Pre-FFT minimization process

Sample Timing, Carrier Frequencyin are varied in order to minimise the difference between and , after the amplitude ratio of and has been scaled. Best fit (minimum difference) is achieved when the RMS difference value between and is an absolute minimum.

The carrier frequency variation is the measurement result: carrier frequency error.

From the acquired samples, one value of carrier frequency error can be derived.

Note 1: The minimisation process, to derive the RF error can be supported by post-FFT operations. However the minimisation process defined in the pre-FFT domain comprises all acquired samples (i.e. it does not exclude the samples in-between the FFT widths and it does not exclude the bandwidth outside the transmission bandwidth configuration).

Note 2: The algorithm would allow to derive carrier frequency error and sample frequency error of the TX under test separately. However there are no requirements for sample frequency error. Hence the algorithm models the RF and the sample frequency commonly (not independently). It returns one error and does not distinguish between both.

After this process, the samples are called .

# H.4 Timing of the FFT window

The FFT window length is *FFT size* samples per OFDM symbol.

The position in time for the FFT shall be determined.

In an ideal signal, the FFT may start at any instant within the cyclic prefix without causing an error. The TX filter, however, reduces the window. The EVM requirements shall be met within a window *W* < CP. There are three different instants for FFT:

- Centre of the reduced window, called ,

- , and

- .

The value of EVM window length *W* is obtained from tables 6.5.3.5-2 for 15 kHz SCS, 6.5.3.5-3 for 30 kHz SCS and 6.5.3.5-4 for 60 kHz SCS and the transmission bandwidth.

The IAB-MT shall transmit a signal according to the test models intended for EVM. The demodulation reference signal of the second ideal signal shall be used to find the centre of the FFT window.

The timing of the measured signal is determined in the pre-FFT domain as follows, using and :

1. The measured signal is delay spread by the TX filter. Hence the distinct borders between the OFDM symbols and between data and CP are also spread and the timing is not obvious.

2. In the ideal signal , the timing is known.

Correlation between bullet (1) and (2) will result in a correlation peak. The meaning of the correlation peak is approximately the "impulse response" of the TX filter.

3. The meaning of "impulse response" assumes that the autocorrelation of the ideal signal is a Dirac peak and that the correlation between the ideal signal and the data in the measured signal is 0. The correlation peak, (the highest, or in case of more than one highest, the earliest) indicates the timing in the measured signal.

The number of samples used for FFT is reduced compared to . This subset of samples is called .

From the acquired samples one timing can be derived.

The timing of the centre is determined according to the cyclic prefix length of the OFDM symbols. For normal CP, there are two values for in a 1 ms period:

- = length of cylic prefix / 2,

- = Longer CP length - length of cylic prefix / 2,

Where the length of cyclic prefix is obtained from table 6.5.3.5-2 for 15 kHz SCS, table 6.5.3.5-3 for 30 kHz SCS and table 6.5.3.5-4 for 60 kHz SCS, and the longer CP length is obtained from table H.2.4-1.

As per the example values:

- = 144 within the CP of length 288 for OFDM symbols 1 to 13 of a slot,

- = 208= 352 - 144) within the CP of length 352 for OFDM symbol 0 of a slot.

# H.5 Resource element TX power

Perform FFT on with the FFT window timing . The result is called . The RE TX power (RETP) is then defined as:

Where SCS is the subcarrier spacing in Hz.

From RETP the OFDM Symbol TX power (OSTP) is derived as follows:

Where the summation accumulates RETP values of all *Nsym* OFDM symbols that carry PUSCH and not containing PUCCH, SRS or PRACH within a slot.

From the acquired samples, values for each OSTP can be obtained and averaged where for TDD, is the number of slots with uplink symbols in a 10 ms measurement interval and is computed according to the values in table 4.9.2.2-1.

For the example used in the annex, and .

# H.6 Post-FFT equalisation

Perform FFTs on , one for each OFDM symbol within 10 ms measurement interval with the FFT window timing to produce an array of samples, in the time axis *t* by *FFT size* in the frequency axis *f*.

For the example in the annex, 280 FFTs are performed on . The result is an array of samples, 280 in the time axis by 4096 in the frequency axis.

The equalizer coefficients and are determined as follows:

1. Calculate the complex ratios (amplitude and phase) of the post-FFT acquired signal and the post-FFT ideal signal for each demodulation reference signal, over 10 ms measurement interval. This process creates a set of complex ratios:

2. Perform time averaging at each demodulation reference signal subcarrier of the complex ratios, the time-averaging length is 10 ms measurement interval. Prior to the averaging of the phases an unwrap operation must be performed according to the following definition:

- The unwrap operation corrects the radian phase angles of by adding multiples of 2 \* π when absolute phase jumps between consecutive time instances are greater than or equal to the jump tolerance of π radians.

- This process creates an average amplitude and phase for each demodulation reference signal subcarrier (i.e. every second subcarrier).

and

Where *N* is the number of demodulation reference signals time-domain locations from for each demodulation reference signal subcarrier *f*.

3. The equalizer coefficients for amplitude and phase and at the demodulation reference signal subcarriers are obtained by computing the moving average in the frequency domain of the time-averaged demodulation reference signal subcarriers. The moving average window size is 19 and averaging is over the DM-RS subcarriers in the allocated RBs. For DM-RS subcarriers at or near the edge of the channel, or when the number of available DM-RS subcarriers within a set of contiguously allocated RBs is smaller than the moving average window size, the window size is reduced accordingly as per figure H.6-1.

4. Perform linear interpolation from the equalizer coefficients and to compute coefficients, for each subcarrier.

Figure H.6-1: Reference subcarrier smoothing in the frequency domain

# H.7 EVM

## H.7.0 General

For EVM create two sets of , according to the timing and , using the equalizer coefficients from H.6.

The equivalent ideal samples are calculated from (annex H.2.2) and are called .

The EVM is the difference between the ideal signal and the equalized measured signal.

Where:

- T is the set of symbols with the considered modulation scheme being active within the slot,

- is the set of subcarriers within the resource blocks with the considered modulation scheme being active in symbol *t*,

- is the ideal signal reconstructed by the measurement equipment in accordance with relevant test models,

- is the equalized signal under test.

NOTE: Although the basic unit of measurement is one slot, the equalizer is calculated over the entire 10 ms measurement interval to reduce the impact of noise in the reference signals.

## H.7.1 Averaged EVM (TDD)

EVM is averaged over all allocated uplink resource blocks with the considered modulation scheme in the frequency domain, and a minimum of slots where is the number of slots in a 10 ms measurement interval.

For TDD, let be the number of slots with uplink symbols within a 10 ms measurement interval, the averaging in the time domain can be calculated from slots of different 10 ms measurement intervals and should have a minimum of slots averaging length where is the number of slots in a 10 ms measurement interval.

- is derived by: Square the EVM results in each 10 ms measurement interval. Sum the squares, divide the sum by the number of EVM relevant locations, square-root the quotient (RMS).

- Where is the number of resource blocks with the considered modulation scheme in slot *i*.

- The is calculated, using the maximum of at the window *W* extremities. Thus is calculated using and is calculated using (*l* and *h*, low and high; where low is the timing and and high is the timing ).

- In order to unite at least slots, consider the minimum integer number of 10 ms measurement intervals, where is determined by.

and for 15 kHz SCS, for 30 kHz SCS and for 60 kHz SCS normal CP.

- Unite by RMS.

Annex <X> (informative):  
Change history

This is the last annex for TS/TSs which details the change history using the following table.  
This table is to be used for recording progress during the WG drafting process till TSG approval of this TS/TR.  
For TRs under change control, use one line per approved Change Request  
Date: use format YYYY-MM  
CR: four digits, leading zeros as necessary  
Rev: blank, or number (max two digits)  
Cat: use one of the letters A, B, C, D, F  
Subject/Comment: for TSs under change control, include full text of the subject field of the Change Request cover  
New vers: use format [n]n.[n]n.[n]n

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| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
|  |  |  |  |  |  |  |  |

Change history of this template:

|  |  |  |
| --- | --- | --- |
| 2001-07 | Copyright date changed to 2001; space character added before TTC in copyright notification; space character before first reference deleted. | 1.3.3 |
| 2002-01 | Copyright date changed to 2002. | 1.3.4 |
| 2002-07 | Extra Releases added to title area. | 1.3.5 |
| *2002-12* | *"TM" added to 3GPP logo.* | *1.3.6* |
| *2003-02* | *Copyright date changed to 2003.* | *1.3.7* |
| *2003-12* | *Copyright date changed to 2004. Chinese OP changed from CWTS to CCSA* | *14.0* |
| *2004-04* | *North American OP changed from T1 to ATIS* | *1.5.0* |
| *2005-11* | *Stock text of clause 3 includes reference to 21.905.* | *1.6.0* |
| *2005-11* | *Caters for new TSG structure. Minor corrections.* | *1.6.1* |
| *2006-01* | *Revision marks removed.* | *1.6.2* |
| *2008-11* | *LTE logo line added, © date changed to 2008, guidance on keywords modified; acknowledgement of trade marks; sundry editorial corrections and cosmetic improvements* | *1.7.0* |
| *2010-02* | *3GPP logo changed for cleaner version, with tag line; LTE-Advanced logo line added;  © date changed to 2010; editorial change to cover page footnote text; trade marks acknowledgement text modified; additional Releases added on cover page; proforma copyright release text block modified* | *1.8.0* |
| *2010-02* | *Smaller 3GPP logo file used.* | *1.8.1* |
| *2010-07* | *Guidance note concerning use of LTE-Advanced logo added.* | *1.8.2* |
| *2011-04-01* | *Guidance of use of logos on cover page modified; copyright year modified.* | *1.8.3* |
| *2013-05-15* | *Changed File Properties to MCC macro default.*  *Removed R99, added Rel-12/13.*  *Modified Copyright year.*  *Guidance on annex X Change history.* | *1.8.4* |
| *2014-10-27* | *Updated Release selection on cover. In clause 3, added "3GPP" to TR 21.905.* | *1.8.5* |
| *2015-01-06* | *New Organizational Partner TSDSI added to copyright block. Old Releases removed.* | *1.9.0* |
| *2015-12-03* | *Provision for LTE Advanced Pro logo  Update copyright year to 2016* | *1.10.0* |
| *2016-03-08* | *Standarization of the layout of the Change History table in the last annex.(Unreleased)* | *1.11.0* |
| *2016-06-15* | *Minor adjustment to Change History table heading* | *1.11.1* |
| *2017-03-13* | *Adds option for 5G logo on cover* | *1.12.0* |
| *2017-05-03* | *Smaller 5G logo to reduce file size* | *1.12.1* |
| *2019-02-25* | *Replacement of frames on cover pages by in-line text.*  *Clarification of help text on when to use 5G logo. Removal of defunct keywords frame on page 2. Add Rel-16, Rel-17 options, eliminated earlier, frozen, Releases (cover page, below title) Corrections to some guidance text, addition of guidance text concerning automatic page headers under Word 2016 ff. Use of modal auxiliary verbs added to Foreword. More explicit guidance on Bibliography and Index annexes. Converted to .docx format.* | *1.13.0* |
| *2019-09-12* | *Cover page table outline shown dotted for ease of logo selection. (Author to hide outline after logo selection.) User now needs to delete whole table rows instead of individual cells, which proved to be tricky.*  *Change of style for "notes" in the Foreword to normal paragraphs.*  *Insertion of new bookmarks, correction of location of existing bookmarks. (To improve navigation.)*  *Improvements to guidance text.* | *1.13.1* |