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TECHNICAL SPECIFICATION

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Contents

Foreword

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

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

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

NOTE 1: The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

NOTE 2: 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

NOTE 3: 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

NOTE 4: The constructions "can" and "cannot" shall not to be used as 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

NOTE 5: 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).

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

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

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

[4] 3GPP TS 38.101-2: “NR User Equipment (UE) radio transmission and reception: Part 2: Range 2 Standalone”

[5] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios "

[6] 3GPP TS 38.133: “NR: Requirements for support of radio resource management”

[7] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[8] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[9] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[10] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[11] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[12] 3GPP TS 38.215: "NR; Physical layer measurements".

[13] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[14] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[15] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

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

[17] ERC Recommendation 74-01, "Unwanted emissions in the spurious domain".

[18] ITU-R Recommendation M.1545: “Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications – 2000”

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

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

[21] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".

3 Definitions, symbols and abbreviations

3.1 Definitions

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].

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*.

3.2 Symbols

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

$P_{CMAX,\,f,\,c}$ The configured maximum output power for carrier *f* of serving cell *c* in each slot

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].

BFD	Beam Failure Detection
BFD-RS	BFD Reference Signal
BLER	Block Error Rate
BM-RS	Beam Management Reference Signal
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PLMN	Public Land Mobile Network
PRACH	Physical RACH
pTAG	Primary Timing Advance Group
PUCCH	Physical Uplink Control Channel
PUSCH	Physical Uplink Shared Channel
RLM	Radio Link Monitoring
RLM-RS	Reference Signal for RLM
RMSI	Remaining Minimum System Information
RRC	Radio Resource Control
RRM	Radio Resource Management

4 General

4.1 Relationship with other core specifications

The present document is a single-RAT specification for an IAB_DU and IAB-MT, covering RF characteristics and minimum performance requirements and RRM requirements for the IAB_MT. Conducted and radiated core requirements are defined for the IAB node architectures and IAB node types defined in subclause 4.3.

The applicability of each requirement is described in clause 4.6.

4.2 Relationship between minimum requirements and test requirements

Conformance to the present specification is demonstrated by fulfilling the test requirements specified in the conformance specification [Test specification references].

The minimum requirements given in this specification make no allowance for measurement uncertainty. The test specifications [Test specification references] define test tolerances. These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in this specification to create test requirements. For some requirements, including regulatory requirements, the test tolerance is set to zero.

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 [18].

4.3 Conducted and radiated requirement reference points

4.3.2 IAB type 1-H

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

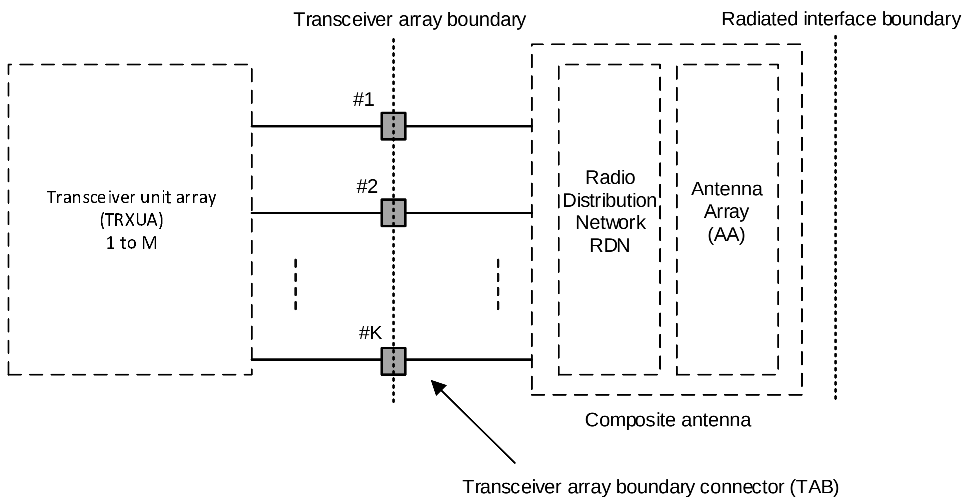

Figure 4.3.2-1: Radiated and conducted reference points for *IAB type 1-H*

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.

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 subclause.

4.3.3 IAB type 1-O and IAB type 2-O

For *IAB type 1-O* and *IAB type 2-O*, the 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.

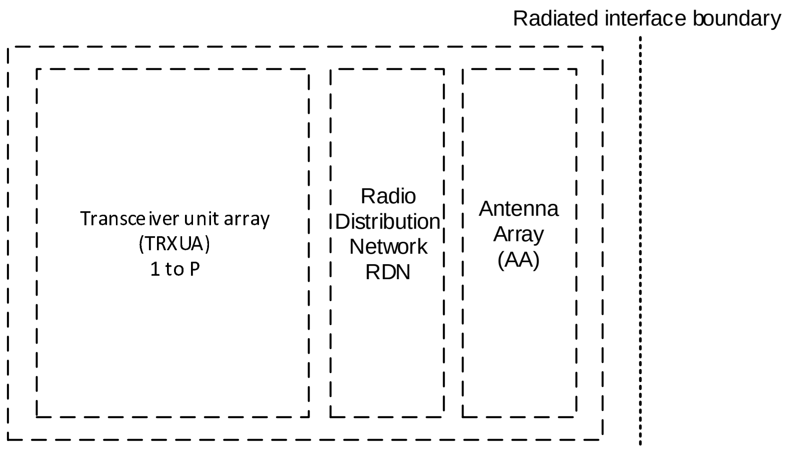

Figure 4.3.3-1: Radiated reference points for *IAB type 1-O* and *IAB type 2-O*

For an *IAB-DU type 1-O* the transceiver unit array must contain at least 8 transmitter units and at least 8 receiver units. Transmitter units and receiver units may be combined into transceiver units. For IAB-MT the transceiver unit array must contain at least FFS transmitter units and FFS receiver units. The transmitter/receiver units have the ability to transmit/receive parallel independent modulated symbol streams.

4.4 IAB classes

4.4.1 IAB-DU classes

The requirements in this specification apply to Wide Area IAB-DU, Medium Range IAB-DU and Local Area IAB-DU unless otherwise stated. The associated deployment scenarios for each class are exactly the same for IAB-DU with and without connectors.

For IAB *type 1-O* and 2-O, 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 distance along the ground equal to 35 m.
- Medium Range IAB-DU are characterised by requirements derived from Micro Cell scenarios with a BS to UE minimum distance along the ground equal to 5 m.
- Local Area IAB-DU are characterised by requirements derived from Pico Cell scenarios with a BS to UE minimum distance along the ground equal to 2 m.

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.

4.4.2 IAB-MT classes

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, 1-O, and 2-O, 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.

4.5 Regional requirements

Void

4.6 Applicability of requirements

In table 4.6-1, the requirement applicability for each *requirement set* of IAB-DUs is defined. In table 4.6-2, the requirement applicability for each *requirement set* of IAB-MTs 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 4.6-1: *Requirement set* applicability for IAB-DUs

Requirement	*IAB-DU type 1-H*	*IAB-DU type 1-O*	*IAB-DU type 2-O*
Output power	6.2	NA	NA
Output power dynamics	6.3		
Transmit ON/OFF power	6.4		
Transmitted signal quality	6.5		
Occupied bandwidth	6.6.2		
ACLR	6.6.3		
Operating band unwanted emissions	6.6.4		
Transmitter spurious emissions	6.6.5		
Transmitter intermodulation	6.7		
Reference sensitivity level	7.2		
Dynamic range	7.3		
In-band selectivity and blocking	7.4		
Out-of-band blocking	7.5		
Receiver spurious emissions	7.6		
Receiver intermodulation	7.7		
In-channel selectivity	7.8		
Performance requirements	8		
Radiated transmit power	9.2	9.2	9.2
OTA Output power	NA	9.3	9.3
OTA output power dynamics		9.4	9.4
OTA transmit ON/OFF power		9.5	9.5
OTA transmitted signal quality		9.6	9.6
OTA occupied bandwidth		9.7.2	9.7.2
OTA ACLR		9.7.3	9.7.3
OTA out-of-band emission		9.7.4	9.7.4
OTA transmitter spurious emission		9.7.5	9.7.5
OTA transmitter intermodulation		9.8	NA
OTA sensitivity	10.2	10.2	NA
OTA reference sensitivity level	NA	10.3	10.3
OTA dynamic range		10.4	NA
OTA in-band selectivity and blocking		10.5	10.5
OTA out-of-band blocking		10.6	10.6
OTA receiver spurious emission		10.7	10.7
OTA receiver intermodulation		10.8	10.8
OTA in-channel selectivity		10.9	10.9
Radiated performance requirements		11	11

Table 4.6-1: *Requirement set* applicability for IAB-MTs

Requirement	*IAB-MT type 1-H*	*IAB-MT type 1-O*	*IAB-MT type 2-O*
Output power	6.2	NA	NA
Output power dynamics	6.3		
Transmit ON/OFF power	6.4		
Transmitted signal quality	6.5		
Occupied bandwidth	6.6.2		
ACLR	6.6.3		
Operating band unwanted emissions	6.6.4		
Transmitter spurious emissions	6.6.5		
Transmitter intermodulation	6.7		
Reference sensitivity level	7.2		
Dynamic range	7.3		
In-band selectivity and blocking	7.4		
Out-of-band blocking	7.5		
Receiver spurious emissions	7.6		
Receiver intermodulation	NA		
In-channel selectivity	NA		
Performance requirements	8		
Radiated transmit power	9.2	9.2	9.2
OTA Output power	NA	9.3	9.3
OTA output power dynamics		9.4	9.4
OTA transmit ON/OFF power		9.5	9.5
OTA transmitted signal quality		9.6	9.6
OTA occupied bandwidth		9.7.2	9.7.2
OTA ACLR		9.7.3	9.7.3
OTA out-of-band emission		9.7.4	9.7.4
OTA transmitter spurious emission		9.7.5	9.7.5
OTA transmitter intermodulation		9.8	NA
OTA sensitivity	10.2	10.2	NA
OTA reference sensitivity level	NA	10.3	10.3
OTA dynamic range		NA	NA
OTA in-band selectivity and blocking		10.5	10.5
OTA out-of-band blocking		10.6	10.6
OTA receiver spurious emission		10.7	10.7
OTA receiver intermodulation		10.8	NA
OTA in-channel selectivity		NA	NA
Radiated performance requirements		11	11

4.7 Applicability of RRM requirements in this specification

4.7.1 Applicability of signalling characteristics related RRM requirements

The RRM requirements on the signalling characteristics for IAB MTs specified in section 12.3 shall apply only for the local area IAB class defined in section 4.4.

4.8 Requirements for contiguous and non-contiguous spectrum

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

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

5 Operating bands and channel arrangement

5.1 General

The channel arrangements presented in this clause are based on the *operating bands* and *IAB-DU or IAB-MT channel bandwidths* defined in the present release of specifications.

NOTE: Other *operating bands* and *IAB-DU or IAB-MT channel bandwidth*s may be considered in future releases.

Requirements throughout the RF specifications are in many cases defined separately for different frequency ranges (FR). The frequency ranges in which NR can operate according to the present version of the specification are identified as described in table 5.1-1.

Table 5.1-1: Definition of frequency ranges

Frequency range designation	Corresponding frequency range
FR1	410 MHz – 7125 MHz
FR2	24250 MHz – 52600 MHz

5.2 Operating bands

NR IAB is designed to operate in the *operating bands* in FR1 defined in table 5.2-1 and operating bands in FR2 defined in 38.104 [2].

Table 5.2-1 NR IAB *operating bands* in FR1

NR operating band	Uplink (UL) operating band BS receive / UE transmit $F_{UL,low}$ – $F_{UL,high}$	Downlink (DL) operating band BS transmit / UE receive $F_{DL,low}$ – $F_{DL,high}$	Duplex Mode
n41	2469 MHz – 2690 MHz	2469 MHz – 2690 MHz	TDD
n77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	TDD
n78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	TDD
n79	4400 MHz – 5000 MHz	4400 MHz – 5000 MHz	TDD

5.3 *Channel bandwidth*

5.3.1 General

The IAB-DU channel bandwidth supports a single NR RF carrier in the uplink or downlink at the IAB node. Different UE or IAB-MT channel bandwidths may be supported within the same spectrum for transmitting to and receiving from UEs or IAB-MT connected to the IAB-DU. The placement of the UE or IAB-MT channel bandwidth is flexible but can only be completely within the IAB-DU channel bandwidth. The IAB-DU shall be able to transmit to and/or receive from one or more UE or IAB-MT Bandwidth parts that are smaller than or equal to the number of carrier resource blocks on the RF carrier, in any part of the carrier resource blocks.

The IAB-MT channel bandwidth supports a single NR RF carrier in the uplink or downlink at the IAB-MT. From a BS or IAB-DU perspective, different IAB-MT channel bandwidths may be supported within the same spectrum for transmitting to and receiving from UEs or IAB-MT connected to the IAB-DU. Transmission of multiple carriers to the same IAB-MT (CA) or multiple carriers to different UEs or IAB-MT within the IAB-DU channel bandwidth can be supported.

From a IAB-MT perspective, the IAB-MT is configured with one or more BWP / carriers, each with its own IAB-MT channel bandwidth. The IAB-MT does not need to be aware of the BS or IAB-DU channel bandwidth or how the BS or IAB-DU allocates bandwidth to different UEs or IAB-MT.

The placement of the IAB-MT channel bandwidth for each IAB-MT carrier is flexible but can only be completely within the BS or IAB-DU channel bandwidth.

The relationship between the IAB-DU or IAB-MT channel bandwidth, the guardband and the transmission bandwidth configuration is shown in Figure 5.3.1-1.

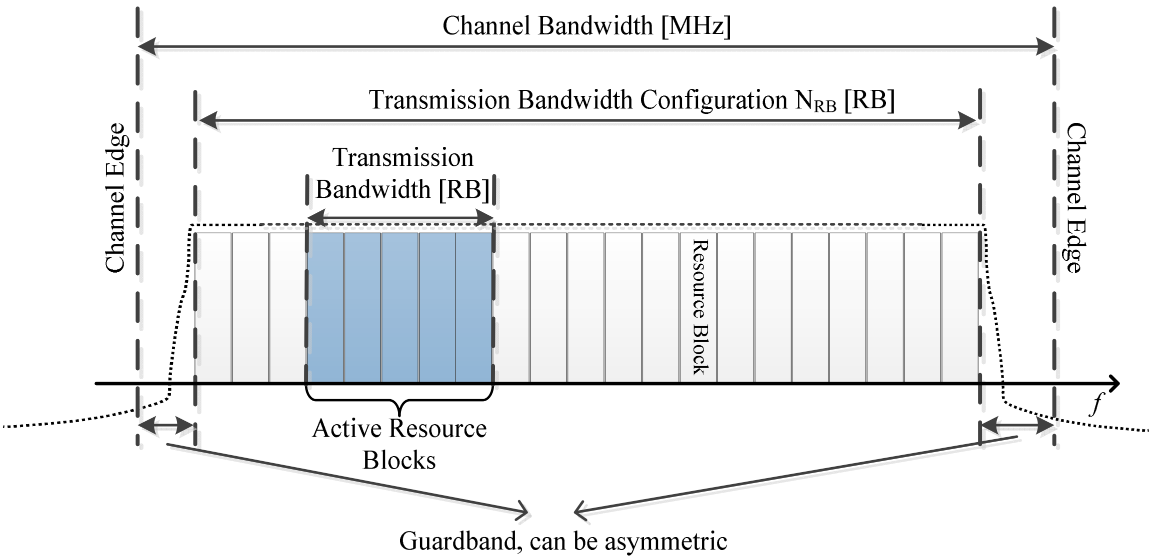

Figure 5.3.1-1: Definition of channel bandwidth and transmission bandwidth configuration for one NR channel

5.3.2 Transmission bandwidth configuration

For IAB-DU, the transmission bandwidth configuration is the same as specified for BS in TS 38.104 [2], subclause 5.3.2.

For IAB-MT, the transmission bandwidth configuration is the same as specified for UE in TS 38.101-1[3] for FR1 in subclause 5.3.2 and in TS 38.101-2 [4] for FR2 in subclause 5.3.2.

5.3.3 Minimum guardband and transmission bandwidth configuration

For IAB-DU, the minimum guardband and transmission bandwidth configuration is the same as specified for BS in TS38.104[2], subclause 5.3.3.

For IAB-MT, the minimum guardband and transmission bandwidth configuration is the same as specified for UE in TS38.101-1[3] for FR1 and in TS 38.101-2 [4] for FR2 in subclause 5.3.3.

5.3.4 RB alignment

For each *IAB-DU channel bandwidth* and each numerology, *IAB-DU transmission bandwidth configuration* must fulfil the minimum guardband requirement specified in clause 5.3.3.

For IAB-DU, for each numerology, its common resource blocks are specified in clause 4.4.4.3 in [7], and the starting point of its *transmission bandwidth configuration* on the common resource block grid for a given channel bandwidth is indicated by an offset to “Reference point A” in the unit of the numerology.

For IAB-DU, for each numerology, all *UE and IAB-MT transmission bandwidth configurations* indicated to UEs or IAB-MT served by the IAB-DU by higher layer parameter *carrierBandwidth* defined in TS 38.331 [15] shall fall within the *IAB-DU transmission bandwidth configuration*.

For IAB-MT, the RB alignment is the same as specified for UE in TS38.101-1 [3] for FR1 in subclause 5.3.4 and in TS 38.101-2 [4] for FR2 in subclause 5.3.3.

5.3.5 IAB-DU and IAB-MT channel bandwidth per operating band

For IAB-DU, the channel bandwidth for NR bands for FR1 in Table 5.2.1 and for NR bands for FR2 defined in TS38.104 [2] is the same as specified for BS in TS38.104 [2], subclause 5.3.5.

For IAB-MT, the channel spacing for NR bands for FR1 in Table 5.2-1 is the same as specified for UE in TS38.101-1[3] in subclause 5.3.5 and for NR bands for FR2 defined in TS38.104[2] is the same as specified for UE in TS38.101-2[4] in subclause 5.3.5.

5.3A IAB-DU channel bandwidth for CA

The IAB-DU channel bandwidth for CA is the same as specified for BS in TS38.104[2], subclause 5.3A.

5.4 Channel arrangement

5.4.1 Channel spacing

For IAB-DU, the channel spacing is the same as specified for BS in TS38.104[2], subclause 5.4.1.

For IAB-MT, the channel spacing is the same as specified for UE in TS38.101-1[3] for FR1 in subclause 5.4.1 and in TS38.101-2[4] for FR2 in subclause 5.4.1.

5.4.2 Channel raster

5.4.2.1 NR-ARFCN and channel raster

For IAB-DU, the NR-ARFCN and channel raster is the same as specified for BS in TS38.104[2], subclause 5.4.2.1.

For IAB-MT, the NR-ARFCN and channel raster is the same as specified for UE in TS38.101-1[3] for FR1 in subclause 5.4.2.1 and in TS38.101-2[4] for FR2 in subclause 5.4.2.1.

5.4.2.2 Channel raster to resource element mapping

For IAB-DU, the Channel raster to resource element mapping is the same as specified for BS in TS38.104[2], subclause 5.4.2.2.

For IAB-MT, the Channel raster to resource element mapping is the same as specified for UE in TS38.101-1[3] for FR1 in subclause 5.4.2.2 and in TS38.101-2[4] for FR2 in subclause 5.4.2.2.

5.4.2.3 Channel raster entries for each *operating band*

For IAB-DU, the channel raster entries for NR bands for FR1 in Table 5.2-1 and NR bands for FR2 defined in TS38.104[2] are the same as specified for BS in TS38.104[2], subclause 5.4.2.3.

For IAB-MT, the channel raster entries for NR bands for FR1 in Table 5.2-1 are the same as specified for UE in TS38.101-1[3] in subclause 5.4.2.3 and for NR bands for FR2 defined in TS38.104[2] are the same as specified for UE in TS38.101-2[4] in subclause 5.4.2.3.

5.4.3 Synchronization raster

5.4.3.1 Synchronization raster and numbering

For IAB-DU, the synchronization raster and numbering are the same as specified for BS in TS38.104[2], subclause 5.4.3.1.

For IAB-MT, the synchronization raster and numbering are the same as specified for UE in TS38.101-1[3] for FR1 in subclause 5.4.3.1 and in TS38.101-2[4] for FR2 in subclause 5.4.3.1.

5.4.3.2 Synchronization raster to synchronization block resource element mapping

For IAB-DU, the synchronization raster to synchronization block resource element mapping is the same as specified for BS in TS38.104[2], subclause 5.4.3.2.

For IAB-MT, the synchronization raster to synchronization block resource element mapping is the same as specified for UE in TS38.101-1[3] for FR1 in subclause 5.4.3.2 and in TS38.101-2[4] for FR2 in subclause 5.4.3.2.

5.4.3.3 Synchronization raster entries for each operating band

For IAB-DU, the synchronization raster entries for NR bands for FR1 in Table 5.2-1 and for NR bands for FR2 defined in TS38.104[2] are the same as specified for BS in TS38.104[2], subclause 5.4.3.3.

For IAB-MT, the synchronization raster entries entries for NR bands for FR1 in Table 5.2-1 are the same as specified for UE in TS38.101-1[3] in subclause 5.4.3.3 and for NR bands for FR2 defined in TS38.104[2] are the same as specified for UE in TS38.101-2[4] in subclause 5.4.3.

6 Conducted transmitter characteristics

6.1 General

Unless otherwise stated, the conducted transmitter characteristics are specified at the *TAB connector* for *IAB-DU* and *IAB-MT type 1-H*, with a full complement of transceiver units for the configuration in normal operating conditions.

For *IAB-DU* and *IAB-MT type 1-H* 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 (N_{cells}) 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 type 1-H* manufacturer shall also declare *TAB connector TX min cell groups*. The declaration is done separately for IAB-DU and IAB-MT. Every *TAB connector* of the *IAB-DU type 1-H* and IAB-MT 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 ($N_{TXU,counted}$) for *IAB-DU and IAB-MT type 1-H* is calculated as follows:

$$N_{TXU,counted} = min(N_{TXU,active}\ ,\ 8 \times N_{cells})$$

$N_{TXU,countedpercell}$ is used for scaling of *basic limits* and is derived as $N_{TXU,countedpercell} = N_{TXU,counted} / N_{cells}$

NOTE: $N_{TXU,active}$ depends on the actual number of *active transmitter units* and is independent to the declaration of N_{cells}.

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 type 1-H* and in table 6.2.1-2 for *IAB-MT type 1-H*.

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

IAB-DU class	$P_{rated,c,sys}$	$P_{rated,c,TABC}$
Wide Area IAB-DU	(Note)	(Note)
Medium Range IAB-DU	≤ 38 dBm +10log($N_{TXU,counted}$)	≤ 38 dBm
Local Area IAB-DU	≤ 24 dBm +10log($N_{TXU,counted}$)	≤ 24 dBm
NOTE: There is no upper limit for the $P_{rated,c,sys}$ or $P_{rated,c,TABC}$ of the Wide Area IAB-DU.		

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

IAB-MT class	$P_{rated,c,sys}$	$P_{rated,c,TABC}$
Wide Area IAB-MT	(Note)	(Note)
Local Area IAB-MT	≤ 24 dBm +10log($N_{TXU,counted}$)	≤ 24 dBm
NOTE: There is no upper limit for the $P_{rated,c,sys}$ or $P_{rated,c,TABC}$ of the Wide area IAB-MT.		

6.2.2 Minimum requirement for IAB type 1-H

In normal conditions, $P_{max,c,TABC}$ shall remain within +2 dB and -2 dB of the *rated carrier output power* $P_{rated,c,TABC}$ for each *TAB connector* as declared by the manufacturer.

In extreme conditions, $P_{max,c,TABC}$ shall remain within +2.5 dB and -2.5 dB of the *rated carrier output power* $P_{rated,c,TABC}$ for each *TAB connector* as declared by the manufacturer.

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

6.2.3 Additional requirements (regional)

In certain regions, additional regional requirements may apply.

6.3 Output power dynamics

6.3.1 IAB-DU Output Power Dynamics

6.3.1.1 General

The requirements in clause 6.3 apply during the *transmitter ON period*. Transmitted signal quality (as specified in clause 6.5) shall be maintained for the output power dynamics requirements of this clause.

Power control is used to limit the interference level.

6.3.1.2 RE power control dynamic range

6.3.1.2.1 General

The RE power control dynamic range is the difference between the power of an RE and the average RE power for a IAB-DU at maximum output power ($P_{max,c,TABC}$) for a specified reference condition.

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

6.3.1.2.2 Minimum requirement for *IAB-DU type 1-H*

The RE power control dynamic range is specified the same as the conducted RE power control dynamic range requirement for BS *type 1-H* in TS 38.104 [2], subclause 6.3.2.2.

6.3.1.3 Total power dynamic range

6.3.1.3.1 General

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-DU 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 for IAB-DU *type 1-H*

The total power dynamic range is specified the same as the total power dynamic range requirement for BS *type 1-H* in TS 38.104x[2], subclause 6.3.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

6.3.2 IAB-MT Output Power Dynamics

6.3.2.1 Total power dynamic range

6.3.2.1.1 General

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 for IAB-MT *type 1-H*

For a wide area IAB-MT the total power dynamic range for each NR carrier shall be larger than or equal to 5 dB.

For a local area IAB-MT the total power dynamic range for each NR carrier shall be larger than or equal to 10 dB.

6.3.3 Power control

6.3.3.1 Relative power tolerance for local area IAB-MT type 1-H

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.

The minimum requirements specified for each *TAB-connector* in Table 6.3.3.1-1 apply only when the output power is within the limits set by declared maximum output power and specified dynamic range.

2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep. For those exceptions, the power tolerance limit is a maximum of [± 6.0 dB] in Table 6.3.3.1-1.

Table 6.3.3.1-1: Relative power tolerance

Power step ΔP (Up or down) (dB)	Power tolerance (dB)
ΔP < 2	[± 2.5]
2 ≤ ΔP < 3	[± 3.5]
3 ≤ ΔP < 4	[± 4.5]
4 ≤ ΔP < 10	[± 5.5]

6.3.3.2 Aggregate power tolerance for local area IAB-MT type 1-H

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 [10] kept constant.

The minimum requirements specified for each *TAB-connector* in Table 6.3.3.2-1 apply only when the output power is within the limits set by declared maximum output power and specified dynamic range.

Table 6.3.3.2-1: Aggregate power tolerance

TPC command	UL channel	Aggregate power tolerance within [21 ms]
0 dB	PUCCH	[± 2.5 dB]
0 dB	PUSCH	[± 3.5 dB]

6.4 Transmit ON/OFF power

6.4.1 Transmitter OFF power

6.4.1.1 General

Transmit OFF power requirements apply to TDD operation of IAB-DU and FDD/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 (BW_{Config}) centred on the assigned channel frequency during the *transmitter OFF period*. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

For IAB-DU, 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 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-DU/MT Channel Bandwidth* $BW_{Channel\_CA}$ centred on $(F_{edge,high}+F_{edge,low})/2$ during the *transmitter OFF period*. N = SCS/15, where SCS is the smallest supported Sub Carrier Spacing in kHz in the *Aggregated IAB-DU (IAB-MT) Channel Bandwidth*.

6.4.1.3 Minimum requirement for *IAB-DU type 1-H*

The BS requirements specified in 6.4.1.3 in TS 38.104 [2] apply to *IAB-DU type 1-H*.

6.4.1.4 Minimum requirement for *IAB-MT type 1-H*

The BS requirements specified in 6.4.1.3 in TS 38.104 [2] apply to *IAB-MT type 1-H*.

6.4.2 Transmitter transient period

6.4.2.1 General

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

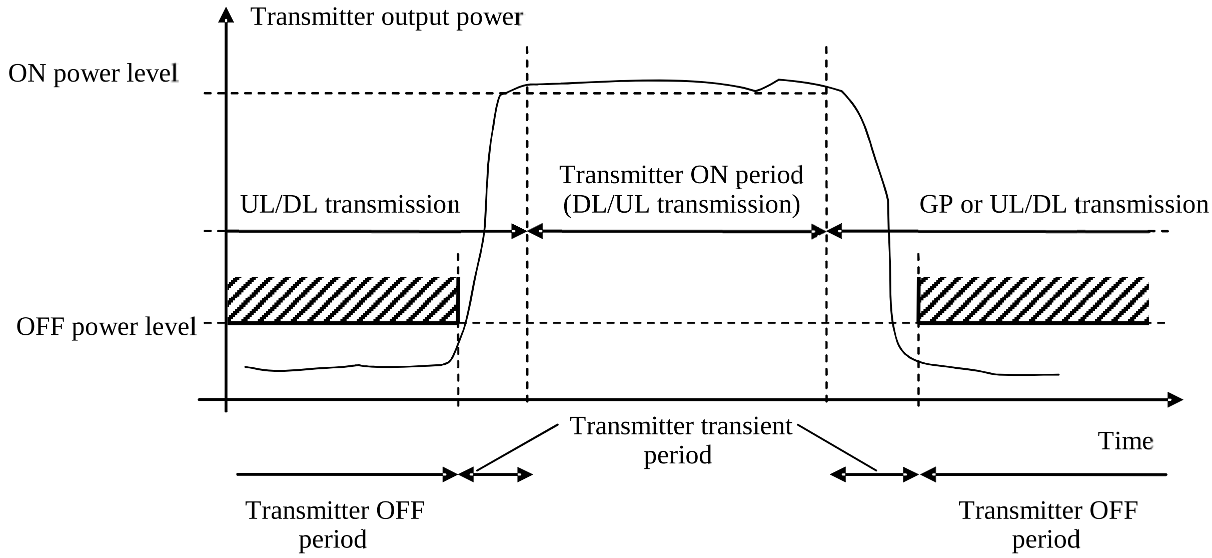

Figure 6.4.2.1-1: Example of relations between transmitter ON period, transmitter OFF period and transmitter transient period for IAB-DU and IAB-MT

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

6.4.2.2 Minimum requirement for IAB-DU type 1-H

The BS requirements specified in clause 6.4.2.2 in TS 38.104 [2] apply to IAB-DU type 1-H.

6.4.2.3 Minimum requirement for IAB-MT type 1-H

The BS requirements specified in clause 6.4.2.2 in TS 38.104 [2] apply to IAB-MT type 1-H.

6.5 Transmitted signal quality

6.5.1 Frequency error

6.5.1.1 IAB-DU frequency error

The requirements in clause 6.5.1 for BS type 1-H in TS 38.104 [2] apply to IAB-DU type 1-H.

6.5.1.2 IAB-MT frequency error

The IAB-MT basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of IAB-MT modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to the carrier frequency received from the parent node.

6.5.2.2 IAB-MT modulation quality

6.5.2.2.1 General

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. Details about how the EVM is determined are specified in Annex D.

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

6.5.2.2.2 Minimum requirements for IAB-MT type 1-H

For *IAB-MT type 1-H*, the EVM levels of each NR carrier for different modulation schemes outlined in table 6.5.2.2.2-1 shall be met

Table 6.5.2.2.2-1: Requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level
QPSK	%	17.5
16 QAM	%	12.5
64 QAM	%	8
256 QAM	%	3.5

6.5.2 Modulation quality

6.5.2.1 IAB-DU modulation quality

The requirements in clause 6.5.2 for BS type 1-H in TS 38.104 [2] apply to IAB-DU type 1-H.

6.5.3 Time alignment error

6.5.3.1 IAB-DU time alignment error

The requirements in clause 6.5.3 for BS type 1-H in TS 38.104 [2] apply to IAB-DU type 1-H.

6.6 Unwanted emissions

6.6.1 General

Unwanted emissions consist of out-of-band emissions and spurious emissions according to ITU definitions [16]. 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 Δf_{OBUE}. 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 Δf_{OBUE} above and Δf_{OBUE} below each band. Unwanted emissions outside of this frequency range are limited by a spurious emissions requirement.

The values of Δf_{OBUE} 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	Δf_{OBUE} (MHz)
IAB-DU type 1-H	$F_{DL,high} – F_{DL,low} < 100$ MHz	10
	100 MHz $\leq F_{DL,high} – F_{DL,low} \leq$ 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	Δf_{OBUE} (MHz)
IAB-MT type 1-H	$F_{UL,high} – F_{UL,low} < 100$ MHz	10
	100 MHz $\leq F_{UL,high} – F_{UL,low} \leq$ 900 MHz	40

For *IAB-DU type 1-H* and *IAB-MT 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 $\beta/2$ of the total mean transmitted power. See also Recommendation ITU-R SM.328 [19].

The value of $\beta/2$ 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-DU type 1-H* and *IAB-MT type 1-H* this requirement shall be applied at each *TAB connector* supporting transmission in the *operating band.*

6.6.2.2 Minimum requirement for *IAB-DU type 1-H*

The occupied bandwidth for each NR carrier shall be less than the *IAB-DU channel bandwidth*. For intra-band contiguous CA, the occupied bandwidth shall be less than or equal the *Aggregated IAB-DU Channel Bandwidth*.

6.6.2.3 Minimum requirement for *IAB-MT type 1-H*

The occupied bandwidth for each NR carrier shall be less than the *IAB-MT channel bandwidth*. For intra-band contiguous CA, the occupied bandwidth shall be less than or equal the *Aggregated IAB-MT Channel Bandwidth*.

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 Limits and *Basic limits*

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

The ACLR shall be higher than the value specified in table 6.6.3.2-1.

Table 6.6.3.2-1: IAB-DU type 1-H and IAB-MT type 1-H ACLR limit

IAB-DU and IAB-MT channel bandwidth of lowest/highest carrier transmitted $BW_{Channel}$ (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
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90,100	$BW_{Channel}$	NR of same BW (Note 2)	Square (BW_{Config})	45 dB
	2 x $BW_{Channel}$	NR of same BW (Note 2)	Square (BW_{Config})	45 dB
	$BW_{Channel}$ /2 + 2.5 MHz	5 MHz E-UTRA	Square (4.5 MHz)	45 dB (Note 3)
	$BW_{Channel}$ /2 + 7.5 MHz	5 MHz E-UTRA	Square (4.5 MHz)	45 dB (Note 3)
NOTE 1: $BW_{Channel}$ and BW_{Config} are the *IAB-DU 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 (BW_{Config}). 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 6.6.3.2-2.

Table 6.6.3.2-2: IAB-DU type 1-H and IAB-MT 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 6.6.3.2-3.

Table 6.6.3.2-3: IAB-DU type 1-H and IAB-MT type 1-H ACLR limit in non-contiguous spectrum or multiple bands

IAB-DU and IAB-MT channel bandwidth of lowest/highest carrier transmitted $BW_{Channel}$ (MHz)	Sub-block or Inter RF Bandwidth gap size (W_{gap}) where the limit applies (MHz)	IAB-DU and IAB-MT adjacent channel centre frequency offset below or above the sub-block or IAB-DU or IAB-MT RF Bandwidth edge (inside the gap)	Assumed adjacent channel carrier	Filter on the adjacent channel frequency and corresponding filter bandwidth	ACLR limit
5, 10, 15, 20	W_{gap} ≥ 15 (Note 3) W_{gap} ≥ 45 (Note 4)	2.5 MHz	5 MHz NR (Note 2)	Square (BW_{Config})	45 dB
	W_{gap} ≥ 20 (Note 3) W_{gap} ≥ 50 (Note 4)	7.5 MHz	5 MHz NR (Note 2)	Square (BW_{Config})	45 dB
25, 30, 40, 50, 60, 70, 80, 90, 100	W_{gap} ≥ 60 (Note 4) W_{gap} ≥ 30 (Note 3)	10 MHz	20 MHz NR (Note 2)	Square (BW_{Config})	45 dB
	W_{gap} ≥ 80 (Note 4) W_{gap} ≥ 50 (Note 3)	30 MHz	20 MHz NR (Note 2)	Square (BW_{Config})	45 dB
NOTE 1: BW_{Config} is the transmission bandwidth configuration of the assumed adjacent channel carrier. NOTE 2: With SCS that provides largest transmission bandwidth configuration (BW_{Config}). NOTE 3: Applicable in case the *IAB-DU* or *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz. NOTE 4: Applicable in case the *IAB-DU* 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, *IAB-MT RF Bandwidth edges* or *IAB-DU 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 6.6.3.2-4: IAB-DU type 1-H and IAB-MT type 1-H CACLR limit

IAB-DU and IAB-MT channel bandwidth of lowest/highest carrier transmitted $BW_{Channel}$ (MHz)	Sub-block or Inter RF Bandwidth gap size (W_{gap}) where the limit applies (MHz)	IAB-DU and IAB-MT adjacent channel centre frequency offset below or above the sub-block or IAB-DU or IAB-MT RF Bandwidth edge (inside the gap)	Assumed adjacent channel carrier	Filter on the adjacent channel frequency and corresponding filter bandwidth	CACLR limit
5, 10, 15, 20	5 ≤W_{gap}< 15 (Note 3) 5 ≤W_{gap}< 45 (Note 4)	2.5 MHz	5 MHz NR (Note 2)	Square (BW_{Config})	45 dB
	10 < W_{gap}< 20 (Note 3) 10 ≤W_{gap}< 50 (Note 4)	7.5 MHz	5 MHz NR (Note 2)	Square (BW_{Config})	45 dB
25, 30, 40, 50, 60, 70, 80,90, 100	20 ≤W_{gap}< 60 (Note 4) 20 ≤W_{gap}< 30 (Note 3)	10 MHz	20 MHz NR (Note 2)	Square (BW_{Config})	45 dB
	40 < W_{gap}< 80 (Note 4) 40 ≤W_{gap}< 50 (Note 3)	30 MHz	20 MHz NR (Note 2)	Square (BW_{Config})	45 dB
NOTE 1: BW_{Config} is the transmission bandwidth configuration of the assumed adjacent channel carrier. NOTE 2: With SCS that provides largest transmission bandwidth configuration (BW_{Config}). NOTE 3: Applicable in case the *IAB-DU* or *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz. NOTE 4: Applicable in case the *IAB-DU* 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-DU and IAB-MT 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	-32 dBm/MHz

Table 6.6.3.2-6: 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*

6.6.3.3 Minimum requirement for *IAB-DU type 1-H* and *IAB-MT type 1-H*

The ACLR (CACLR) absolute *basic limits* in table 6.6.3.2-2 + X, 6.6.3.2-5 + X (where X = $10\log_{10}(N_{TXU,countedpercell})$) or the ACLR (CACLR) *limits* in table 6.6.3.2-1, 6.6.3.2-3 or 6.6.3.2-4, whichever is less stringent, shall apply for each *TAB connector TX min cell group*.

NOTE: Conformance to the *IAB-DU type 1-H* and *IAB-MT type 1-H* ACLR requirements 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 *basic limit*. 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 *basic limit* 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-DU type 1-H* or *IAB-MT type 1-H* is 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. 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* scaled by X -10log$_{10}$(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 General

Unless otherwise stated, the operating band unwanted emission (OBUE) limits for IAB-DU in FR1 are defined from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band* up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*. The values of Δf_{OBUE} 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 Δf_{OBUE} below the lowest frequency of each supported uplink *operating band* up to Δf_{OBUE} above the highest frequency of each supported uplink *operating band*. The values of Δf_{OBUE} 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_offset_{max} is the offset to the frequency Δf_{OBUE} outside the downlink *operating band* of IAB-DU and uplink *operating band* of IAB-MT, where Δf_{OBUE} is defined in tables 6.6.1-1 and 6.6.1-2.
- Δf_{max} is equal to f_offset_{max} minus half of the bandwidth of the measuring filter.

For a *multi-band connector* inside any *Inter RF Bandwidth gaps* with $W_{gap} < 2*\Delta f_{OBUE}$, a combined *basic* limit shall be applied which is the cumulative sum of the *basic limit*s specified at the *IAB-DU* and *IAB-MT RF Bandwidth edges* on each side of the *Inter RF Bandwidth gap*. The *basic limit* for *IAB-DU* and *IAB-MT 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-DU* or *IAB-MT RF Bandwidth edge* frequency and the nominal -3 dB point of the measuring filter closest to the *IAB-DU* or *IAB-MT RF Bandwidth edge*.
- f_offset is the separation from the *IAB-DU* or *IAB-MT RF Bandwidth edge* frequency to the centre of the measuring filter.
- f_offset_{max} is equal to the *Inter RF Bandwidth gap* minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to f_offset_{max} 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 $2*\Delta f_{OBUE}$, f_offset_{max} shall be the offset to the frequency Δf_{OBUE} 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 (Δf_{max}), shall apply from Δf_{OBUE} MHz below the lowest frequency, up to Δf_{OBUE} 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 $2*\ \Delta f_{OBUE}$, f_offsetmax shall be the offset to the frequency Δf_{OBUE} 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 Δf_{OBUE} MHz below the lowest frequency, up to Δf_{OBUE} 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_offset_{max} is equal to the *sub-block gap* bandwidth minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to f_offset_{max} 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 *Basic limits*

6.6.4.2.1 *Basic limits* for Wide Area IAB-DU and Wide Area IAB-MT (Category A)

For operating in Bands n41, n77, n78, n79, *basic limits* are specified in table 6.6.4.2.1-1:

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	$-7 dBm - \frac{7}{5} \cdot \left(\frac{f\_offset}{MHz} - 0.05 \right) dB$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf_{max})	5.05 MHz ≤ f_offset < min(10.05 MHz, f_offset_{max})	-14 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf_{max}	10.5 MHz ≤ f_offset < f_offset_{max}	-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 Δf ≥ 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*Δf_{OBUE} 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 Δf_{max} < 10 MHz.

6.6.4.2.2 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 6.6.4.2.2.1 shall be applied.

6.6.4.2.2.1 Category B requirements

For IAB-DU and IAB-MT operating in Bands n41, n77, n78, n79 *basic limits* are specified in tables 6.6.4.2.2.1-1:

Table 6.6.4.2.2.1-1: 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	$-7dBm-\frac{7}{5}\cdot\left(\frac{f\_offset}{MHz}-0.05\right)dB$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf_{max})	5.05 MHz ≤ f_offset < min(10.05 MHz, f_offset_{max})	-14 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf_{max}	10.5 MHz ≤ f_offset < f_offset_{max}	-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 Δf ≥ 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*Δf_{OBUE} 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 Δf_{max} < 10 MHz.			

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

For Medium Range IAB-DU, *basic limits* are specified in table 6.6.4.2.3-1 and table 6.6.4.2.3-2.

For the tables in this clause for *IAB-DU type 1-H* and *IAB-DU type 1-O* $P_{rated,x} = P_{rated,c,cell} - 10*\log_{10}(N_{TXU,countedpercell})$,

Table 6.6.4.2.3-1: Medium Range IAB-DU *operating band* unwanted emission limits, 31< $P_{rated,x}$ ≤ 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	$P_{rated,x}-53dB-\frac{7}{5}\left(\frac{f\_offset}{MHz}-0.05\right)dB$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf_{max})	5.05 MHz ≤ f_offset < min(10.05 MHz, f_offset_{max})	$P_{rated,x}$ - 60dB	100 kHz
10 MHz ≤ Δf ≤ Δf_{max}	10.05 MHz ≤ f_offset < f_offset_{max}	Min($P_{rated,x}$ - 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 Δf ≥ 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($P_{rated,x}$ -60dB, -25dBm)/100kHz. NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2*Δf_{OBUE} 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 Δf_{max} < 10 MHz.			

Table 6.6.4.2.3-2: Medium Range IAB-DU operating band unwanted emission limits, $P_{rated,x} \le 31$ 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	$-22\,\mathrm{dBm} - \frac{7}{5}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf_{max})	5.05 MHz ≤ f_offset < min(10.05 MHz, f_offset_{max})	-29 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf_{max}	10.05 MHz ≤ f_offset < f_offset_{max}	-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 Δf ≥ 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*Δf_{OBUE} 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 Δf_{max} < 10 MHz.

6.6.4.2.4 *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 6.6.4.2.4-1.

Table 6.6.4.2.4-1: 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	$-30\,dBm - \frac{7}{5}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf_{max})	5.05 MHz ≤ f_offset < min(10.05 MHz, f_offset_{max})	-37 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf_{max}	10.05 MHz ≤ f_offset < f_offset_{max}	-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 Δf ≥ 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*Δf_{OBUE} 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 Δf_{max} < 10 MHz.

6.6.4.2.5 *Basic limits* for additional requirements

6.6.4.2.5.1 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 [20], when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer.

6.6.4.3 Minimum requirements for *IAB-DU type 1-H* and *IAB-MT type 1-H*

The operating band unwanted emissions requirements for *IAB-DU type 1-H* and *IAB-MT 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 = $10\log_{10}(N_{TXU,countedpercell})$.

NOTE: Conformance to the *IAB-DU type 1-H* and *IAB-MT 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 $-10\log_{10}(n)$, 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 General

For IAB-DU, the transmitter spurious emission limits shall apply from 9 kHz to 12.75 GHz, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} 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 [2].

For IAB-MT, the transmitter spurious emission limits shall apply from 9 kHz to 12.75 GHz, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported uplink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported uplink *operating band*, where the Δf_{OBUE} 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 [2].

For a *multi-band connector*, for each supported *operating band* together with Δf_{OBUE} 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 Basic limits

6.6.5.2.1 General transmitter spurious emissions requirements

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 – 5^{th} 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 [2], s4.1.
NOTE 2: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1.
NOTE 3: For IAB-DU, this spurious frequency range applies only for *operating bands* for which the 5^{th} 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 5^{th} 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-DU type 1-H and IAB-MT 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 – 5^{th} 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 [2], s4.1.
NOTE 2: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1.
NOTE 3: For IAB-DU, this spurious frequency range applies only for *operating bands* for which the 5^{th} 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 5^{th} 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-DU type 1-H and IAB-MT 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 CDMA850	869 – 894 MHz	-57 dBm	100 kHz	
	824 – 849 MHz	-61 dBm	100 kHz	
UTRA FDD Band I or E-UTRA Band 1 or NR Band n1	2110 – 2170 MHz	-52 dBm	1 MHz	
	1920 – 1980 MHz	-49 dBm	1 MHz	
UTRA FDD Band II or E-UTRA Band 2 or NR Band n2	1930 – 1990 MHz	-52 dBm	1 MHz	
	1850 – 1910 MHz	-49 dBm	1 MHz	
UTRA FDD Band III or E-UTRA Band 3 or NR Band n3	1805 – 1880 MHz	-52 dBm	1 MHz	
	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 Band VI, XIX or E-UTRA Band 6, 18, 19 or NR Band n18	860 – 890 MHz	-52 dBm	1 MHz	
	815 – 830 MHz	-49 dBm	1 MHz	
	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	
	2350 – 2360 MHz	-52 dBm	1 MHz	

E-UTRA Band 30 or NR Band n30	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 Δf_{OBUE} 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 co-location requirement	***Basic limits***			Measurement bandwidth	Note
		WA IAB-DU and WA IAB-MT	**MR IAB-DU**	**LA IAB-DU and LA IAB-MT**		

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 Δf_{OBUE} 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 [4].

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 Minimum requirements for *IAB-DU* and *IAB-MT type 1-H*

The Tx spurious emissions requirements for *IAB-DU type 1-H* and *IAB-MT 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 = $10\log_{10}(N_{TXU,countedpercell})$, unless stated differently in regional regulation.

NOTE: Conformance to the *IAB-DU type 1-H* and *IAB-MT 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 $-10\log_{10}(n)$, where n is the number of *TAB connectors* in the *TAB connector TX min cell group*.

6.7 Transmitter intermodulation

6.7.1 General

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 or IAB.

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 intermodulation requirement.

6.7.2 Minimum requirements for *IAB-DU type 1-H* and *IAB-MT type 1-H*

6.7. 2.1 Co-location minimum requirements

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 7.6 in the presence of an NR interfering signal according to table 6.7. 2.1-1

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*$BW_{Channel}$ (where $BW_{Channel}$ is the minimal *IAB 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. 2.1-1: 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 channel bandwidth* ($BW_{Channel}$) with 15 kHz SCS of the band defined in clause 5.3.5.
Interfering signal level	*Rated total output power* per *TAB connector* ($P_{rated,t,TABC}$) 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	$f_{offset} = \pm BW_{Channel}\left(n - \frac{1}{2}\right)$, 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.	

6.7.2.2 Intra-system minimum requirements

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6 in the presence of an NR interfering signal according to table 6.7. 2.2-1.

Table 6.7.2.2-1: 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 *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 $P_{rated,c,TABC}$.	

7 Conducted receiver characteristics

7.1 General

Void

7.2 Reference sensitivity level

7.2.1 IAB-DU reference sensitivity level

7.2.1.1 General

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

7.2.1.2 Minimum requirements for *IAB-DU type 1-H*

The wide area IAB-DU reference sensitivity level is specified the same as the wide area BS reference sensitivity level requirement for BS *type 1-H* in TS 38.104x [2], subclause 7.2.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU reference sensitivity level is specified the same as the medium range BS reference sensitivity level requirement for BS *type 1-H* in TS 38.104x [2], subclause 7.2.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU reference sensitivity level is specified the same as the local area BS reference sensitivity level requirement for BS *type 1-H* in TS 38.104x [2], subclause 7.2.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

Referenced requirements applying to NB IoT are not applicable to the IAB-DU

7.2.2 IAB-MT reference sensitivity level

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 7.2.2-1 for Wide Area IAB-MT and in table 7.2.2-2 for Local Area IAB-MT.

Table 7.2.2-1: Wide Area IAB-MT reference sensitivity levels

***IAB-MT channel bandwidth* (MHz)**	**Sub-carrier spacing (kHz)**	**Reference measurement channel**	**Reference sensitivity power level, $P_{REFSENS}$ (dBm)**
10, 15	30	G-FR1-A1-22 (Note 1)	-102.0
10, 15	60	G-FR1-A1-23 (Note 1)	-99.0
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-25 (Note 1)	-95.4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-26 (Note 1)	-95.6
NOTE 1: $P_{REFSENS}$ 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 7.2.2-2: Local Area IAB-MT reference sensitivity levels

IAB-MT channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	Reference sensitivity power level, $P_{REFSENS}$ (dBm)
10, 15	30	G-FR1-A1-22 (Note 1)	-94.0
10, 15	60	G-FR1-A1-23 (Note 1)	-91.0
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-25 (Note 1)	-87.4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-26 (Note 1)	-87.6
NOTE 1: $P_{REFSENS}$ 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 IAB-DU dynamic range

7.3.1.1 General

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 *antenna connector* for *IAB-DU type 1-C* or *TAB connector* for *IAB-DU type 1-H* 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.

7.3.1.2 Minimum requirement for *IAB-DU type 1-H*

The wide area IAB-DU dynamic range is specified the same as the wide area BS dynamic requirement for BS *type 1-H* in TS 38.104x[2], subclause 7.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU dynamic range is specified the same as the medium range BS dynamic range requirement for BS *type 1-H* in TS 38.104x[2], subclause 7.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU dynamic range is specified the same as the local area BS dynamic range requirement for BS *type 1-H* in TS 38.104x[2], subclause 7.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

Referenced requirements applying to NB IoT are not applicable to the IAB-DU

7.4 In-band selectivity and blocking

7.4.1 Adjacent Channel Selectivity (ACS)

7.4.1.1 General

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-MT type 1-H or IAB-DU 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 for *IAB-DU type 1-H*

Minimum requirement is the same as specified for BS type 1-H in TS38.104[2], subclause 7.4.1.2.

7.4.1.3 Minimum requirement for *IAB-MT type 1-H*

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-MT type 1-H TAB connector* are specified in table 7.4.1.3-1 and the frequency offset between the wanted and interfering signal in table 7.4.1.3-2 for ACS. The reference measurement channel for the wanted signal is identified in table 7.2.2-1 and 7.2.2-2 for each *IAB-MT channel bandwidth* and further specified in annex [A.1]. The characteristics of the interfering signal is further specified in annex [D].

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 7.4.1.3-2. 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 7.4.1.3-2. 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-MT type 1-H.*

Table 7.4.1.3-1: 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)**
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 (Note 1)	$P_{REFSENS}$ + 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-DU for that bandwidth.		

Table 7.4.1.3-2: 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**
5	±2.5025	5 MHz CP-OFDM NR signal 15 kHz SCS, 25 RBs
10	±2.5075	
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 General

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-DU type 1-H* and *IAB-MT 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 for IAB-DU type 1-H

Minimum requirement is the same as specified for BS type 1-H in TS38.104[2], subclause 7.4.2.2.

7.4.2.3 Minimum requirement for IAB-MT type 1-H

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *IAB-MT type 1-H TAB connector* using the parameters in tables 7.4.2.3-1, 7.4.2.3-2 and 7.4.2.3-3 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 [D].

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 $F_{DL,low}$ - Δf_{OOB} to $F_{DL,high}$ + Δf_{OOB}. The Δf_{OOB} for *wide area IAB-MT type 1-H* is defined in table 7.4.2.3-0.

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

Table 7.4.2.3-0: Δf_{OOB} offset for NR *operating bands*

IAB-MT type	*Operating band* characteristics	Δf_{OOB} (MHz)
IAB-MT type 1-H	$F_{DL,high} – F_{DL,low}$ < 100 MHz	20
	100 MHz ≤ $F_{DL,high} – F_{DL,low}$ ≤ 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 tables 7.4.2.3-1. 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 tables 7.4.2.3-1.

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 7.4.2.3-3. 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 7.4.2.3-3. The interfering signal offset is defined relative to the *IAB-MT RF Bandwidth* edges inside the *Inter RF Bandwidth gap*.

Table 7.4.2.3-1: 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**
5, 10, 15, 20	$P_{REFSENS}$ + 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	$P_{REFSENS}$ + 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: $P_{REFSENS}$ depends on the RAT. For NR, $P_{REFSENS}$ depends also on the IAB-MT *channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2.				

Table 7.4.2.3-2: 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)**
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80,90, 100 (Note 1)	$P_{REFSENS}$ + 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: $P_{REFSENS}$ 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 7.4.2.2-3: 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	20 MHz CP-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-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 General

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-DU type 1-H and IAB-MT 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 for IAB-DU type 1-H

Minimum requirement is the same as specified for BS type 1-H in TS38.104[2], subclause 7.5.2.

7.5.2 Co-location minimum requirements for IAB-DU type 1-H

Minimum requirement is the same as specified for BS type 1-H in TS38.104[2], subclause 7.5.3.

7.5.2 Minimum requirement for IAB-MT type 1-H

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *IAB-Node type 1-H TAB connector* using the parameters in table 7.5.2-1. The reference measurement channel for the wanted signal is identified in subclause 7.2.1 and subclause 7.2.2 for each *IAB-Node channel bandwidth* and further specified in [annex A.1].

The out-of-band blocking requirement apply from 1 MHz to $F_{DL,low}$ - Δf_{OOB} and from $F_{DL,high}$ + Δf_{OOB} up to 12750 MHz. The Δf_{OOB} for *IAB-MT type 1-H* is defined in table 7.5.2-1.

Table 7.5.2-1: Δf_{OOB} offset for NR *operating bands*

IAB-MT type	*Operating band* characteristics	Δf_{OOB} (MHz)
type 1-H	$F_{DL,high} – F_{DL,low} < 100$ MHz	20
	100 MHz $\le F_{DL,high} – F_{DL,low} \le$ 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 7.5.2-1: Out-of-band blocking performance requirement for NR

Wanted Signal mean power (dBm)	Interfering Signal mean power (dBm)	Type of Interfering Signal
$P_{REFSENS}$ +6 dB (Note)	-15	CW carrier
NOTE 1: For NR, $P_{REFSENS}$ depends also on the *IAB-MT channel bandwidth* as specified in subclause 7.2.1 and subclause 7.2.2.		

7.5.3 Co-location minimum requirements for *IAB-MT type 1-H*

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 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 7.5.3-1 for all the IAB Node classes. The reference measurement channel for the wanted signal is identified in subclause 7.2.1 and subclause 7.2.2 for each *IAB 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-MT type 1-H.*

Table 7.5.3-1: 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*	$P_{REFSENS}$ +6dB (Note 1)	+16	x (Note 2)	CW carrier
NOTE 1: $P_{REFSENS}$ depends on the *IAB 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 Δf_{OOB} immediately outside any of the supported downlink *operating band(s)*.				

7.6 Receiver spurious emissions

7.6.1 General

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-DU type 1-H and IAB-MT 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-DU type 1-H* and *IAB-MT 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-DU type 1-H* and *IAB-MT 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 ($N_{RXU,counted}$) for IAB-DU *type 1-H* and *IAB-MT type 1-H* is calculated as follows:

$$N_{RXU,counted} = min(N_{RXU,active} , 8 \times N_{cells})$$

$N_{RXU,countedpercell}$ is used for scaling of *basic limits* and is derived as $N_{RXU,countedpercell} = N_{RXU,counted} / N_{cells}$, where N_{cells} is defined in clause 6.1.

NOTE: $N_{RXU,active}$ is the number of actually active receiver units and is independent to the declaration of N_{cells}.

7.6.2. IAB-DU receiver spurious emissions

7.6.2.1 Basic limits

The receiver spurious emissions *basic limits* are provided in table 7.6.2.1-1.

Table 7.6.2.1-1: General IAB-DU 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 UL *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 [16], s4.1. NOTE 2: Upper frequency as in ITU-R SM.329 [16], 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 Δf_{OBUE} below the lowest frequency of the IAB transmitter *operating band* to Δf_{OBUE} above the highest frequency of the IAB transmitter *operating band* may be excluded from the requirement. Δf_{OBUE} is defined in clause [6.6.1]. For *multi-band connectors*, the exclusion applies for all supported *operating bands*.			

7.6.2.2 Minimum requirement for IAB-DU type 1-H

The RX spurious emissions requirements for *IAB-DU type 1-H* are that for each applicable *basic limit* specified in table 7.6.2.1-1 for each *TAB connector RX min cell group*, the power sum of emissions at respective *TAB connectors* shall not exceed the BS limits specified as the *basic limit*s + X, where X = $10\log_{10}(N_{RXU,countedpercell})$, 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 BS.

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 $-10\log_{10}(n)$, where n is the number of *TAB connectors* in the *TAB connector RX min cell group*.

7.6.3. IAB-MT receiver spurious emissions

7.6.3.1 Basic limits

The IAB-MT receiver spurious emissions *basic limits* are provided in table 7.6.3.1-1.

Table 7.6.3.1-1: 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 [16], s4.1. NOTE 2: Upper frequency as in ITU-R SM.329 [16], 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 Δf_{OBUE} below the lowest frequency of the IAB-MT transmitter *operating band* to Δf_{OBUE} above the highest frequency of the IAB-MT transmitter *operating band* may be excluded from the requirement. Δf_{OBUE} is defined in clause [6.6.1]. For *multi-band connectors*, the exclusion applies for all supported *operating bands*.			

7.6.3.2 Minimum requirement for IAB-MT type 1-H

The RX spurious emissions requirements for *IAB-MT type 1-H* are that for each applicable *basic limit* specified in table 7.6.3.1-1 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 = $10\log_{10}(N_{RXU,countedpercell})$, 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 $-10\log_{10}(n)$, where n is the number of *TAB connectors* in the *TAB connector RX min cell group*.

7.7 Receiver intermodulation

7.7.1 General

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 TAB connector for IAB-DU type 1-H [and IAB-MT 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 for *IAB-DU type 1-H*

The Wide Area IAB-DU receiver intermodulation requirement is specified the same as the Wide Area receiver intermodulation requirement for BS *type 1-H* in TS 38.104[2], subclause 7.7.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The Medium Range IAB-DU receiver intermodulation requirement is specified the same as the Medium Range BS receiver intermodulation requirement for BS *type 1-H* in TS 38.104[2], subclause 7.7.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The Local Area IAB-DU receiver intermodulation requirement is specified the same as the Local Area BS receiver intermodulation requirement for BS *type 1-H* in TS 38.104[2], subclause 7.7.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

Referenced requirements applying to NB-IoT are not applicable to the IAB-DU

7.7.3. Minimum requirement for *IAB-MT type 1-H*

The Wide Aarea IAB-MT receiver intermodulation requirement is specified the same as the Wide Area receiver intermodulation requirement for BS *type 1-H* in TS 38.104[x], subclause 7.7.2, where references to *BS channel bandwidth* apply to *IAB-MT channel bandwidth*.

The Local Area IAB-MT receiver intermodulation requirement is specified the same as theLocal Area BS receiver intermodulation requirement for BS *type 1-H* in TS 38.104[x], subclause 7.7.2, where references to *BS channel bandwidth* apply to *IAB-MT channel bandwidth*.

Interfering signal for IAB-MT *type 1-H* should be CP-OFDM.

7.8 In-channel selectivity

7.8.1 General

In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations *TAB connector* for *IAB-DU type 1-H* 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 for *IAB-DU type 1-H*

The wide area IAB-DU receiver in-channel selectivity requirement is specified the same as the wide area receiver in-channel selectivity requirement for BS *type 1-H* in TS 38.104[2], subclause 7.8.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU receiver in-channel selectivity requirement is specified the same as the medium range BS receiver in-channel selectivity requirement for BS *type 1-H* in TS 38.104[2], subclause 7.8.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU receiver in-channel selectivity requirement is specified the same as the local area BS receiver in-channel selectivity requirement for BS *type 1-H* in TS 38.104[2], subclause 7.8.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

Referenced requirements applying to NB-IoT are not applicable to the IAB-DU

8 Conducted performance requirements

Void

9 Radiated transmitter characteristics

9.1 General

Radiated transmitter characteristics requirements apply on the *IAB-DU* and *IAB-MT type 1-H*, *IAB-DU* and *IAB-MT type 1-O*, or *IAB-DU* and *IAB-MT type 2-O* including all its functional components active and for all foreseen modes of operation unless otherwise stated.

When calculating the IAB output power and TX emissions limits ($N_{TXU,counted}$) defined for *IAB-DU and IAB-MT type 1-H* in sub-clause 6.1 shall be applied for *IAB-MT type 1-O*.

9.2 Radiated transmit power

9.2.1 General

IAB-DU and *IAB-MT type 1-H, IAB-DU* and *IAB-MT type 1-O* and *IAB-DU* and *IAB-MT type 2-O* are declared to support one or more beams, as per manufacturer's declarations. Radiated transmit power is defined as the EIRP level for a declared beam at a specific *beam peak direction*. Declarations are done for IAB-DU and IAB-MT separately.

For each beam, the requirement is based on declaration of a beam identity, *reference beam direction pair*, beamwidth, *rated beam EIRP*, *OTA peak directions set*, the *beam direction pairs* at the maximum steering directions and their associated *rated beam EIRP* and beamwidth(s).

For a declared beam and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the base station is declared to radiate at the associated *beam peak direction* during the *transmitter ON period*.

For each *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a specific *rated beam EIRP* level may be claimed. Any claimed value shall be met within the accuracy requirement as described below. *Rated beam EIRP* is only required to be declared for the *beam direction pairs* subject to conformance testing.

NOTE 1: *OTA peak directions set* is set of *beam peak directions* for which the EIRP accuracy requirement is intended to be met. 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.

NOTE 2: A *beam direction pair* is data set consisting of the *beam centre direction* and the related *beam peak direction.*

NOTE 3: A declared EIRP value is a value provided by the manufacturer for verification according to the conformance specification declaration requirements, whereas a claimed EIRP value is provided by the manufacturer to the equipment user for normal operation of the equipment and is not subject to formal conformance testing.

For *operating bands* where the supported *fractional bandwidth* (FBW) is larger than 6%, two rated carrier EIRP may be declared by manufacturer:

- $P_{rated,c,FBWlow}$ for lower supported frequency range, and
- $P_{rated,c,FBWhigh}$ for higher supported frequency range.

For frequencies in between F_{FBWlow} and $F_{FBWhigh}$ the rated carrier EIRP is:

- $P_{rated,c,FBWlow,}$ for the carrier whose carrier frequency is within frequency range $F_{FBWlow} \leq f < (F_{FBWlow} + F_{FBWhigh}) / 2$,
- $P_{rated,c,FBWhigh,}$ for the carrier whose carrier frequency is within frequency range $(F_{FBWlow} + F_{FBWhigh}) / 2 \leq f \leq F_{FBWhigh}$.

9.2.2 Minimum requirement for IAB-DU type 1-H, IAB-DU type 1-O, IAB-MT type 1-H and IAB-MT type 1-O

For each declared beam, in normal conditions, for any specific *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a manufacturer claimed EIRP level in the corresponding *beam peak direction* shall be achievable to within ±2.2 dB of the claimed value.

For *IAB type 1-O* only, for each declared beam, in extreme conditions, for any specific *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a manufacturer claimed EIRP level in the corresponding *beam peak direction* shall be achievable to within ±2.7 dB of the claimed value.

Normal and extreme conditions are defined in [TS 38.141-2, annex B [6]].

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

9.2.3 Minimum requirement for IAB-DU type 2-O and IAB-MT type 2-O

For each declared beam, in normal conditions, for any specific *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a manufacturer claimed EIRP level in the corresponding *beam peak direction* shall be achievable to within ± 3.4 dB of the claimed value.

For each declared beam, in extreme conditions, for any specific *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a manufacturer claimed EIRP level in the corresponding *beam peak direction* shall be achievable to within ± 4.5 dB of the claimed value.

Normal and extreme conditions are defined in [TS 38.141-2, annex B [6]].

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

9.2.4 Configured radiated output power

9.2.4.1 IAB-MT configured output power for IAB-MT type 1-H, 1-O and 2-O

The configured maximum output power $P_{CMAX,f,c}$ is set in each slot according to the following equation:

$$P_{CMAX,f,c} = P_{Rated,c,EIRP}$$

where $P_{Rated,c,EIRP}$ is declared by manufacturer.

9.3 IAB output power

9.3.1 General

OTA IAB output power is declared as the TRP radiated requirement, with the output power accuracy requirement defined at the RIB during the *transmitter ON period*. TRP does not change with beamforming settings as long as the *beam peak direction* is within the *OTA peak directions set*. Thus the TRP accuracy requirement must be met for any beamforming setting for which the *beam peak direction* is within the *OTA peak directions set*. Declarations are made separately for IAB-DU and IAB-MT.

The IAB *rated carrier TRP output power* for *IAB type 1-O* shall be within limits as specified in table 9.3.1-1 for *IAB-DU type 1-O* and in table 9.3.1-2 for *IAB-MT type 1-O*.

Table 9.3.1-1: IAB-DU *rated carrier TRP output power* limits for *IAB-DU type 1-O*

IAB-DU class	$P_{rated,c,TRP}$
Wide Area IAB-DU	(note)
Medium Range IAB-DU	≤ + 47 dBm
Local Area IAB-DU	≤ + 33 dBm
NOTE: There is no upper limit for the $P_{rated,c,TRP}$ of the Wide Area IAB-DU	

Table 9.3.1-2: IAB-MT *rated carrier TRP output power* limits for *IAB-MT type 1-O*

IAB-MT class	$P_{rated,c,TRP}$
Wide Area IAB-MT	(note)
Local Area IAB-MT	≤ 24 dBm + 10log($N_{TXU,counted}$)
NOTE: There is no upper limit for the $P_{rated,c,TRP}$ of the Wide Area IAB-MT.	

There is no upper limit for the *rated carrier TRP output power* of *IAB type 2-O*.

Despite the general requirements for the IAB output power described in clauses 9.3.2 – 9.3.3, additional regional requirements might be applicable.

NOTE: In certain regions, power limits corresponding to IAB classes may apply for *IAB type 2-O*.

9.3.2 Minimum requirement for IAB-DU type 1-O and IAB-MT type 1-O

In normal conditions, the *IAB type 1-O maximum carrier TRP output power*, $P_{max,c,TRP}$ measured at the RIB shall remain within ±2 dB of the *rated carrier TRP output power* $P_{rated,c,TRP}$, as declared by the manufacturer.

Normal conditions are defined in [TS 38.141-1, annex B [6]].

9.3.3 Minimum requirement for IAB type 2-O

In normal conditions, the *IAB type 2-O maximum carrier TRP output power*, $P_{max,c,TRP}$ measured at the RIB shall remain within ±3 dB of the *rated carrier TRP output power* $P_{rated,c,TRP}$, as declared by the manufacturer.

Normal conditions are defined in [TS 38.141-2, annex B [6]].

9.4 OTA output power dynamics

9.4.1 IAB-DU OTA Output Power Dynamics

9.4.1.1 General

The requirements in clause 9.4 apply during the *transmitter ON period*. Transmit signal quality (as specified in clause 9.6) shall be maintained for the output power dynamics requirements.

The OTA output power requirements are *directional requirements* and apply to the *beam peak directions* over the *OTA peak directions set*.

9.4.1.2 OTA RE power control dynamic range

9.4.1.2.1 General

The OTA RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS at maximum output power ($P_{max,c,EIRP}$) for a specified reference condition.

This requirement shall apply at each RIB supporting transmission in the *operating band*.

9.4.1.2.2 Minimum requirement for *IAB-DU type 1-O*

The OTA RE power control dynamic range is specified the same as the conducted RE power control dynamic range requirement for BS *type 1-H* in TS 38.104x[2], subclause 6.3.2.2.

9.4.1.3 OTA total power dynamic range

9.4.1.3.1 General

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

This requirement shall apply at each RIB supporting transmission in the *operating band*.

NOTE 1: The upper limit of the OTA total power dynamic range is the IAB-DU maximum carrier EIRP ($P_{max,c,EIRP}$) when transmitting on all RBs. The lower limit of the OTA total power dynamic range is the average EIRP for single RB transmission in the same direction using the same beam. The OFDM symbol carries PDSCH and not contain RS or SSB.

9.4.1.3.2 Minimum requirement for *IAB-DU type 1-O*

The OTA total power dynamic range is specified the same as the total power dynamic range requirement for BS *type 1-H* in TS 38.104x[2], subclause 6.3.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

9.4.1.3.3 Minimum requirement for *IAB-DU type 2-O*

The OTA total power dynamic range is specified the same as the OTA total power dynamic range requirement for BS *type 2-O* in TS 38.104x[2], subclause 9.4.3.3.

9.4.2 IAB-MT OTA Output Power Dynamics

9.4.2.1 OTA total power dynamic range

9.4.2.1.1 General

The OTA 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.

This requirement shall apply at each RIB supporting transmission in the *operating band*.

9.4.2.1.2 Minimum requirement for IAB-MT type 1-O

For a wide area IAB-MT the total power dynamic range for each NR carrier shall be larger than or equal to 5 dB.

For a local area IAB-MT the total power dynamic range for each NR carrier shall be larger than or equal to 10 dB.

9.4.2.1.3 Minimum requirement for IAB-MT type 2-O

For a wide area IAB-MT the total power dynamic range for each NR carrier shall be larger than or equal to 5 dB.

For a local area IAB-MT the total power dynamic range for each NR carrier shall be larger than or equal to 10 dB.

9.4.3 Power control

9.4.3.1 Power control for local area IAB-MT type 1-O

9.4.3.1.1 Relative EIRP tolerance for local area IAB-MT type 1-O

The relative EIRP tolerance is the ability of the transmitter to set its radiated 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 20 ms.

The minimum requirements specified in Table 9.4.3.1.1-1 apply only when the output power is within the limits set by declared maximum output power and specified dynamic range.

2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep. For those exceptions, the power tolerance limit is a maximum of [± 11.0 dB] in Table 9.4.3.1.1-1.

Table 9.4.3.1.1-1: Relative EIRP tolerance for local area IAB-MT type 1-O

Power step ΔP (Up or down) (dB)	EIRP tolerance (dB)
ΔP < 2	[± 2.5]
2 ≤ ΔP < 3	[± 3.5]
3 ≤ ΔP < 4	[± 4.5]
4 ≤ ΔP < 10	[± 5.5]

9.4.3.1.2 Aggregate EIRP tolerance for local area IAB-MT type 1-O

The aggregate EIRP control tolerance is the ability of the transmitter to maintain its EIRP in a sub-frame (1 ms) during non-contiguous transmissions within [21ms] in response to 0 dB TPC commands with respect to the first UE transmission and all other power control parameters as specified in 3GPP TS 38.213 [10]kept constant.

The minimum requirements specified in Table 9.4.3.1.2-1 apply only when the output power is within the limits set by declared maximum output power and specified dynamic range.

Table 9.4.3.1.2-1: Aggregate power tolerance for local area IAB-MT type 1-O

TPC command	UL channel	Aggregate EIRP tolerance within [21 ms]
0 dB	PUCCH	[± 2.5 dB]
0 dB	PUSCH	[± 3.5 dB]

9.4.3.2 Power control for local area IAB-MT type 2-O

9.4.3.2.1 Relative EIRP tolerance for local area IAB-MT type 2-O

The relative EIRP tolerance is the ability of the transmitter to set its radiated 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 20 ms.

The minimum requirements specified in Table 9.4.3.1.1-1 apply only when the output power is within the limits set by declared maximum output power and specified dynamic range.

2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep. For those exceptions, the power tolerance limit is a maximum of [± 11.0 dB] in Table 9.4.3.1.1-1.

Table 9.4.3.2.1-1: Relative EIRP tolerance for local area IAB-MT type 2-O

Power step ∆P (Up or down) (dB)	EIRP tolerance (dB)
ΔP < 2	[±5.0]
2 ≤ ΔP < 3	[±6.0]
3 ≤ ΔP < 4	[±7.0]
4 ≤ ΔP < 10	[±8.0]

9.4.3.2.2 Aggregate EIRP tolerance for local area IAB-MT type 2-O

The aggregate EIRP control tolerance is the ability of the transmitter to maintain its EIRP in a sub-frame (1 ms) during non-contiguous transmissions within [21ms] in response to 0 dB TPC commands with respect to the first UE transmission and all other power control parameters as specified in 3GPP TS 38.213 [10] kept constant.

The minimum requirements specified in Table 9.4.3.1.2-1 apply only when the output power is within the limits set by declared maximum output power and specified dynamic range.

Table 9.4.3.2.2-1: Aggregate power tolerance for local area IAB-MT type 2-O

TPC command	UL channel	Aggregate EIRP tolerance within [21 ms]
0 dB	PUCCH	[± 5.5 dB]
0 dB	PUSCH	[± 5.5 dB]

9.5 OTA transmit ON/OFF power

9.5.1 General

OTA transmit ON/OFF power requirements apply to TDD operation of IAB-DU and FDD/TDD operation of IAB-MT.

9.5.2 OTA transmitter OFF power

9.5.2.1 General

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

For IAB supporting intra-band contiguous CA, the OTA 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-DU/MT Channel Bandwidth* $BW_{Channel\_CA}$ centred on ($F_{edge,high}$+$F_{edge,low}$)/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*.

For *IAB type 1-O*, the transmitter OFF power is defined as the output power at the *co-location reference antenna* conducted output(s). For *IAB type 2-O* the transmitter OFF power is defined as TRP.

For *multi-band RIBs* and *single band RIBs* supporting transmission in multiple bands, the requirement is only applicable during the *transmitter OFF period* in all supported *operating bands*.

9.5.2.2 Minimum requirement for IAB-DU type 1-O

The BS requirements specified in 9.5.2.2 in TS 38.104 [2] apply to *IAB-DU type 1-O*.

9.5.2.3 Minimum requirement for IAB-DU type 2-O

The BS requirements specified in 9.5.2.3 in TS 38.104 [2] apply to *IAB-DU type 1-O*.

9.5.2.4 Minimum requirement for IAB-MT type 1-O

The BS requirements specified in 9.5.2.2 in TS 38.104 [2] apply to *IAB-MT type 1-O*.

9.5.2.5 Minimum requirement for IAB-MT type 2-O

The BS requirements specified in 9.5.2.3 in TS 38.104 [2] apply to *IAB-DU type 1-O*.

9.5.3 OTA transient period

9.5.3.1 General

The OTA *transmitter transient period* is the time period during which the transmitter is changing from the tra*nsmitter 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.

This requirement shall be applied at each RIB supporting transmission in the *operating band*.

9.5.3.2 Minimum requirement for IAB-DU type 1-O

The BS requirements specified in 9.5.3.2 in TS 38.104 [2] apply to *IAB-DU type 1-O*.

9.5.3.3 Minimum requirement for IAB-DU type 2-O

The BS requirements specified in 9.5.3.3 in TS 38.104 [2] apply to *IAB-DU type 2-O*.

9.5.3.4 Minimum requirement for IAB-MT type 1-O

The BS requirements specified in 9.5.3.2 in TS 38.104 [2] apply to *IAB-MT type 1-O*.

9.5.3.5 Minimum requirement for IAB-MT type 2-O

The BS requirements specified in 9.5.3.3 in TS 38.104 [2] apply to *IAB-MT type 2-O*.

9.6 OTA transmitted signal quality

9.6.1 OTA frequency error

9.6.1.1 IAB-DU OTA frequency error

The requirements in clause 9.6.1 for BS type 1-O and type 2-O in TS 38.104 [2] apply to IAB-DU type 1-O and type 2-O respectively.

9.6.1.2 IAB-MT OTA frequency error

9.6.1.2.1 General

The requirements in subclause 9.6.1.2 apply to the *transmitter ON period*.

OTA frequency error requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range*.

9.6.1.2.2 Minimum requirement for IAB-MT type 1-O

The IAB-MT basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of IAB-MT modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of 1 msec of cumulated measurement intervals compared to the carrier frequency received from the parent node.

9.6.1.2.3 Minimum requirement for IAB-MT type 2-O

The IAB-MT basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of IAB-MT modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of 1 msec of cumulated measurement intervals compared to the carrier frequency received from the parent node.

9.6.2 OTA modulation quality

9.6.2.1 IAB-DU OTA modulation quality

The requirements in clause 9.6.2 for BS type 1-O and type 2-O in TS 38.104 [2] apply to IAB-DU type 1-O and type 2-O respectively.

9.6.2.2 IAB-MT OTA modulation quality

9.6.2.2.1 General

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). Details about how the EVM is determined are specified in Annex D for FR1 and Annex E for FR2.

OTA modulation quality requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range*.

9.6.2.2.2 Minimum requirement for IAB-MT type 1-O

For IAB-MT type 1-O, the EVM levels of each NR carrier for different modulation schemes outlined in table 6.5.2.2.2-1 shall be met. Requirements shall be the same as clause 6.5.2.2.2.

9.6.2.2.3 Minimum requirement for IAB-MT type 2-O

For IAB-MT type 2-O, the EVM levels of each NR carrier for different modulation schemes outlined in table 9.6.2.2.3-1 shall be met.

Table 9.6.2.2.3-1: Minimum requirements for error vector magnitude

Parameter	Unit	Average EVM level
QPSK	%	17.5
16 QAM	%	12.5
64 QAM	%	8.0

9.6.3 OTA time alignment error

9.6.3.1 IAB-DU OTA time alignment error

The requirements in clause 9.6.3 for BS type 1-O and type 2-O in TS 38.104 [2] apply to IAB-DU type 1-O and type 2-O respectively.

9.7 OTA unwanted emissions

9.7.1 General

Unwanted emissions consist of so-called out-of-band emissions and spurious emissions according to ITU definitions ITU-R SM.329 [2]. 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 OTA out-of-band emissions requirement for the *IAB-MT type 1-O. IAB-DU type 1-O, IAB-DU type 1-O* and *IAB-DU type 2-O* transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and operating band unwanted emissions (OBUE). OTA Unwanted emissions outside of this frequency range are limited by an OTA spurious emissions requirement.

The maximum offset of the operating band unwanted emissions mask from the *operating band* edge is Δf_{OBUE}. The value of Δf_{OBUE} is defined in table 9.7.1-1 *IAB-DU type 1-O* and *type 2-O* and in table 9.7.1-2 *IAB-MT type 1-O* and *type 2-O* for NR *operating bands*.

Table 9.7.1-1: Maximum offset Δf_{OBUE} outside the downlink *operating band* for IAB-DU

IAB-DU type	*Operating band* characteristics	Δf_{OBUE} (MHz)
IAB-DU type 1-O	$F_{DL,high} – F_{DL,low} < 100$ MHz	10
	100 MHz $\le F_{DL,high} – F_{DL,low} \le$ 900 MHz	40

IAB-DU type 2-O	$F_{DL,high} – F_{DL,low}$ ≤ 4000 MHz	1500

Table 9.7.1-2: Maximum offset Δf$_{OBUE}$ outside the uplink *operating band* for IAB-MT

IAB-MT type	*Operating band* characteristics	Δf$_{OBUE}$ (MHz)
IAB-MT type 1-O	$F_{UL,high} – F_{UL,low}$ < 100 MHz	10
	100 MHz ≤ $F_{UL,high} – F_{UL,low}$ ≤ 900 MHz	40
IAB-MT type 2-O	$F_{UL,high} – F_{UL,low}$ ≤ 4000 MHz	1500

The unwanted emission requirements are applied per cell for all the configurations. Requirements for OTA unwanted emissions are captured using TRP, *directional requirements* or co-location requirements as described per requirement.

There is in addition a requirement for occupied bandwidth.

9.7.2 OTA occupied bandwidth

9.7.2.1 General

The OTA 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 β/2 of the total mean transmitted power. See also recommendation ITU-R SM.328 [3].

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

The OTA 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 OTA occupied bandwidth according to the definition in the present clause.

The OTA occupied bandwidth is defined as a *directional requirement* and shall be met in the manufacturer's declared *OTA coverage range* at the RIB.

9.7.2.2 Minimum requirement for *IAB-DU type 1-O* and *IAB-DU type* 2-O

The OTA occupied bandwidth for each NR carrier shall be less than the *IAB-DU channel bandwidth*. For intra-band contiguous CA, the OTA occupied bandwidth shall be less than or equal to the *Aggregated IAB-DU Channel Bandwidth*.

9.7.2.3 Minimum requirement for *IAB-MT type 1-O* and *IAB-MT type* 2-O

The OTA occupied bandwidth for each NR carrier shall be less than the *IAB-MT channel bandwidth*. For intra-band contiguous CA, the OTA occupied bandwidth shall be less than or equal to the *Aggregated IAB-MT Channel Bandwidth*.

9.7.3 OTA Adjacent Channel Leakage Power Ratio (ACLR)

9.7.3.1 General

OTA 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 measured power is TRP.

The requirement shall be applied per RIB during the *transmitter ON period*.

9.7.3.2 Minimum requirement for *IAB-DU type 1-O and IAB-MT type 1-O*

The ACLR (CACLR) absolute *basic limits* in table 6.6.3.2-2 + X, 6.6.3.2-5 + X (where and X = 9 dB for IAB-DU and X = $10\log_{10}(N_{TXU,countedpercell})$ for IAB-MT) or the ACLR (CACLR) *basic limit* in table 6.6.3.2-1, 6.6.3.2-3 or 6.6.3.2-4, whichever is less stringent, shall apply.

For a *RIB* operating in multi-carrier or contiguous CA, the ACLR requirements in clause 6.6.3.2 shall apply to *IAB-DU* and *IAB-MT channel bandwidths* of the outermost carrier for the frequency ranges defined in table 6.6.3.2-1.For a RIB 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 RIB*, 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.

9.7.3.3 Minimum requirement for *IAB-DU type 2-O* and *Wide Area IAB-MT type 2-O*

The OTA ACLR limit is specified in table 9.7.3.3-1.

The OTA ACLR absolute limit is specified in table 9.7.3.3-2.

The OTA ACLR (CACLR) absolute limit in table 9.7.3.3-2 or 9.7.3.3-5 or the ACLR (CACLR) limit in table 9.7.3.3-1, 9.7.3.3-3 or 9.7.3.3-4, whichever is less stringent, shall apply.

For a *RIB* operating in multi-carrier or contiguous CA, the OTA ACLR requirements in table 9.7.3.3-1 shall apply to *IAB-DU* and *IAB-MT channel bandwidths* of the outermost carrier for the frequency ranges defined in the table.For a RIB operating in *non-contiguous spectrum*, the OTA ACLR requirement in table 9.7.3.3-3 shall apply in *sub-block gaps* for the frequency ranges defined in the table, while the OTA CACLR requirement in table 9.7.3.3-4 shall apply in *sub-block gaps* for the frequency ranges defined in the table.

The CACLR in a *sub-block 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*, and

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

The assumed filter for the adjacent channel frequency is defined in table 9.7.3.3-4 and the filters on the assigned channels are defined in table 9.7.3.3-6.

For operation in *non-contiguous spectrum*, the CACLR for NR carriers located on either side of the *sub-block gap* shall be higher than the value specified in table 9.7.3.3-4.

Table 9.7.3.3-1: *IAB-DU type 2-O* and Wide area IAB-MT type 2-O ACLR limit

***IAB-DU* and *IAB-MT channel bandwidth* of *lowest/highest carrier* transmitted $BW_{Channel}$ (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**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**ACLR limit (dB)**
50, 100, 200, 400	$BW_{Channel}$	NR of same BW (Note 2)	Square (BW_{Config})	28 (Note 3) 26 (Note 4)

NOTE 1: $BW_{Channel}$ and BW_{Config} are the *IAB-DU* 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* (BW_{Config}).
NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz
NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz

Table 9.7.3.3-2: *IAB-DU type 2-O* and Wide area IAB-MT type 2-O ACLR absolute limit

IAB-DU and IAB-MT class	**ACLR absolute limit**
Wide area IAB-DU and Wide area IAB-MT	-13 dBm/MHz
Medium range IAB-DU	-20 dBm/MHz
Local area IAB-DU	-20 dBm/MHz

Table 9.7.3.3-3: *IAB DU type 2-O* and Wide Area IAB-MT type 2-O ACLR limit in non-contiguous spectrum

***IAB-DU* and *IAB-MT channel bandwidth* of *lowest/highest carrier* transmitted (MHz)**	***Sub-block gap* size (W_{gap}) where the limit applies (MHz)**	***IAB-DU* and *IAB-MT* adjacent channel centre frequency offset below or above the *sub-block* edge (inside the gap)**	**Assumed adjacent channel carrier**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**ACLR limit**
50, 100	W_{gap}≥ 100 (Note 5) W_{gap}≥ 250 (Note 6)	25 MHz	50 MHz NR (Note 2)	Square (BW_{Config})	28 (Note 3) 26 (Note 4)
200, 400	W_{gap}≥ 400 (Note 6) W_{gap}≥ 250 (Note 5)	100 MHz	200 MHz NR (Note 2)	Square (BW_{Config})	28 (Note 3) 26 (Note 4)
NOTE 1: BW_{Config} is the *transmission bandwidth configuration* of the assumed adjacent channel carrier. NOTE 2: With SCS that provides largest *transmission bandwidth configuration* (BW_{Config}). NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz. NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz. NOTE 5: Applicable in case the *IAB-DU or IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz. NOTE 6: Applicable in case the *IAB-DU or IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz.					

Table 9.7.3.3-4: *IAB DU type 2-O* and Wide Area IAB-MT type 2-O CACLR limit in non-contiguous spectrum

***IAB-DU* and *IAB-MT channel bandwidth* of *lowest/highest carrier* transmitted (MHz)**	***Sub-block gap* size (W_{gap}) where the limit applies (MHz)**	***IAB-DU* and *IAB-MT* adjacent channel centre frequency offset below or above the *sub-block* edge (inside the gap)**	**Assumed adjacent channel carrier**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**CACLR limit**
50, 100	50 ≤W_{gap}< 100 (Note 5) 50 ≤W_{gap}< 250 (Note 6)	25 MHz	50 MHz NR (Note 2)	Square (BW_{Config})	28 (Note 3) 26 (Note 4)
200, 400	200 ≤W_{gap}< 400 (Note 6) 200 ≤W_{gap}< 250 (Note 5)	100 MHz	200 MHz NR (Note 2)	Square (BW_{Config})	28 (Note 3) 26 (Note 4)
NOTE 1: BW_{Config} is the transmission bandwidth configuration of the assumed adjacent channel carrier. NOTE 2: With SCS that provides largest transmission bandwidth configuration (BW_{Config}). NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz. NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz. NOTE 5: Applicable in case the *IAB-DU* or *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz. NOTE 6: Applicable in case the *IAB-DU* or *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz.					

Table 9.7.3.3-5: *IAB-DU type 2-O* and Wide area IAB-MT type 2-O CACLR absolute limit

IAB-DU and IAB-MT class	**CACLR absolute limit**
Wide area IAB-DU and Wide area IAB-MT	-13 dBm/MHz
Medium range IAB-DU	-20 dBm/MHz
Local area IAB-DU	-20 dBm/MHz

Table 9.7.3.3-6: Filter parameters for the assigned channel

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

9.7.3.4 Minimum requirement for *Local Area IAB-MT type 2-O*

The OTA ACLR limit is specified in table 9.7.3.4-1.

The OTA ACLR absolute limit is specified in table 9.7.3.4-2.

The OTA ACLR (CACLR) absolute limit in table 9.7.3.4-2 or 9.7.3.4-5 or the ACLR (CACLR) limit in table 9.7.3.4-1, 9.7.3.4-3 or 9.7.3.4-4, whichever is less stringent, shall apply.

Requirements specified for Local Area IAB-DU type 2-O in clause 9.7.3.3 shall apply to Local Area IAB-MT type 2-O during transmission in DL timeslot.

For a *RIB* operating in multi-carrier or contiguous CA, the OTA ACLR requirements in table 9.7.3.4-1 shall apply to *IAB-MT channel bandwidths* of the outermost carrier for the frequency ranges defined in the table.For a RIB operating in *non-contiguous spectrum*, the OTA ACLR requirement in table 9.7.3.4-3 shall apply in *sub-block gaps* for the frequency ranges defined in the table, while the OTA CACLR requirement in table 9.7.3.4-4 shall apply in *sub-block gaps* for the frequency ranges defined in the table.

The CACLR in a *sub-block 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*, and

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

The assumed filter for the adjacent channel frequency is defined in table 9.7.3.4-4 and the filters on the assigned channels are defined in table 9.7.3.4-6.

For operation in *non-contiguous spectrum*, the CACLR for NR carriers located on either side of the *sub-block gap* shall be higher than the value specified in table 9.7.3.4-4.

Table 9.7.3.4-1: Local Area *IAB-MT type 2-O* ACLR limit

***IAB-MT channel bandwidth* of *lowest/highest carrier* transmitted $BW_{Channel}$ (MHz)**	***IAB-MT* adjacent channel centre frequency offset below the *lowest* or above the *highest carrier* centre frequency transmitted**	**Assumed adjacent channel carrier**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**ACLR limit (dB)**
50, 100, 200, 400	$BW_{Channel}$	NR of same BW (Note 2)	Square (BW_{Config})	24 (Note 3)
NOTE 1: $BW_{Channel}$ and BW_{Config} are the *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* (BW_{Config}). NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz and 37 – 52.6 GHz				

Table 9.7.3.3-2: Local Area *IAB-MT type 2-O* ACLR absolute limit

IAB-MT class	ACLR absolute limit
Local area IAB-MT	-20 dBm/MHz

Table 9.7.3.3-3: Local Area *IAB-MT type 2-O* ACLR limit in non-contiguous spectrum

***IAB-MT channel bandwidth* of *lowest/highest carrier* transmitted (MHz)**	***Sub-block gap* size (W_{gap}) where the limit applies (MHz)**	***IAB-MT* adjacent channel centre frequency offset below or above the *sub-block* edge (inside the gap)**	**Assumed adjacent channel carrier**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**ACLR limit**
50, 100	W_{gap}≥ 100 (Note 4) W_{gap}≥ 250 (Note 5)	25 MHz	50 MHz NR (Note 2)	Square (BW_{Config})	24 (Note 3)
200, 400	W_{gap}≥ 400 (Note 5) W_{gap}≥ 250 (Note 4)	100 MHz	200 MHz NR (Note 2)	Square (BW_{Config})	24 (Note 3)

NOTE 1: BW_{Config} is the *transmission bandwidth configuration* of the assumed adjacent channel carrier.
NOTE 2: With SCS that provides largest *transmission bandwidth configuration* (BW_{Config}).
NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz and 37 – 52.6 GHz.
NOTE 4: Applicable in case the *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz.
NOTE 5: Applicable in case the *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz.

Table 9.7.3.3-4: Local Area *IAB-MT type 2-O* CACLR limit in non-contiguous spectrum

***IAB-MT channel bandwidth* of *lowest/highest carrier* transmitted (MHz)**	***Sub-block gap* size (W_{gap}) where the limit applies (MHz)**	***IAB-MT* adjacent channel centre frequency offset below or above the *sub-block* edge (inside the gap)**	**Assumed adjacent channel carrier**	**Filter on the adjacent channel frequency and corresponding filter bandwidth**	**CACLR limit**
50, 100	50 ≤W_{gap}< 100 (Note 4) 50 ≤W_{gap}< 250 (Note 5)	25 MHz	50 MHz NR (Note 2)	Square (BW_{Config})	24 (Note 3)
200, 400	200 ≤W_{gap}< 400 (Note 5) 200 ≤W_{gap}< 250 (Note 4)	100 MHz	200 MHz NR (Note 2)	Square (BW_{Config})	24 (Note 3)

NOTE 1: BW_{Config} is the transmission bandwidth configuration of the assumed adjacent channel carrier.
NOTE 2: With SCS that provides largest transmission bandwidth configuration (BW_{Config}).
NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz.
NOTE 4: Applicable in case the *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz.
NOTE 5: Applicable in case the *IAB-MT channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz.

Table 9.7.3.3-5: Local Area *IAB-MT type 2-O* CACLR absolute limit

IAB-MT class	**CACLR absolute limit**
Local area IAB-MT	-20 dBm/MHz

Table 9.7.3.3-6: Filter parameters for the assigned channel

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

9.7.4 OTA operating band unwanted emissions

9.7.4.1 General

The OTA limits for operating band unwanted emissions are specified as TRP per RIB unless otherwise stated.

9.7.4.2 Minimum requirement for *IAB-DU type 1-O*

Out-of-band emissions in FR1 are limited by OTA operating band unwanted emission limits. Unless otherwise stated, the operating band unwanted emission limits in FR1 are defined from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band* up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*. The values of Δf_{OBUE} are defined in table 9.7.1-1 for the NR *operating bands*.

The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer's specification. For a *RIB* operating in multi-carrier or contiguous CA, the requirements apply to *IAB-DU channel bandwidths* of the outermost carrier for the frequency ranges defined in clause 6.6.4.1.

For a *RIB* operating in *non-contiguous spectrum*, the requirements shall apply inside any *sub-block gap* for the frequency ranges defined in clause 6.6.4.1.

For a *multi-band RIB*, the requirements shall apply inside any *Inter RF Bandwidth gap* for the frequency ranges defined in clause 6.6.4.1.

The OTA operating band unwanted emission requirement for *IAB-DU type 1-O* is that for each applicable *basic limit* in clause 6.6.4.2, the power of any unwanted emission shall not exceed an OTA limit specified as the *basic limit* + X, where X = 9 dB.

9.7.4.3 Minimum requirement for *IAB-MT type 1-O*

Out-of-band emissions in FR1 are limited by OTA operating band unwanted emission limits. Unless otherwise stated, the operating band unwanted emission limits in FR1 are defined from Δf_{OBUE} below the lowest frequency of each supported uplink *operating band* up to Δf_{OBUE} above the highest frequency of each supported uplink *operating band*. The values of Δf_{OBUE} are defined in table 9.7.1-2 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. For a *RIB* operating in multi-carrier or contiguous CA, the requirements apply to *IAB-MT channel bandwidths* of the outermost carrier for the frequency ranges defined in clause 6.6.4.1.

For a *RIB* operating in *non-contiguous spectrum*, the requirements shall apply inside any *sub-block gap* for the frequency ranges defined in clause 6.6.4.1.

For a *multi-band RIB*, the requirements shall apply inside any *Inter RF Bandwidth gap* for the frequency ranges defined in clause 6.6.4.1.

The OTA operating band unwanted emission requirement for *IAB-MT type 1-O* is that for each applicable *basic limit* in clause 6.6.4.2, the power of any unwanted emission shall not exceed an OTA limit specified as the *basic limit* + X, where $X = 10\log_{10}(N_{TXU,countedpercell})$ dB.

9.7.4.4 Additional requirements

9.7.4.4.1 Limits in FCC Title 47

The IAB-DU and IAB-MT may have to comply with the applicable emission limits established by FCC Title 47 [20], when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer.

9.7.4.5 Minimum requirement for *IAB-DU type 2-O* and *IAB-MT type 2-O*

9.7.4.5.1 General

The requirements of either clause 9.7.4.5.2 (Category A limits) or clause 9.7.4.5.3 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for General OTA transmitter spurious emissions requirements (*IAB-DU and IAB-MT type 2-O*) in clause 9.7.6.3.2. In addition, the limits in clause 9.7.4.5.4 may also apply.

Out-of-band emissions in FR2 are limited by OTA operating band unwanted emission limits.

For IAB-DU type 2-O, unless otherwise stated, the OTA operating band unwanted emission limits in FR2 are defined from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band* up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*.

For IAB-MT type 2-O, unless otherwise stated, the OTA operating band unwanted emission limits in FR2 are defined from Δf_{OBUE} below the lowest frequency of each supported uplink *operating band* up to Δf_{OBUE} above the highest frequency of each supported uplink *operating band*.

The values of Δf_{OBUE} are defined in table 9.7.1-1 and 9.7.1-2 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. For a *RIB* operating in multi-carrier or contiguous CA, the requirements apply to the frequencies (Δf_{OBUE}) starting from the edge of the *contiguous transmission bandwidth*. In addition, for a *RIB* operating in *non-contiguous spectrum*, the requirements apply inside any *sub-block gap*.

Emissions shall not exceed the maximum levels specified in the tables below, where:

- Δf is the separation between the *contiguous transmission bandwidth* edge frequency and the nominal -3dB point of the measuring filter closest to the *contiguous transmission bandwidth* edge.
- f_offset is the separation between the *contiguous transmission bandwidth* edge frequency and the centre of the measuring filter.
- f_offset_{max} is the offset to the frequency Δf_{OBUE} outside the downlink *operating band*, where Δf_{OBUE} is defined in table 9.7.1-1.
- Δf_{max} is equal to f_offset_{max} minus half of the bandwidth of the measuring filter.

In addition, inside any *sub-block gap* for a *RIB* operating in *non-contiguous spectrum*, emissions shall not exceed the cumulative sum of the limits specified for the adjacent *sub-blocks* on each side of the *sub-block gap*. The limit for each *sub-block* is specified in clauses 9.7.4.5.2 and 9.7.4.5.3 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_offset_{max} is equal to the *sub-block gap* bandwidth minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to f_offset_{max} minus half of the bandwidth of the measuring filter.

9.7.4.5.2 OTA operating band unwanted emission limits (Category A)

IAB-DU and IAB-MT unwanted emissions shall not exceed the maximum levels specified in table 9.7.4.3.2-1 and 9.7.4.3.2-2.

Table 9.7.4.5.2-1: OBUE limits applicable in the frequency range 24.25 – 33.4 GHz

Frequency offset of measurement filter -3B point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Limit	*Measurement bandwidth*
0 MHz ≤ Δf < 0.1*$BW_{contiguous}$	0.5 MHz ≤ f_offset < 0.1* $BW_{contiguous}$ +0.5 MHz	Min(-5 dBm, Max($P_{rated,t,TRP}$ – 35 dB, -12 dBm))	1 MHz
0.1*$BW_{contiguous}$ ≤ Δf < Δf_{max}	0.1* $BW_{contiguous}$ +0.5 MHz ≤ f_offset < f_offset_{max}	Min(-13 dBm, Max($P_{rated,t,TRP}$ – 43 dB, -20 dBm))	1 MHz
NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limit within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*.			

Table 9.7.4.5.2-2: OBUE limits applicable in the frequency range 37 – 52.6 GHz

Frequency offset of measurement filter -3B point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Limit	*Measurement bandwidth*
0 MHz ≤ Δf < 0.1*$BW_{contiguous}$	0.5 MHz ≤ f_offset < 0.1* $BW_{contiguous}$ +0.5 MHz	Min(-5 dBm, Max($P_{rated,t,TRP}$ – 33 dB, -12 dBm))	1 MHz
0.1*$BW_{contiguous}$ ≤ Δf < $Δf_{max}$	0.1* $BW_{contiguous}$ +0.5 MHz ≤ f_offset < f_ $offset_{max}$	Min(-13 dBm, Max($P_{rated,t,TRP}$ – 41 dB, -20 dBm))	1 MHz
NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limit within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*.			

9.7.4.5.3 OTA operating band unwanted emission limits (Category B)

IAB-DU and IAB-MT unwanted emissions shall not exceed the maximum levels specified in table 9.7.4.5.3-1 or 9.7.4.5.3-2.

Table 9.7.4.5.3-1: OBUE limits applicable in the frequency range 24.25 – 33.4 GHz

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Limit	*Measurement bandwidth*
0 MHz ≤ Δf < 0.1*$BW_{contiguous}$	0.5 MHz ≤ f_offset < 0.1* $BW_{contiguous}$ +0.5 MHz	Min(-5 dBm, Max($P_{rated,t,TRP}$ – 35 dB, -12 dBm))	1 MHz
0.1*$BW_{contiguous}$ ≤ Δf < $Δf_B$	0.1* $BW_{contiguous}$ +0.5 MHz ≤ f_offset < $Δf_B$ +0.5 MHz	Min(-13 dBm, Max($P_{rated,t,TRP}$ – 43 dB, -20 dBm))	1 MHz
$Δf_B$ ≤ Δf < $Δf_{max}$	$Δf_B$ +5 MHz ≤ f_offset < f_ $offset_{max}$	Min(-5 dBm, Max($P_{rated,t,TRP}$ – 33 dB, -10 dBm))	10 MHz
NOTE 1: For non-contiguous spectrum operation within any *operating band* the limit within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap. NOTE 2: $Δf_B$ = 2*$BW_{contiguous}$ when $BW_{contiguous}$ ≤ 500 MHz, otherwise $Δf_B$ = $BW_{contiguous}$ + 500 MHz.			

Table 9.7.4.5.3-2: OBUE limits applicable in the frequency range 37 – 52.6 GHz

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Limit	*Measurement bandwidth*
0 MHz ≤ Δf < 0.1*$BW_{contiguous}$	0.5 MHz ≤ f_offset < 0.1* $BW_{contiguous}$ +0.5 MHz	Min(-5 dBm, Max($P_{rated,t,TRP}$ – 33 dB, -12 dBm))	1 MHz
0.1*$BW_{contiguous}$ ≤ Δf < $Δf_B$	0.1* $BW_{contiguous}$ +0.5 MHz ≤ f_offset < $Δf_B$ +0.5 MHz	Min(-13 dBm, Max($P_{rated,t,TRP}$ – 41 dB, -20 dBm))	1 MHz
$Δf_B$ ≤ Δf < $Δf_{max}$	$Δf_B$ +5 MHz ≤ f_offset < f_ $offset_{max}$	Min(-5 dBm, Max($P_{rated,t,TRP}$ – 31 dB, -10 dBm))	10 MHz
NOTE 1: For non-contiguous spectrum operation within any *operating band* the limit within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap. NOTE 2: $Δf_B$ = 2*$BW_{contiguous}$ when $BW_{contiguous}$ ≤ 500 MHz, otherwise $Δf_B$ = $BW_{contiguous}$ + 500 MHz.			

9.7.4.5.4 Additional OTA operating band unwanted emission requirements

9.7.4.5.4.1 Protection of Earth Exploration Satellite Service

For IAB-DU and IAB-MT operating in the frequency range 24.25 – 27.5 GHz, the power of unwanted emission shall not exceed the limits in table 9.7.4.5.4.1-1.

Table 9.7.4.5.4.1-1: OBUE limits for protection of Earth Exploration Satellite Service

Frequency range	Limit	*Measurement Bandwidth*
23.6 – 24 GHz	-3 dBm (Note 1)	200 MHz
23.6 – 24 GHz	-9 dBm (Note 2)	200 MHz
NOTE 1: This limit applies to IAB-DU and IAB-MT brought into use on or before 1 September 2027 and enters into force from January 1, 2021. NOTE 2: This limit applies to IAB-DU and IAB-MT brought into use after 1 September 2027.		

9.7.5 OTA transmitter spurious emissions

9.7.5.1 General

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

The OTA spurious emissions limits are specified as TRP per RIB unless otherwise stated.

9.7.5.2 Minimum requirement for *IAB-DU type 1-O and IAB-MT type 1-O*

9.7.5.2.1 General

For IAB-DU, the OTA transmitter spurious emission limits for FR1 shall apply from 30 MHz to 12.75 GHz, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} is defined in table 9.7.1-1. For some FR1 *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 [16].

For IAB-MT, the OTA transmitter spurious emission limits for FR1 shall apply from 30 MHz to 12.75 GHz, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported uplink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported uplink *operating band*, where the Δf_{OBUE} is defined in table 9.7.1-2. For some FR1 *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 [16].

For *multi-band RIB* each supported *operating band* and Δf_{OBUE} MHz around each band are excluded from the OTA transmitter spurious emissions requirements.

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.

IAB-DU type 1-O and *IAB-MT type 1-O* requirements consist of OTA transmitter spurious emission requirements based on TRP and co-location requirements not based on TRP.

9.7.5.2.2 General OTA transmitter spurious emissions requirements

The Tx spurious emissions requirements for *IAB-DU type 1-O* are that for each applicable *basic limit* above 30 MHz in clause 6.6.5.2.1, the TRP of any spurious emission shall not exceed an OTA limit specified as the *basic limit* + X, where X = 9 dB, unless stated differently in regional regulation.

The Tx spurious emissions requirements for *IAB-MT type 1-O* are that for each applicable *basic limit* above 30 MHz in clause 6.6.5.2.1, the TRP of any spurious emission shall not exceed an OTA limit specified as the *basic limit* + X, where $X = 10\log_{10}(N_{TXU,countedpercell})$ dB, unless stated differently in regional regulation.

9.7.5.2.3 Additional spurious emissions requirements

These requirements may be applied for the protection of systems operating in frequency ranges other IAB-DU downlink *operating band* or IAB-MT uplink *operating band*. 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.). The Tx additional spurious emissions requirements for *IAB-DU type 1-O* and *IAB-MT type 1-O* are that for each applicable *basic limit* in clause 6.6.5.2.3, the TRP of any spurious emission shall not exceed an OTA limit specified as the *basic limit* + X, where X = 9 dB for IAB-DU and X = $10\log_{10}(N_{TXU,countedpercell})$ dB for IAB-MT.

9.7.5.2.4 Co-location with other base stations and IAB-Nodes

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

The requirements assume co-location with the same class.

NOTE: For co-location with UTRA, the requirements are based on co-location with UTRA FDD or TDD base stations.

This requirement is a co-location requirement as defined in clause 4.9, the power levels are specified at the *co-location reference antenna* output(s).

The power sum of any spurious emission is specified over all supported polarizations at the output(s) of the *co-location reference antenna* and shall not exceed the *basic limits* in clause 6.6.5.2.3 + X dB, where X = -21 dB for IAB-DU and X = $-30 + 10\log_{10}(N_{TXU,countedpercell})$ dB for IAB-MT.

For a *multi-band RIB*, the exclusions and conditions in the notes column of table 6.6.5.2.3-1 apply for each supported *operating band*.

9.7.5.3 Minimum requirement for *IAB-DU type 2-O and IAB-MT type 2-O*

9.7.5.3.1 General

For IAB-DU type 2-O, the OTA transmitter spurious emission limits apply from 30 MHz to 2[nd] harmonic of the upper frequency edge of the downlink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of the downlink *operating band*, up to Δf_{OBUE} above the highest frequency of the downlink *operating band*, where the Δf_{OBUE} is defined in table 9.7.1-1.

For IAB-MT type 2-O, the OTA transmitter spurious emission limits apply from 30 MHz to 2[nd] harmonic of the upper frequency edge of the downlink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of the uplink *operating band*, up to Δf_{OBUE} above the highest frequency of the uplink *operating band*, where the Δf_{OBUE} is defined in table 9.7.1-2.

9.7.5.3.2 General OTA transmitter spurious emissions requirements

9.7.5.3.2.1 General

The requirements of either clause 9.7.5.3.2.2 (Category A limits) or clause 9.7.5.3.2.3 (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 9.7.4.

9.7.5.3.2.2 OTA transmitter spurious emissions (Category A)

The power of any spurious emission shall not exceed the limits in table 9.7.5.3.2-1

Table 9.7.5.3.2.2-1: IAB-DU and IAB-MT radiated Tx spurious emission limits in FR2

Frequency range	Limit	*Measurement Bandwidth*	Note
30 MHz – 1 GHz	-13 dBm	100 kHz	Note 1
1 GHz – 2nd harmonic of the upper frequency edge of the DL *operating band*		1 MHz	Note 1, Note 2
NOTE 1: Bandwidth as in ITU-R SM.329 [2], s4.1 NOTE 2: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1.			

9.7.5.3.2.3 OTA transmitter spurious emissions (Category B)

The power of any spurious emission shall not exceed the limits in table 9.7.5.3.2.3-1.

Table 9.7.5.3.2.3-1: IAB-DU and IAB-MT radiated Tx spurious emission limits in FR2 (Category B)

Frequency range (Note 4)	Limit	*Measurement Bandwidth*	Note
30 MHz ↔ 1 GHz	-36 dBm	100 kHz	Note 1
1 GHz ↔ 18 GHz	-30 dBm	1 MHz	Note 1
18 GHz ↔ $F_{step,1}$	-20 dBm	10 MHz	Note 2
$F_{step,1}$ ↔ $F_{step,2}$	-15 dBm	10 MHz	Note 2
$F_{step,2}$ ↔ $F_{step,3}$	-10 dBm	10 MHz	Note 2
$F_{step,4}$ ↔ $F_{step,5}$	-10 dBm	10 MHz	Note 2
$F_{step,5}$ ↔ $F_{step,6}$	-15 dBm	10 MHz	Note 2
$F_{step,6}$ ↔ 2nd harmonic of the upper frequency edge of the DL *operating band*	-20 dBm	10 MHz	Note 2, Note 3
NOTE 1: Bandwidth as in ITU-R SM.329 [2], s4.1 NOTE 2: Limit and bandwidth as in ERC Recommendation 74-01 [19], Annex 2. NOTE 3: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1. NOTE 4: The step frequencies $F_{step,X}$ are defined in Table 9.7.5.3.2.3-2.			

Table 9.7.5.3.2.3-2: Step frequencies for defining the IAB-DU and IAB-MT radiated Tx spurious emission limits in FR2 (Category B)

Operating band	$F_{step,1}$ (GHz)	$F_{step,2}$ (GHz)	$F_{step,3}$ (GHz) (Note 2)	$F_{step,4}$ (GHz) (Note 2)	$F_{step,5}$ (GHz)	$F_{step,6}$ (GHz)
n258	18	21	22.75	29	30.75	40.5
n259	23.5	35.5	38	45	47.5	59.5
NOTE 1: $F_{step,X}$ are based on ERC Recommendation 74-01 [19], Annex 2. NOTE 2: $F_{step,3}$ and $F_{step,4}$ are aligned with the values for Δf_{OBUE} in Table 9.7.1-1 and Table 9.7.1-2.						

9.7.5.3.3 Additional OTA transmitter spurious emissions requirements

These requirements may be applied for the protection of systems operating in frequency ranges other than the IAB-Node. 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.

9.7.5.3.3.1 Limits for protection of Earth Exploration Satellite Service

For IAB-DU and IAB-MT operating in the frequency range 24.25 – 27.5 GHz, the power of any spurious emissions shall not exceed the limits in Table 9.7.5.3.3.1-1.

Table 9.7.5.3.3.1-1: Limits for protection of Earth Exploration Satellite Service

Frequency range	Limit	*Measurement Bandwidth*	Note
23.6 – 24 GHz	-3 dBm	200 MHz	Note 1
23.6 – 24 GHz	-9 dBm	200 MHz	Note 2
NOTE 1: This limit applies to IAB-DU and IAB-MT brought into use on or before 1 September 2027 and enters into force from January 1, 2021. NOTE 2: This limit applies to IAB-DU and IAB-MT brought into use after 1 September 2027.			

9.8 OTA transmitter intermodulation

9.8.1 General

The OTA 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 RDN and antenna array from a co-located base station or IAB. The requirement applies during the *transmitter ON period* and the *transmitter transient period.*

The requirement shall apply at each RIB supporting transmission in the *operating band*.

The transmitter intermodulation level is the *total radiated power* of the intermodulation products when an interfering signal is injected into the *co-location reference antenna*.

The OTA transmitter intermodulation requirement is not applicable for *IAB type 2-O*.

9.8.2 Minimum requirement for *IAB-DU type 1-O* and *IAB-MT type 1-O*

For *IAB type 1-O* the transmitter intermodulation level shall not exceed the TRP unwanted emission limits specified for OTA transmitter spurious emission in clause [9.7.5.2 (except clause 9.7.5.2.3 and clause 9.7.5.2.5)], OTA operating band unwanted emissions in clause [9.7.4.2] and OTA ACLR in clause [9.7.3.2] in the presence of a wanted signal and an interfering signal, defined in table 9.8.2-1.

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 RIBs 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 RIBs supporting operation in multiple *operating bands*, 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*$BW_{Channel}$ (where $BW_{Channel}$ is the minimal *IAB 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 9.8. 2-1: Interfering and wanted signals for the OTA transmitter intermodulation requirement

Parameter	Value
Wanted signal	NR signal or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers
Interfering signal type	NR signal the minimum *IAB channel bandwidth* ($BW_{Channel}$) with 15 kHz SCS of the band defined in clause 5.3.5
Interfering signal level	The interfering signal level is the same power level as the IAB ($P_{rated,t,TRP}$) fed into a *co-location reference antenna*.
Interfering signal centre frequency offset from the lower (upper) edge of the wanted signal or edge of *sub-block* inside a gap	$f_{offset} = \pm BW_{Channel}\left(n - \frac{1}{2}\right)$, for n=1, 2 and 3
NOTE 1: Interfering signal positions that are partially or completely outside of any downlink *operating band* of the RIB 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. NOTE 3: The $P_{rated,t,TRP}$ is split between polarizations at the *co-location reference antenna*.	

10 Radiated receiver characteristics

10.1 General

Radiated receiver characteristics are specified at RIB for *IAB type 1-H*, *IAB type 1-O*, or *IAB type 2-O*, with full complement of transceivers for the configuration in normal operating condition.

Unless otherwise stated, the following arrangements apply for the radiated receiver characteristics requirements in clause 10:

- Requirements apply during the IAB receive period.
- Requirements shall be met for any transmitter setting.
- When IAB is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.
- For ACS, blocking and intermodulation characteristics, the negative offsets of the interfering signal apply relative to the lower *IAB RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*, and the positive offsets of the interfering signal apply relative to the upper *IAB RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*.
- Each requirement shall be met over the RoAoA specified.

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

For FR1 requirements which are to be met over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

$$\Delta_{OTAREFSENS} = 44.1 - 10*\log_{10}(BeW_{\theta,REFSENS}*BeW_{\varphi,REFSENS}) \text{ dB for the reference direction}$$

and

$$\Delta_{OTAREFSENS} = 41.1 - 10*\log_{10}(BeW_{\theta,REFSENS}*BeW_{\varphi,REFSENS}) \text{ dB for all other directions}$$

For requirements which are to be met over the *minSENS RoAoA* absolute requirement values are offset by the following term:

$$\Delta_{minSENS} = P_{REFSENS} – EIS_{minSENS} \text{ (dB)}$$

For FR2 requirements which are to be met over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

$$\Delta_{FR2\_REFSENS} = -3 \text{ dB for the reference direction}$$

and

$$\Delta_{FR2\_REFSENS} = 0 \text{ dB for all other directions}$$

10.2 OTA sensitivity

10.2.1 IAB-DU OTA sensitivity

10.2.1.1 IAB-DU type 1-H and IAB-DU type 1-O

The OTA sensitivity requirement is a *directional requirement* based upon the declaration of one or more *OTA sensitivity direction declarations* (OSDD), related to a *IAB-DU type 1-H* and *IAB-DU type 1-O* receiver.

The IAB-DU reference sensitivity level is specified the same as the BS reference sensitivity level requirement for BS in TS 38.104x[2], subclause 10.2.1, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

10.2.1.2 IAB-DU type 2-O

There is no OTA sensitivity requirement for FR2, the OTA sensitivity is the same as the OTA reference sensitivity in clause 10.3.

10.2.2 IAB-MT OTA sensitivity

10.2.2.1 IAB-MT type 1-H and IAB-MT type 1-O

10.2.2.1.1 General

The OTA sensitivity requirement is a *directional requirement* based upon the declaration of one or more *OTA sensitivity direction declarations* (OSDD), related to a *IAB-MT type 1-H* and *IAB-MT type 1-O* receiver.

The *IAB-MT type 1-H* and *IAB-MT type 1-O* may optionally be capable of redirecting/changing the *receiver target* by means of adjusting IAB-MT settings resulting in multiple *sensitivity RoAoA*. The *sensitivity RoAoA* resulting from the current IAB-MT settings is the active *sensitivity RoAoA*.

If the IAB-MT is capable of redirecting the *receiver target* related to the OSDD then the OSDD shall include:

- *IAB-MT channel bandwidth* and declared minimum EIS level applicable to any active *sensitivity RoAoA* inside the *receiver target redirection range* in the OSDD.
- A declared *receiver target redirection range*, describing all the angles of arrival that can be addressed for the OSDD through alternative settings in the IAB-MT.
- Five declared *sensitivity RoAoA* comprising the conformance testing directions as detailed in TS 38.141-2 [21].
- The *receiver target reference direction*.

NOTE 1: Some of the declared *sensitivity RoAoA* may coincide depending on the redirection capability.

NOTE 2: In addition to the declared *sensitivity RoAoA*, several *sensitivity RoAoA* may be implicitly defined by the *receiver target redirection range* without being explicitly declared in the OSDD.

If the IAB-MT is not capable of redirecting the *receiver target* related to the OSDD, then the OSDD includes only:

- The set(s) of RAT, *IAB-MT channel bandwidth* and declared minimum EIS level applicable to the *sensitivity RoAoA* in the OSDD.
- One declared active *sensitivity RoAoA*.
- The *receiver target reference direction*.

NOTE 4: For IAB-MT without target redirection capability, the declared (fixed) *sensitivity RoAoA* is always the active *sensitivity RoAoA*.

The OTA sensitivity EIS level declaration shall apply to each supported polarization, under the assumption of *polarization match*.

10.2.2.1.2 Minimum requirement

For a received signal whose AoA of the incident wave is within the active *sensitivity RoAoA* of an OSDD, the error rate criterion as described in clause 7.2.2 shall be met when the level of the arriving signal is equal to the minimum EIS level in the respective declared set of EIS level and *IAB-MT channel bandwidth*.

10.2.2.2 IAB-MT type 2-O

There is no OTA sensitivity requirement for FR2, the OTA sensitivity is the same as the OTA reference sensitivity in clause 10.3.

10.3 OTA reference sensitivity level

10.3.1 General

The OTA REFSENS requirement is a *directional requirement* and is intended to ensure the minimum OTA reference sensitivity level for a declared *OTA REFSENS RoAoA*. The OTA reference sensitivity power level $EIS_{REFSENS}$ is the minimum mean power received at the RIB at which a reference performance requirement shall be met for a specified reference measurement channel.

The OTA REFSENS requirement shall apply to each supported polarization, under the assumption of *polarization match*.

10.3.2 IAB-DU OTA reference sensitivity level

10.3.2.1 Minimum requirement for *IAB-DU type 1-O*

The wide area IAB-DU reference sensitivity level is specified the same as the wide area BS reference sensitivity level requirement for BS in TS 38.104[2], subclause 10.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU reference sensitivity level is specified the same as the medium range BS reference sensitivity level requirement for BS in TS 38.104[2], subclause 10.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU reference sensitivity level is specified the same as the local area BS reference sensitivity level requirement for BS in TS 38.104[2], subclause 10.3.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

10.3.2.2 Minimum requirement for *IAB-DU type 2-O*

The wide area IAB-DU reference sensitivity level is specified the same as the wide area BS reference sensitivity level requirement for BS in TS 38.104[2], subclause 10.3.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU reference sensitivity level is specified the same as the medium range BS reference sensitivity level requirement for BS in TS 38.104[2], subclause 10.3.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU reference sensitivity level is specified the same as the local area BS reference sensitivity level requirement for BS in TS 38.104[2], subclause 10.3.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

10.3.3 IAB-MT OTA reference sensitivity level

10.3.3.1 Minimum requirement for *IAB-MT type 1-O*

The OTA REFSENS requirement is a *directional requirement* and is intended to ensure the minimum OTA reference sensitivity level for a declared *OTA REFSENS RoAoA*. The OTA reference sensitivity power level $EIS_{REFSENS}$ is the minimum mean power received at the RIB at which a reference performance requirement shall be met for a specified reference measurement channel.

10.3.3.2 Minimum requirement for *IAB-MT type 1-O*

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in the corresponding table and annex A.1 when the OTA test signal is at the corresponding $EIS_{REFSENS}$ level and arrives from any direction within the *OTA REFSENS RoAoA*.

Table 10.3.3.2-1: Wide Area IAB-MT type 1-O reference sensitivity levels

***IAB-MT channel bandwidth* (MHz)**	**Sub-carrier spacing (kHz)**	**Reference measurement channel**	**OTA reference sensitivity level, $EIS_{REFSENS}$ (dBm)**
10, 15	30	G-FR1-A1-22	$-102.0 - \Delta_{OTAREFSENS}$
10, 15	60	G-FR1-A1-23	$-99.0 - \Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-25	$-95.4 - \Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-26	$-95.6 - \Delta_{OTAREFSENS}$
NOTE: $EIS_{REFSENS}$ 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 10.3.3.2-2: Local Area IAB-MT type 1-O reference sensitivity levels

IAB-MT channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	OTA reference sensitivity level, $EIS_{REFSENS}$ (dBm)
10, 15	30	G-FR1-A1-22	-94.0 - $\Delta_{OTAREFSENS}$
10, 15	60	G-FR1-A1-23	-91.0 - $\Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-25	-87.4 - $\Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-26	-87.6 - $\Delta_{OTAREFSENS}$
NOTE: $EIS_{REFSENS}$ 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*.			

10.3.3.3 Minimum requirement for *IAB-MT type 2-O*

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in the corresponding table and annex A.1 when the OTA test signal is at the corresponding $EIS_{REFSENS}$ level and arrives from any direction within the *OTA REFSENS RoAoA*.

$EIS_{REFSENS}$ levels are derived from a single declared basis level $EIS_{REFSENS\_50M}$, which is based on a reference measurement channel with 50 MHz [*IAB-MT] channel bandwidth*. $EIS_{REFSENS\_50M}$ itself is not a requirement and although it is based on a reference measurement channel with 50 MHz [*IAB-MT] channel bandwidth* it does not imply that IAB-MT has to support 50 MHz [*IAB-MT] channel bandwidth*.

For Wide Area IAB-MT, $EIS_{REFSENS\_50M}$ is an integer value in the range -96 to -119 dBm. The specific value is declared by the vendor.

For Local Area IAB-MT, $EIS_{REFSENS\_50M}$ is an integer value in the range -86 to -114 dBm. The specific value is declared by the vendor.

Table 10.3.3.2-1: FR2 OTA reference sensitivity requirement

[IAB-DU] channel Bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	OTA reference sensitivity level, $EIS_{REFSENS}$ (dBm)
NOTE 1: $EIS_{REFSENS}$ 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*. NOTE 2: The declared $EIS_{REFSENS\_50M}$ shall be within the range specified above.			

10.4 OTA Dynamic range

10.4.1 IAB-DU OTA dynamic range

10.4.1.1 General

The OTA dynamic range is a measure of the capability of the receiver unit to receive a wanted signal in the presence of an interfering signal inside the received *[IAB-DU] channel bandwidth*.

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

10.4.1.2 Minimum requirement for *IAB-DU type 1-O*

The wide area IAB-DU dynamic range is specified the same as the wide area BS dynamic requirement for BS *type 1-O* in TS 38.104[2], subclause 10.4.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU dynamic range is specified the same as the medium range BS dynamic range requirement for BS *type 1-O* in TS 38.104[2], subclause 10.4.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU dynamic range is specified the same as the local area BS dynamic range requirement for BS *type 1-O* in TS 38.104[2], subclause 10.4.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

10.5 OTA in-band selectivity and blocking

10.5.1 OTA adjacent channel selectivity

10.5.1.1 General

OTA Adjacent channel selectivity (ACS) is a measure of the receiver's ability to receive an OTA wanted signal at its assigned channel frequency in the presence of an OTA adjacent channel signal with a specified centre frequency offset of the interfering signal to the band edge of a victim system.

10.5.1.2 Minimum requirement for *IAB-DU type 1-O*

Minimum requirement is the same as specified for BS type 1-O in TS38.104[2], subclause 10.5.1.2.

10.5.1.3 Minimum requirement for *IAB-DU type 2-O*

Minimum requirement is the same as specified for BS type 2-O in TS38.104[2], subclause 10.5.1.3.

10.5.1.4 Minimum requirement for *IAB-MT type 2-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the -*OTA REFSENS RoAoA.*

The wanted and interfering signals apply to all supported polarizations, under the assumption o*f polarization match*.

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

For FR2, the OTA wanted and the interfering signal are specified in table 10.5.1.4-1 and table 10.5.1.4-2 for ACS. The reference measurement channel for the OTA wanted signal is further specified in annex [A.1]. The characteristics of the interfering signal is further specified in annex [D].

The OTA ACS requirement is applicable outside the IAB-MT [RF Bandwidth]. The OTA interfering signal offset is defined relative to the IAB-MT [RF Bandwidth] edges.

For Wide Area IAB-MT, for RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA 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 10.5.1.4-2 . The OTA interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

Table 10.5.1.4-1: OTA ACS requirement for Wide Area and Local Area IAB MT

***IAB-MT channel bandwidth* of the lowest/highest carrier received (MHz)**	**Wanted signal mean power (dBm)**	**Interfering signal mean power (dBm)**
50, 100, 200, 400	$EIS_{REFSENS}$ + 6 dB (Note 3)	$EIS_{REFSENS\_50M}$ + 27.7 + $\Delta_{FR2\_REFSENS}$ (Note 1) $EIS_{REFSENS\_50M}$ + 26.7 + $\Delta_{FR2\_REFSENS}$ (Note 2)
NOTE 1: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz NOTE 2: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz NOTE 3: $EIS_{REFSENS}$ is given in subclause [10.3.3]		

Table 10.5.1.4-2: OTA ACS interferer frequency offset for *IAB-MT type 2-O*

***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**
50	±24.29	50 MHz CP-OFDM NR signal,60 kHz SCS, 64 RBs
100	±24.31	
200	±24.29	
400	±24.31	

10.5.1.5 Minimum requirement for *IAB-MT type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

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

For FR1, the OTA wanted and the interfering signal are specified in table 10.5.1.5-1, table 10.5.1.5-2 and table 10.5.1.5-3 for OTA ACS. The reference measurement channel for the OTA wanted signal is further specified in annex [A.1]. The characteristics of the interfering signal is further specified in annex [D].

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

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA 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 10.5.1.5-2 and table table 10.5.1.5-3. The OTA interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For *multi-band RIBs*, the OTA 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 10.5.1.5-2 and table 10.5.1.5-3. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* edges inside the *Inter RF Bandwidth gap*.

Table 10.5.1.5-1: OTA ACS requirement for *IAB-MT*

***IAB-MT channel bandwidth* of the *lowest/highest carrier* received (MHz)**	**Wanted signal mean power (dBm) (Note 2)**	**Interfering signal mean power (dBm)**
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80,90, 100 (Note 1)	$EIS_{minSENS}$ + 6 dB	Wide Area IAB-MT: -52 – $\Delta_{minSENS}$ Local Area IAB-MT: -44– $\Delta_{minSENS}$
NOTE 1: The SCS for the *lowest/highest carrier* received is the lowest SCS supported by the IAB-MT for that bandwidth NOTE 2: $EIS_{minSENS}$ depends on the IAB-MT *channel bandwidth*		

Table 10.5.1.5-2: OTA ACS interferer frequency offset for *IAB-MT type 1-O*

***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**
5	±2.5025	5 MHz CP-OFDM NR signal, 15 kHz SCS, 25 RBs
10	±2.5075	
15	±2.5125	
20	±2.5025	
25	±9.4675	20 MHz CP-OFDM NR signal, 15 kHz SCS, 100 RBs

10.5.2 OTA in-band blocking

10.5.2.1 General

The OTA in-band blocking characteristics is a measure of the receiver's ability to receive a OTA wanted signal at its assigned channel in the presence of an unwanted OTA interferer, which is an NR signal for general blocking or an NR signal with one RB for narrowband blocking.

10.5.2.2 Minimum requirement for *IAB-DU type 1-O*

Minimum requirement is the same as specified for BS type 1-O in TS38.104[2], subclause 10.5.2.2.

10.5.2.3 Minimum requirement for *IAB DU type 2-O*

Minimum requirement is the same as specified for BS type 2-O in TS38.104[2], subclause 10.5.2.3.

10.5.2.4 Minimum requirement for *IAB-MT of type 2-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

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

For Wide Area *IAB-MT type 2-O*, the OTA wanted and OTA interfering signals are provided at RIB using the parameters in table 10.5.2.4-1 for general OTA blocking requirements. The reference measurement channel for the wanted signal is further specified in annex [A.1]. The characteristics of the interfering signal is further specified in annex D.

The OTA blocking requirements are applicable outside the IAB-MT RF Bandwidth. The interfering signal offset is defined relative to the IAB-MT RF Bandwidth edges.

For Wide Area *IAB-MT type 2-O* the OTA in-band blocking requirement shall apply from F_{DL_low} - Δf_{OOB} to F_{DL_high} + Δf_{OOB}. The Δf_{OOB} for *IAB-MT type 2-O* is defined in table 10.5.2.4-0.

Table 10.5.2.4-0: Δf_{OOB} offset for NR *operating bands* for Wide Area IAB-MT in FR2

IAB-MT type	*Operating band* characteristics	Δf_{OOB} (MHz)
IAB-MT type 2-O	$F_{DL\_high} – F_{DL\_low} \leq 3250$ MHz	1500

For Wide Area IAB-MT and for a RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA 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 10.5.2.4-1. The interfering signal offset is defined relative to the sub-block edges inside the sub-block gap.

Table 10.5.2.4-1: General OTA blocking requirement for *Widea Area IAB-MT*

***IAB MT channel bandwidth* of the lowest/highest carrier received (MHz)**	**OTA wanted signal mean power (dBm)**	OTA interfering signal mean power (dBm)	**OTA 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 OTA interfering signal**
50, 100, 200, 400	$EIS_{REFSENS}$ + 6 dB	$EIS_{REFSENS\_50M}$ + 33 + $\Delta_{FR2\_REFSENS}$	±75	50 MHz CP-OFDM NR signal, 60 kHz SCS, 64 RBs
NOTE: $EIS_{REFSENS}$ and $EIS_{REFSENS\_50M}$ are given in subclause [10.3.3].				

10.5.2.5 Minimum requirement for *IAB-MT of type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and:

- when the wanted signal is based on $EIS_{REFSENS}$: the AoA of the incident wave of a received signal and the interfering signal are within the *OTA REFSENS RoAoA.*

- when the wanted signal is based on $EIS_{minSENS}$: the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with OTA wanted and OTA interfering signal specified in tables 10.5.2.5-1, table 10.5.2.5-2 and table 10.5.2.5-3 for general OTA and narrowband OTA blocking requirements. The reference measurement channel for the OTA wanted signal is identified in clause 10.3.3 and are further specified in annex [A.1]. The characteristics of the interfering signal is further specified in annex [D].

The OTA 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.

For *IAB-MT type 1-O* the OTA in-band blocking requirement shall apply in the in-band blocking frequency range, which is from $F_{DL,low}$ - Δf_{OOB} to $F_{DL,high}$ + Δf_{OOB}.. The Δf_{OOB} for *wide area IAB-MT type 1-O* is defined in table 10.5.2.5-0.

Table 10.5.2.5-0: Δf_{OOB} offset for NR *operating bands* in FR1

IAB-MT type	*Operating band* characteristics	Δf_{OOB} (MHz)
IAB-MT type 1-O	$F_{DL,high} – F_{DL,low}$ < 100 MHz	20
	100 MHz ≤ $F_{DL,high} – F_{DL,low}$ ≤ 900 MHz	60

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA 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 10.5.2.2-1. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For *multi-band RIBs*, the OTA in-band 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 tables 10.5.2.5-1 and 10.5.2.5-3.

For a RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA narrowband blocking requirements apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the interfering signal minimum offset in table 10.5.2.5-3. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For a *multi-band RIBs*, the OTA narrowband blocking requirements apply in the narrowband 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 the interfering signal minimum offset in table 10.5.2.5-3.

Table 10.5.2.2-1: General OTA blocking requirement for *IAB-MT type 1-O*

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
5, 10, 15, 20	$EIS_{REFSENS}$ + 6 dB	Wide Area IAB-MT: -43 - $\Delta_{OTAREFSENS}$ Local Area IAB-MT: -35 - $\Delta_{OTAREFSENS}$	±7.5	5 MHz CP-OFDM NR signal, 15 kHz SCS, 25 RBs
	$EIS_{minSENS}$ + 6 dB	Wide Area IAB-MT: -43 – $\Delta_{minSENS}$ Local Area IAB-MT: -35 - $\Delta_{OTAREFSENS}$	±7.5	
25 ,30, 40, 50, 60, 70, 80, 90, 100	$EIS_{REFSENS}$ + 6 dB	Wide Area IAB-MT: -43 - $\Delta_{OTAREFSENS}$ Local Area IAB-MT: -35 - $\Delta_{OTAREFSENS}$	±30	20 MHz CP-OFDM NR signal, 15 kHz SCS, 100 RBs
	$EIS_{minSENS}$ + 6 dB	Wide Area IAB-MT: -43 – $\Delta_{minSENS}$ Local Area IAB-MT: -35 - $\Delta_{OTAREFSENS}$	±30	

Table 10.5.2.2-2: OTA narrowband blocking requirement for *IAB-MT type 1-O*

***IAB-MT channel bandwidth* of the *lowest/highest carrier* received (MHz)**	**OTA Wanted signal mean power (dBm)**	**OTA Interfering signal mean power (dBm)**
5, 10, 15, 20	$EIS_{REFSENS}$ + 6 dB	Wide Area IAB-MT: -49 - $\Delta_{OTAREFSENS}$ Local Area IAB-MT: -41 - $\Delta_{OTAREFSENS}$
	$EIS_{minSENS}$ + 6 dB	Wide Area IAB-MT: -49 – $\Delta_{minSENS}$ Local Area IAB-MT: -41 - $\Delta_{OTAREFSENS}$
25, 30, 40, 50, 60, 70, 80, 90, 100	$EIS_{REFSENS}$ + 6 dB	Wide Area IAB-MT: -49 - $\Delta_{OTAREFSENS}$ Local Area IAB-MT: -41 - $\Delta_{OTAREFSENS}$
	$EIS_{minSENS}$ + 6 dB	Wide Area IAB-MT: -49 – $\Delta_{minSENS}$ Local Area IAB-MT: -41 - $\Delta_{OTAREFSENS}$
NOTE 1: The SCS for the *lowest/highest carrier* received is the lowest SCS supported by the IAB-MT for that bandwidth. NOTE 2: 7.5 kHz shift is not applied to the wanted signal.		

Table 10.5.2.2-3: OTA narrowband blocking interferer frequency offsets for *IAB-MT type 1-O*

***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	20 MHz CP-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 is 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.		

10.6 OTA out-of-band blocking

10.6.1 General

The OTA out-of-band blocking characteristics are a measure of the receiver unit ability to receive a wanted signal at the *RIB* at its assigned channel in the presence of an unwanted interferer.

10.6.2 Minimum requirement for IAB-MT type 1-O and IAB-DU type 1-O

The requirement shall apply at the RIB when the AoA of the incident wave of the received signal and the interfering signal are from the same direction and are within the [*inSENS RoAoA*.

The wanted signal applies to each supported polarization, under the assumption of *polarization match*. The interferer shall be *polarization matched* in-band and the polarization maintained for out-of-band frequencies.

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 10.6.2-2, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in clause 10.3.2 and subclause 10.3.3 for each *IAB-Node channel bandwidth*.

For a *multi-band RIB*, the OTA out-of-band requirement shall apply for each supported *operating band*, with the exception that the in-band blocking frequency ranges of all supported *operating bands* according to table 10.6.2-1 shall be excluded from the OTA out-of-band blocking requirement.

For OTA out-of-band blocking requirement apply from 30 MHz to $F_{UL,low}$ - Δf_{OOB} and from $F_{UL,high}$ + Δf_{OOB} up to 12750 MHz. The Δf_{OOB} for FR1 OTA out-of-band blocking requirement is defined in table 10.6.2-1.

Table 10.6.2-1: Δf_{OOB}

Operating band **characteristics**	**Δf_{OOB} (MHz)**
$F_{UL,high} – F_{UL,low}$ < 100 MHz	20
100 MHz ≤ $F_{UL,high} – F_{UL,low}$ ≤ 900 MHz	60

Table 10.6.2-2: OTA out-of-band blocking performance requirement

Wanted signal mean power (dBm)	**Interfering signal RMS field-strength (V/m)**	**Type of interfering Signal**
$EIS_{minSENS}$ + 6 dB (Note 1)	0.36	CW
NOTE 1: $EIS_{minSENS}$ depends on the *channel bandwidth* as specified in clause 9.2. NOTE 2: The RMS field-strength level in V/m is related to the interferer EIRP level at a distance described as $E=\frac{\sqrt{30EIRP}}{r}$, where EIRP is in W and r is in m; for example, 0.36 V/m is equivalent to 36 dBm at fixed distance of 30 m.		

10.6.3 Minimum requirement for IAB-MT type 2-O and IAB-DU type 2-O

The requirement shall apply at the RIB when the AoA of the incident wave of the received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA*.

The wanted signal applies to each supported polarization, under the assumption of *polarization match*. The interferer shall be polarization matched in-band and the polarization maintained for out-of-band frequencies.

For *IAB type 2-O* the OTA out-of-band blocking requirement apply from 30 MHz to $F_{UL,low}$ – 1500 MHz and from $F_{UL,high}$ + 1500 MHz up to 2nd harmonic of the upper frequency edge of the *operating band*.

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 10.6.3-1, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in subclause 10.3.2 and subclause 10.3.3 for each *IAB Node channel bandwidth*.

Table 10.6.3-1: OTA out-of-band blocking performance requirement

Frequency range of interfering signal (MHz)	Wanted signal mean power (dBm)	Interferer RMS field-strength (V/m)	Type of interfering signal
30 to 12750	$EIS_{REFSENS}$ + 6 dB	0.36	CW
12750 to $F_{UL,low}$ – 1500	$EIS_{REFSENS}$ + 6 dB	0.1	CW
$F_{UL,high}$ + 1500 to 2nd harmonic of the upper frequency edge of the *operating band*	$EIS_{REFSENS}$ + 6 dB	0.1	CW

10.7 OTA receiver spurious emissions

10.7.1 General

The OTA RX spurious emission is the power of the emissions radiated from the antenna array from a receiver unit.

The metric used to capture OTA receiver spurious emissions for IAB-MT and IAB-DU for *IAB type 1-O* and *IAB type 2-O* is *total radiated power* (TRP), with the requirement defined at the RIB.

When calculating the IAB-MT RX emissions limits ($N_{RXU,counted}$) defined for *IAB-DU and IAB-MT type 1-H* in sub-clause 7.6.2 shall be applied for *IAB-MT type 1-O.*

10.7.2 IAB-DU OTA receiver spurious emissions

10.7.2.1 Minimum requirement for IAB-DU type 1-O

Minimum requirement is the same as specified for BS type 1-O in TS 38.104[2], subclause 10.7.2.

10.7.2.2 Minimum requirement for IAB-DU type 2-O

Minimum requirement is the same as specified for BS type 2-O in TS 38.104[2], subclause 10.7.3.

10.7.3 IAB-MT OTA receiver spurious emissions

10.7.3.1 Minimum requirement for IAB-MT type 1-O

For an IAB-MT operating in TDD, the OTA RX spurious emissions requirement shall apply during the *transmitter OFF period* only.

For RX only *multi-band RIB*, the OTA RX spurious emissions requirements are subject to exclusion zones in each supported *operating band*.

The OTA RX spurious emissions requirement for *IAB-MT type 1-O* is that for each *basic limit* specified in table 10.7.3.1-1, the power sum of emissions at the RIB shall not exceed limits specified as the *basic limit* + X, where $X = 10\log_{10}(N_{RXU,countedpercell})$ dB, unless stated differently in regional regulation.

Table 10.7.3.1-1: General receiver spurious emission basic limits for *IAB-MT type 1-O*

Spurious frequency range	*Basic limit* (Note 4)	Measurement bandwidth	Notes
30 MHz – 1 GHz	-36 dBm	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 bandwidths as in ITU-R SM.329 [16], s4.1. NOTE 2: Upper frequency as in ITU-R SM.329 [16], 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: Additional limits may apply regionally.			

10.7.3.2 Minimum requirement for IAB-MT type 2-O

The OTA RX spurious emissions requirement shall apply during the *transmitter OFF period* only.

For the Wide Area *IAB-MT type 2-O*, the power of any RX spurious emission shall not exceed the limits in table 10.7.3.2-1.

10.7.3.2-1: Radiated Rx spurious emission limits for *IAB-MT type 2-O*

Spurious frequency range (Note 4)	Limit (Note 5)	Measurement Bandwidth	Note
30 MHz ↔ 1 GHz	-36 dBm	100 kHz	Note 1
1 GHz ↔ 18 GHz	-30 dBm	1 MHz	Note 1
18 GHz ↔ $F_{step,1}$	-20 dBm	10 MHz	Note 2
$F_{step,1}$ ↔ $F_{step,2}$	-15 dBm	10 MHz	Note 2
$F_{step,2}$ ↔ $F_{step,3}$	-10 dBm	10 MHz	Note 2
$F_{step,4}$ ↔ $F_{step,5}$	-10 dBm	10 MHz	Note 2
$F_{step,5}$ ↔ $F_{step,6}$	-15 dBm	10 MHz	Note 2
$F_{step,6}$ ↔ 2nd harmonic of the upper frequency edge of the DL *operating band*	-20 dBm	10 MHz	Note 2, Note 3
NOTE 1: Bandwidth as in ITU-R SM.329 [16], s4.1. NOTE 2: Limit and bandwidth as in ERC Recommendation 74-01 [17], Annex 2. NOTE 3: Upper frequency as in ITU-R SM.329 [16], s2.5 table 1. NOTE 4: The step frequencies $F_{step,X}$ are defined in table 10.7.3.2-2. NOTE 5: Additional limits may apply regionally.			

Table 10.7.3.2-2: Step frequencies for defining the radiated Rx spurious emission limits for *IAB-MT type 2-O*

Operating band	$F_{step,1}$ (GHz)	$F_{step,2}$ (GHz)	$F_{step,3}$ (GHz)	$F_{step,4}$ (GHz)	$F_{step,5}$ (GHz)	$F_{step,6}$ (GHz)
n257	18	23.5	25	31	32.5	41.5
n258	18	21	22.75	29	30.75	40.5
n260	25	34	35.5	41.5	43	52
n261	18	25.5	26.0	29.85	30.35	38.35

10.8 OTA receiver intermodulation

10.8.1 General

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 unit to receive a wanted signal on its assigned channel frequency in the presence of two interfering signals which have a specific frequency relationship to the wanted signal. The requirement is defined as a directional requirement at the RIB.

10.8.2 Minimum requirement for *IAB-DU type 1-O*

The Wide Area IAB-DU receiver intermodulation requirement is specified the same as the Wide Area receiver intermodulation requirement for BS *type 1-O* in TS 38.104[x], subclause 10.8.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The Medium Range IAB-DU receiver intermodulation requirement is specified the same as the Medium Range BS receiver intermodulation requirement for BS *type 1-O* in TS 38.104[x], subclause 10.8.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The Local Area IAB-DU receiver intermodulation requirement is specified the same as the Local Area BS receiver intermodulation requirement for BS *type 1-O* in TS 38.104x[x], subclause 10.8.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

10.8.3 Minimum requirement for *IAB-DU type 2-O*

The Wide AreaIAB-DU receiver intermodulation requirement is specified the same as the Wide Area receiver intermodulation requirement for BS *type 2-O* in TS 38.104x[x], subclause 10.8.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The Medium Range IAB-DU receiver intermodulation requirement is specified the same as the Medium Range BS receiver intermodulation requirement for BS *type 2-O* in TS 38.104x[x], subclause 10.8.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The Local Area IAB-DU receiver intermodulation requirement is specified the same as the Local Area BS receiver intermodulation requirement for BS *type 2-O* in TS 38.104x[x], subclause 10.8.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

10.8.4 Minimum requirement for *IAB-MT type 1-O*

The Wide Area IAB-MT receiver intermodulation requirement is specified the same as the Wide Area receiver intermodulation requirement for BS *type 1-O* in TS 38.104[x], subclause 10.8.2, where references to *BS channel bandwidth* apply to *IAB-MT channel bandwidth*.

The Local Area IAB-MT receiver intermodulation requirement is specified the same as the Local Area BS receiver intermodulation requirement for BS *type 1-O* in TS 38.104x[x], subclause 10.8.2, where references to *BS channel bandwidth* apply to *IAB-MT channel bandwidth*.

Interfering signal for IAB-MT *type 1-O* should be CP-OFDM.

10.9 OTA in-channel selectivity

10.9.1 General

In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations in the presence of an interfering signal received at a larger power spectral density. In this condition a throughput requirement shall be met for a specified reference measurement channel. The interfering signal shall be an NR signal as specified in annex [A.1] and shall be time aligned with the wanted signal

10.9.2 Minimum requirement for *IAB-DU* type 1-O

The wide area IAB-DU receiver in-channel selectivity requirement is specified the same as the wide area receiver in-channel selectivity requirement for BS *type 1-O* in TS 38.104[2], subclause 10.9.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU receiver in-channel selectivity requirement is specified the same as the medium range BS receiver in-channel selectivity requirement for BS *type 1-O* in TS 38.104[2], subclause 10.9.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU receiver in-channel selectivity requirement is specified the same as the local area BS receiver in-channel selectivity requirement for BS *type 1-O* in TS 38.104[2], subclause 10.9.2, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

10.9.3 Minimum requirement for *IAB-DU type 2-O*

The wide area IAB-DU receiver in-channel selectivity requirement is specified the same as the wide area receiver in-channel selectivity requirement for BS *type 2-O* in TS 38.104[2], subclause 10.9.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The medium range IAB-DU receiver in-channel selectivity requirement is specified the same as the medium range BS receiver in-channel selectivity requirement for BS *type 2-O* in TS 38.104[2], subclause 10.9.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

The local area IAB-DU receiver in-channel selectivity requirement is specified the same as the local area BS receiver in-channel selectivity requirement for BS *type 2-O* in TS 38.104[2], subclause 10.9.3, where references to *BS channel bandwidth* apply to *IAB-DU channel bandwidth*.

11 Radiated performance requirements

Void

12 Radio Resource Management requirements

12.1 RRC_CONNECTED state mobility for IAB-MTs

12.1.1 RRC Connection Mobility Control

12.1.1.1 SA: RRC Re-establishment

12.1.1.1.1 Introduction

This clause contains requirements on the IAB-MT regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when an IAB-MT in RRC_CONNECTED state loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [15].

The requirements in this clause are applicable for RRC connection re-establishment to NR cell.

12.1.1.1.2 Requirements

In RRC_CONNECTED state the IAB-MT shall be capable of sending *RRCReestablishmentRequest* message within $T_{re-establish\_delay}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re-establish\_delay}$) shall be less than:

$$T_{re-establish\_delay} = T_{IAB-MT\_re-establish\_delay} + T_{UL\_grant}$$

T_{UL_grant}: It is the time required to acquire and process uplink grant from the target PCell. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The IAB-MT re-establishment delay ($T_{IAB-MT\_re-establish\_delay}$) is specified in clause 12.1.1.1.2.1.

12.1.1.1.2.1 IAB MT Re-establishment delay requirement

The IAB-MT re-establishment delay ($T_{IAB-MT\_re-establish\_delay}$) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [15] is detected by the IAB-MT and when the IAB-MT sends PRACH to the target PCell. The IAB-MT re-establishment delay ($T_{IAB-MT\_re-establish\_delay}$) requirement shall be less than:

$$T_{IAB-MT\_re-establish\_delay} = 400 \text{ ms} + T_{identify\_intra\_NR} + \sum_{i=1}^{N_{freq}-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

The intra-frequency target NR cell shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2 and 10.1.3 of TS 38.133 [6] are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.3 of 38.133 [6] for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4 and 10.1.5 of 38.133 [6] are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.2 of 38.133 [6] for a corresponding NR Band are fulfilled.

$T_{identify\_intra\_NR}$: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell and on the frequency range (FR) of the target NR cell. If the IAB-MT is not configured with intra-frequency NR carrier for RRC re-establishment then $T_{identify\_intra\_NR}$=0; otherwise $T_{identify\_intra\_NR}$ shall not exceed the values defined in Table 12.1.1.1.2.1-1.

$T_{identify\_inter\_NR,i}$: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell and on the frequency range (FR) of the target NR cell. $T_{identify\_inter\_NR,i}$ shall not exceed the values defined in Table 12.1.1.1.2.1-2.

T_{SMTC}: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the IAB-MT has been provided with higher layer signaling of *smtc2* [15] and is not capable of 4 SMTC configurations per frequency [15], then T_{smtc} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell. If the IAB-MT has been provided with higher layer signaling of *smtcj*, where 1≤*j*≤4 [15] and is also capable of 4 SMTC configurations per frequency [15], then T_{smtc} follows *smtcj* according to the physical cell ID of the target cell.

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If the IAB-MT is not capable of 4 SMTC configurations per frequency [15], then the requirements shall apply provided that the IAB-MT is configured with only one SMTC configuration for each inter-frequency carrier *i* according to the physical cell ID of the target cell. If the IAB-MT has been provided with higher layer signaling of *smtcj*, where 1≤*j*≤4 [15] and is also capable of 4 SMTC configurations per frequency [15], then T_{smtc} follows *smtcj* configured for the inter-frequency carrier *i* according to the physical cell ID of the target cell. If the IAB-MT is not provided with SMTC configuration then the IAB-MT may assume that the target SSB periodicity is no larger than 160 ms.

T_{SI-NR}: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [15] for the target NR cell.

$T_{PRACH:}$ It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{PRACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in clause 14 of TS 38.213 [10].

N_{freq}: It is the total number of NR frequencies to be monitored for RRC re-establishment; N_{freq} = 1 if the target intra-frequency NR cell is known, else N_{freq} = 2 and $T_{identify\_intra\_NR}$ = 0 if the target inter-frequency NR cell is known.

There is no requirement if the target cell does not contain the IAB-MT context or if the SSB transmission periodicity is larger than 160 ms.

In the requirement defined in the below tables, the target FR1 cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown.

Table 12.1.1.1.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

Serving cell SSB Ês/Iot (dB)	Frequency range (FR) of target NR cell	$T_{identify\_intra\_NR}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (1600 ms, 5 x T_{SMTC})	MAX (6400 ms, 10 x T_{SMTC})
≥ -8	FR2	N/A	MAX (8000 ms, 80 x T_{SMTC}))
< -8	FR1	N/A	6400[Note1]
< -8	FR2	N/A	28160[Note1]
Note 1: The IAB-MT is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} >160 ms and serving cell SSB Ês/Iot < -8 dB.			

Table 12.1.1.1.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

Serving cell SSB Ês/Iot (dB)	Frequency range (FR) of target NR cell	$T_{identify\_inter\_NR,\ i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (1600 ms, 6 x $T_{SMTC,\ i}$)	MAX (6400 ms, 13 x $T_{SMTC,\ i}$)
≥ -8	FR2	N/A	MAX (8000 ms, 104 x $T_{SMTC,\ i}$))
< -8	FR1	N/A	6400[Note1]
< -8	FR2	N/A	32000[Note1]
Note 1: The IAB-MT is not required to successfully identify a cell on any NR frequency layer when $T_{SMTC,i}$ >160 ms and serving cell SSB Ês/Iot < -8 dB.			

12.1.1.2 Random access

The requirements in clause 6.2.2 in TS 38.133 V16.3.0 [6] apply for IAB-MT.

12.1.1.3 SA: RRC Connection Release with Redirection

12.1.1.3.1 Introduction

This clause contains requirements on the IAB-MT regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to NR from NR specified in TS 38.331 [15]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [15].

12.1.1.3.2 Requirements

12.1.1.3.2.1 RRC connection release with redirection to NR

The IAB-MT shall be capable of performing the RRC connection release with redirection to the target NR cell within $T_{connection\_release\_redirect\_NR}$.

The time delay ($T_{connection\_release\_redirect\_NR}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [15]) on the NR PDSCH and the time the IAB-MT starts to send random access to the target NR cell. The time delay ($T_{connection\_release\_redirect\_NR}$) shall be less than:

$$T_{connection\_release\_redirect\_NR} = T_{RRC\_procedure\_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH}$$

The target NR cell shall be considered detetable when for each relevant SSB, the side conditions should be met that,

- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.5 of 38.133 [6] for a corresponding NR Band are fulfilled.

$T_{RRC\_procedure\_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [15].

$T_{identify\text{-}NR}$: It is the time to identify the target NR cell and depends on the frequency range (FR) of the target NR cell. It is defined in Table 12.1.1.3.2-1. Note that $T_{identify\text{-}NR} = T_{PSS/SSS\text{-}sync} + T_{meas}$, in which $T_{PSS/SSS\text{-}sync}$ is the cell search time and T_{meas} is the measurement time due to cell selection criteria evaluation.

$T_{SI\text{-}NR}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the IAB-MT is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

$T_{RACH:}$ It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{RACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in clause 14 of TS 38.213 [10].

T_{rs} is the SMTC periodicity of the target NR cell if the IAB-MT has been provided with an SMTC configuration for the target cell in the redirection command, otherwise T_{rs} is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the IAB-MT is not capable of 4 SMTC configurations per frequency [15], then the requirements shall apply provided that the IAB-MT is configured with only one SMTC configuration on carrier configured configured for RRC connection release with redirection. If the IAB-MT has been provided with higher layer signaling of *smtcj*, where $1 \leq j \leq 4$ [15] and is also capable of 4 SMTC configurations per frequency [15], then T_{smtc} follows *smtcj* according to the physical cell ID of the target cell. If the IAB-MT is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then the requirement in this clause is applied with T_{rs} = 160 ms if the SSB transmission periodicity is not larger than 160 ms.

- There is no requirement if the SSB transmission periodicity is larger than 160ms.

Table 12.1.1.3.2-1: Time to identify target NR cell for RRC connection release with redirection to NR

Frequency range (FR) of target NR cell	$T_{identify\text{-}NR}$
FR1	MAX (5440 ms, 11×T_{rs})
FR2	MAX (7040 ms, 8×11×T_{rs})

12.2 Timing

12.2.1 IAB-MT transmit timing

12.2.1.1 Introduction

The IAB-MT shall have capability to follow the frame timing change of the reference cell in connected state. The uplink frame transmission takes place $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. IAB-MT belonging to local area IAB-MT class as defined in clause 4.4.2 and also capable of carrier aggregation shall use the SpCell as the reference cell for deriving the IAB-MT transmit timing for cells in the PTAG. IAB-MT initial transmit timing accuracy, gradual timing adjustment requirements are defined in the following requirements.

12.2.1.2 Requirements

The IAB-MT initial transmission timing error shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is specified in Table 12.2.1.2-1. This requirement applies for PUCCH, PUSCH and SRS or it is the PRACH transmission.

The IAB-MT shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the IAB-MT during the last 160 ms. The reference point for the IAB-MT initial transmit timing control requirement shall be the downlink timing of the reference cell minus $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$. The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell. N_{TA} for PRACH is defined as 0.

$(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ (in T_c units) for other channels is the difference between IAB-MT transmission timing and the downlink timing immediately after when the last timing advance in clause 12.2.2 was applied. N_{TA} for other channels is not changed until next timing advance is received. The value of $N_{\mathrm{TA\ offset}}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{\mathrm{TA\ offset}}$ is defined in Table 12.2.1.2-2.

Table 12.2.1.2-1: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_e
1	15	15	12*64*T_c
		30	10*64*T_c
		60	10*64*T_c
	30	15	8*64*T_c
		30	8*64*T_c
		60	7*64*T_c
2	120	60	3.5*64*T_c
		120	3.5*64*T_c
	240	60	3*64*T_c
		120	3*64*T_c
Note 1: T_c is the basic timing unit defined in TS 38.211 [8]			

Table 12.2.1.2-2: The Value of $N_{\text{TA offset}}$

Frequency range and band of cell used for uplink transmission	$N_{\text{TA offset}}$ (Unit: T_C)
FR1 TDD band without LTE-NR coexistence case	25600 (Note 1)
FR1 TDD band with LTE-NR coexistence case	39936 (Note 1)
FR2	13792
Note 1: The IAB-MT identifies $N_{\text{TA offset}}$ based on the information n-TimingAdvanceOffset as specified in TS 38.331 [15]. If IAB-MT is not provided with the information n-TimingAdvanceOffset, the default value of $N_{\text{TA offset}}$ is set as 25600 for FR1 band.	

When it is the transmission for PUCCH, PUSCH and SRS transmission, the IAB-MT shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 12.2.3 is applied.

12.2.1.2.1 Gradual timing adjustment

When the transmission timing error between the IAB-MT and the reference timing exceeds $\pm T_e$ then the IAB-MT is required to adjust its timing to within $\pm T_e$. The reference timing shall be $(N_{\text{TA}} + N_{\text{TA offset}}) \times T_c$ before the downlink timing of the reference cell. All adjustments made to the IAB-MT uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be T_q.

2) The minimum aggregate adjustment rate shall be T_p per second.

3) The maximum aggregate adjustment rate shall be T_q per 200 ms.

where the maximum autonomous time adjustment step T_q and the aggregate adjustment rate T_p are specified in Table 12.2.1.2.1-1.

Table 12.2.1.2.1-1: T_q Maximum Autonomous Time Adjustment Step and T_p Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (kHz)	T_q	T_p
1	15	5.5*64*T_c	5.5*64*T_c
	30	5.5*64*T_c	5.5*64*T_c
	60	5.5*64*T_c	5.5*64*T_c
2	60	2.5*64*T_c	2.5*64*T_c
	120	2.5*64*T_c	2.5*64*T_c
NOTE: T_c is the basic timing unit defined in TS 38.211 [8]			

12.2.3 IAB-MT timing advance

The requirements in clause 7.3 in [6] apply for IAB-MT.

12.2.4 Cell phase synchronization accuracy

12.2.4.1 Introduction

Cell phase synchronization accuracy for TDD is defined as the maximum absolute deviation in frame start timing between any pair of cells on the same frequency that have overlapping coverage areas.

12.2.4.2 Requirements

The cell phase synchronization accuracy measured at IAB DU antenna connectors shall be better than 3 μs.

12.3 Signalling Characteristics for IAB MTs

12.3.1 Radio Link Monitoring

12.3.1.1 Introduction

The UE requirements in sub-clause 8.1.1 [6] apply for IAB-MT.

12.3.1.2 Requirements for SSB based radio link monitoring

12.3.1.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell or PSCell, provided that the SSB configured for RLM is actually transmitted within IAB-MT active DL BWP during the entire evaluation period specified in clause 12.3.1.2.2.

Table 12.3.1.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 12.3.1.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

12.3.1.2.2 Minimum requirement

IAB-MT shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_out\_SSB}$ [ms] period becomes worse than the threshold Q_{out_SSB} within $T_{Evaluate\_out\_SSB}$ [ms] evaluation period.

IAB-MT shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_in\_SSB}$ [ms] period becomes better than the threshold Q_{in_SSB} within $T_{Evaluate\_in\_SSB}$ [ms] evaluation period.

$T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ are defined in Table 12.3.1.2.2-1 for FR1 with scaling factor $K_1 = 5$.

$T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ are defined in Table 12.3.1.2.2-2 for FR2 with scaling factor N=8 and $K_2 = 3$.

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, and these measurement gaps are overlapping with some but not all occasions of the SSB; and

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1 - \frac{T_{SSB}}{T_{SMTCperiod}}}$, when RLM-RS resource is not overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with measurement gap and RLM-RS resource is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1 - \frac{T_{SSB}}{MRGP} - \frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
    - $T_{SMTCperiod} \neq$ MGRP or
    - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1 - \frac{T_{SSB}}{MRGP}}$, when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1 - \frac{T_{SSB}}{Min(MRGP, T_{SMTCperiod})}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{P_{sharing\ factor}}{1 - \frac{T_{SSB}}{MRGP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor} = 1$
    - if all of the reference signals configured for RLM outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
    - if all of the reference signal configured for RLM outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped by with the SSB symbols indicated by *SSB-ToMeasure* and 1 symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured;
- $P_{sharing\ factor} = 3$, otherwise.

If the high layer in TS 38.331 [15] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 12.3.1.2.2-1: Evaluation period $T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ for FR1

Configuration	$T_{Evaluate\_out\_SSB}$ (ms)	$T_{Evaluate\_in\_SSB}$ (ms)
no DRX	Max(200 × K_1, Ceil(10 × P × K_1) × T_{SSB})	Max(100 × K_1, Ceil(5 × P × K_1) × T_{SSB})
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM.		

Table 12.3.1.2.2-2: Evaluation period $T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ for FR2

Configuration	$T_{Evaluate\_out\_SSB}$ (ms)	$T_{Evaluate\_in\_SSB}$ (ms)
no DRX	$Max(200 \times K_2, Ceil(10 \times P \times N \times K_2) \times T_{SSB})$	$Max(100 \times K_2, Ceil(5 \times P \times N \times K_2) \times T_{SSB})$
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM.		

12.3.1.2.3 Measurement restrictions for SSB based RLM

The UE requirements in sub-clause 8.1.2.3 [6] apply for IAB-MT.

12.3.1.3 Requirements for CSI-RS based radio link monitoring

12.3.1.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell or PSCell, provided that the CSI-RS configured for RLM is actually transmitted within IAB-MT active DL BWP during the entire evaluation period specified in clause 12.3.1.3.2. IAB-MT is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the IAB-MT active BWP.

Table 12.3.1.3.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	4dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	4dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 12.3.1.3.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

12.3.1.3.2 Minimum requirement

IAB-MT shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_out\_CSI-RS}$ [ms] period becomes worse than the threshold Q_{out_CSI-RS} within $T_{Evaluate\_out\_CSI-RS}$ [ms] evaluation period.

IAB-MT shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_in\_CSI-RS}$ [ms] period becomes better than the threshold Q_{in_CSI-RS} within $T_{Evaluate\_in\_CSI-RS}$ [ms] evaluation period.

- $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ are defined in Table 12.3.1.3.2-1 for FR1 with scaling factor $K_1 = 5$.
- $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ are defined in Table 12.3.1.3.2-2 for FR2 with scaling factor $K_2 = 3$.

The requirements of $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, and these measurement gaps are overlapping with some but not all occasions of the CSI-RS; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when the RLM-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is not overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- P = 3, when the RLM-RS resource is not overlapped with measurement gap and RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
    - $T_{SMTCperiod} \neq$ MGRP or
    - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{3}{1-\frac{T_{CSI-RS}}{MRGP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(MRGP,T_{SMTCperiod})}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{3}{1-\frac{T_{CSI-RS}}{MRGP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

If the high layer in TS 38.331 [15] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

NOTE: The overlap between CSI-RS for RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

The values of M_{out} and M_{in} used in Table 12.3.1.3.2-1 and Table 12.3.1.3.2-2 are defined as:

- M_{out} = 20 and M_{in} = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [8, clause 7.4.1] set to 3 and over the bandwidth $\geqslant$ 24 PRBs.

Table 12.3.1.3.2-1: Evaluation period $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ for FR1

Configuration	$T_{Evaluate\_out\_CSI-RS}$ (ms)	$T_{Evaluate\_in\_CSI-RS}$ (ms)
no DRX	Max(200 × K_1, Ceil(M_{out}×P × K_1)×T_{CSI-RS})	Max(100 × K_1, Ceil(M_{in}×P × K_1) × T_{CSI-RS})
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10ms, 20 ms or 40 ms.		

Table 12.3.1.3.2-2: Evaluation period $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ for FR2

Configuration	$T_{Evaluate\_out\_CSI-RS}$ (ms)	$T_{Evaluate\_in\_CSI-RS}$ (ms)
no DRX	Max(200 × K_2, Ceil(M_{out}×P × K_2)×T_{CSI-RS})	Max(100 × K_2, Ceil(M_{in}×P × K_2) × T_{CSI-RS})
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms.		

12.3.1.3.3 Measurement restrictions for CSI-RS based RLM

The UE requirements in sub-clause 8.1.3.3 [6] apply for IAB-MT.

12.3.1.4 Minimum requirement for IAB-MT turning off the transmitter

The UE requirements in sub-clause 8.1.5 [6] apply for IAB-MT.

12.3.1.5 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than Q_{out}, layer 1 of the IAB-MT shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [15].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Q_{in}, layer 1 of the IAB-MT shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [15].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 [10]. Two successive indications from layer 1 shall be separated by at least $T_{Indication\_interval}$.

$T_{Indication\_interval}$ is max(10ms, $T_{RLM-RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 12.3.1.2 if the RLM-RS resource is SSB, or T_{CSI-RS} specified in clause 12.3.1.3 if the RLM-RS resource is CSI-RS.

12.3.1.6 Scheduling availability of IAB-MT during radio link monitoring

The UE requirements in sub-clause 8.1.7 [6] apply for IAB-MT.

12.3.2 Link Recovery Procedure

12.3.2.1 Introduction

The UE requirements in sub-clause 8.5.1 [6] apply for IAB-MT.

12.3.2.2 Requirements for SSB based beam failure detection

12.3.2.2.1 Introduction

The UE requirements in sub-clause 8.5.2.1 [6] apply for IAB-MT.

12.3.2.2.2 Minimum requirement

IAB-MT shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\overline{q}_0$ estimated over the last $T_{Evaluate\_BFD\_SSB}$ ms period becomes worse than the threshold $Q_{out\_LR\_SSB}$ within $T_{Evaluate\_BFD\_SSB}$ ms period.

The value of $T_{Evaluate\_BFD\_SSB}$ is defined in Table 8.5.2.2-1 for FR1.

The value of $T_{Evaluate\_BFD\_SSB}$ is defined in Table 8.5.2.2-2 for FR2 with scaling factor N= 8.

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
    - $T_{SMTCperiod} \neq$ MGRP or
    - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{Min(MRGP,T_{SMTCperiod})}}$, when the BFD-RS resource is partially overlapped with measurement gap (T_{SSB} <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor} = 1$
    - if all of the reference signals configured for BFD outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
    - if all of the reference signal configured for BFD outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped by with the SSB symbols indicated by SSB-ToMeasure and 1 symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured;
    - $P_{sharing\ factor} = 3$, otherwise.

If the IAB-MT is not capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where 1≤*j*≤2 [15], then $T_{SMTCperiod}$ follows smtcj_{max} where j_{max} is the maximum value of all j for which smtcj has been configured.

If the IAB-MT is capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where 1≤*j*≤4 [15], then $T_{SMTCperiod}$ follows smtcj_{max} where j_{max} is the maximum value of all j for which smtcj has been configured.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 8.5.2.2-1: Evaluation period $T_{Evaluate\_BFD\_SSB}$ for FR1

Configuration	$T_{Evaluate\_BFD\_SSB}$ (ms)
no DRX	Max(50, Ceil(5 × P) × T_{SSB})
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_0$.	

Table 8.5.2.2-2: Evaluation period $T_{Evaluate\_BFD\_SSB}$ for FR2

Configuration	$T_{Evaluate\_BFD\_SSB}$ (ms)
no DRX	Max(50, Ceil(5 × P × N) × T_{SSB})
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_0$.	

12.3.2.2.3 Measurement restriction for SSB based beam failure detection

The UE requirements in sub-clause 8.5.2.3 [6] apply for IAB-MT.

12.3.2.3 Requirements for CSI-RS based beam failure detection

12.3.2.3.1 Introduction

The UE requirements in sub-clause 8.5.3.1 [6] apply for IAB-MT.

12.3.2.3.2 Minimum requirement

IAB-MT shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set $\overline{q}_0$ estimated over the last $T_{Evaluate\_BFD\_CSI-RS}$ ms period becomes worse than the threshold $Q_{out\_LR\_CSI-RS}$ within $T_{Evaluate\_BFD\_CSI-RS}$ ms period.

The value of $T_{Evaluate\_BFD\_CSI-RS}$ is defined in Table 8.5.3.2-1 for FR1.

The value of $T_{Evaluate\_BFD\_CSI-RS}$ is defined in Table 8.5.3.2-2 for FR2 with N=1. The requirements of $T_{Evaluate\_BFD\_CSI-RS}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when the BFD-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- P = $P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MRGP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(MRGP,T_{SMTCperiod})}}$, when the BFD-RS resource is partially overlapped with measurement gap (T_{CSI-RS} < MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MRGP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor} = 3$.

If the IAB-MT is not capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where $1 \leq j \leq 2$ [15], then $T_{SMTCperiod}$ follows $smtcj_{max}$ where j_{max} is the maximum value of all j for which smtcj has been configured.

If the IAB-MT is capable of 4 SMTC configurations per frequency [15], and is provided with higher layer signaling of smtcj, where $1 \leq j \leq 4$ [15], then $T_{SMTCperiod}$ follows $smtcj_{max}$ where j_{max} is the maximum value of all j for which smtcj has been configured.

NOTE: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

The values of M_{BFD} used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

- M_{BFD} = 10, if the CSI-RS resource(s) in set $\overline{q}_0$ used for BFD is transmitted with Density = 3.

Table 8.5.3.2-1: Evaluation period $T_{Evaluate\_BFD\_CSI-RS}$ for FR1

Configuration	$T_{Evaluate\_BFD\_CSI-RS}$ (ms)
no DRX	Max(50, $[M_{BFD} \times P] \times T_{CSI-RS}$)
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_0$.	

Table 8.5.3.2-2: Evaluation period $T_{Evaluate\_BFD\_CSI-RS}$ for FR2

Configuration	$T_{Evaluate\_BFD\_CSI-RS}$ (ms)
no DRX	Max(50, $[M_{BFD} \times P \times N] \times T_{CSI-RS}$)
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_0$.	

12.3.2.3.3 Measurement restrictions for CSI-RS based beam failure detection

The UE requirements in sub-clause 8.5.3.3 [6] apply for IAB-MT.

12.3.2.4 Minimum requirement for L1 indication

When the radio link quality on all the RS resources in set $\overline{q}_0$ is worse than Q_{out_LR}, layer 1 of the UE shall send a beam failure instance indication to the higher layers. A layer 3 filter may be applied to the beam failure instance indications as specified in TS 38.331 [15].

The beam failure instance evaluation for the RS resources in set $\overline{q}_0$ shall be performed as specified in clause 6 in TS 38.213 [10]. Two successive indications from layer 1 shall be separated by at least $T_{Indication\_interval\_BFD}$.

$T_{Indication\_interval\_BFD}$ is max(2ms, $T_{SSB-RS,M}$)) or max(2ms, $T_{CSI-RS,M}$), where $T_{SSB-RS,M}$ and $T_{CSI-RS,M}$ is the shortest periodicity of all RS resources in set $\overline{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\overline{q}_0$ or CSI-RS resource in the set $\overline{q}_0$.

12.3.2.5 Requirements for SSB based candidate beam detection

12.3.2.5.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\overline{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within IAB-MT active DL BWP during the entire evaluation period specified in clause 12.3.2.5.2.

12.3.2.5.2 Minimum requirement

Upon request the IAB-MT shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set $\overline{q}_1$ estimated over the last $T_{Evaluate\_CBD\_SSB}$ ms period becomes better than the threshold Q_{in_LR} provided SSB_RP and SSB Ês/Iot are according to Annex Table in B.2.4.1 [6] for a corresponding band.

The IAB-MT shall monitor the configured SSB resources using the evaluation period in table 12.3.2.5.2-1 and 12.3.2.5.2-2 which is applicable to the non-DRX mode only.

The value of $T_{Evaluate\_CBD\_SSB}$ is defined in Table 12.3.2.5.2-1 for FR1.

The value of $T_{Evaluate\_CBD\_SSB}$ is defined in Table 12.3.2.5.2-2 for FR2 with scaling factor N=8.

Where,

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency [or inter-RAT measurements], which are overlapping with some but not all occasions of the SSB,
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{Min(MRGP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor} = 1$
  - if all of the reference signals configured for CBD outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
  - if all of the reference signal configured for CBD outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped by with the SSB symbols indicated by SSB-ToMeasure and 1 symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured;
- $P_{sharing\ factor} = 3$, otherwise.

Table 12.3.2.5.2-1: Evaluation period $T_{Evaluate\_CBD\_SSB}$ for FR1

Configuration	$T_{Evaluate\_CBD\_SSB}$ (ms)
non-DRX	Ceil(3 × P) × T_{SSB}
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_1$.	

Table 12.3.2.5.2-2: Evaluation period $T_{Evaluate\_CBD\_SSB}$ for FR2

Configuration	$T_{Evaluate\_CBD\_SSB}$ (ms)
non-DRX	Ceil(3 × P × N) × T_{SSB}
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_1$.	

12.3.2.5.3 Measurement restriction for SSB based candidate beam detection

The UE requirements in sub-clause 8.5.5.3 [6] apply for IAB-MT.

12.3.2.6 Requirements for CSI-RS based candidate beam detection

12.3.2.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\overline{q}_1$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within IAB MT active DL BWP during the entire evaluation period specified in clause 12.3.2.6.2.

12.3.2.6.2 Minimum requirement

Upon request the IAB-MT shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set $\overline{q}_1$ estimated over the last $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period becomes better than the threshold Q_{in_LR} within $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period provided CSI-RS Ês/Iot is according to Annex Table in B.2.4.2 [6] for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 12.3.2.6.2-1 and 12.3.2.6.2-2 which is applicable to the non-DRX mode only.

The value of $T_{Evaluate\_CBD\_CSI-RS}$ is defined in Table 12.3.2.6.2-1 for FR1.

The value of $T_{Evaluate\_CBD\_CSI-RS}$ is defined in Table 12.3.2.6.2-2 for FR2 with scaling factor N=8.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency[or inter-RAT measurements], which are overlapping with some but not all occasions of the CSI-RS; and
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- P = 3, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MRGP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{3}{1-\frac{T_{CSI-RS}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(MRGP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- $P = \frac{3}{1-\frac{T_{CSI-RS}}{MRGP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 12.3.2.6.3.

The values of M_{CBD} used in Table 12.3.2.6.2-1 and Table 12.3.2.6.2-2 are defined as

- $M_{CBD} = 3$, if the CSI-RS resource configured in the set $\overline{q}_1$ is transmitted with Density = 3.

Table 12.3.2.6.2-1: Evaluation period $T_{Evaluate\_CBD\_CSI-RS}$ for FR1

Configuration	$T_{EvaluateC\_CBD\_CSI-RS}$ (ms)
non-DRX	Max(25, Ceil($M_{CBD} \times P$) $\times T_{CSI-RS}$)
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_1$.	

Table 12.3.2.6.2-2: Evaluation period $T_{Evaluate\_CBD\_CSI-RS}$ for FR2

Configuration	$T_{Evaluate\_CBD\_CSI-RS}$ (ms)
non-DRX	Max(25, Ceil($M_{CBD} \times P \times N$) $\times T_{CSI-RS}$)
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_1$.	

12.3.2.6.3 Measurement restriction for CSI-RS based candidate beam detection

The UE requirements in sub-clause 8.5.6.3 [6] apply for IAB-MT.

12.3.2.7 Scheduling availability of IAB-MT during beam failure detection

The UE requirements in sub-clause 8.5.7 [6] apply for IAB-MT.

12.3.2.8 Scheduling availability of IAB-MT during candidate beam detection

The UE requirements in sub-clause 8.5.8 [6] apply for IAB-MT.

Annex A (normative): IAB-MT Reference measurement channels

A.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.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.

The parameters for the reference measurement channels are specified in tables A.1-2 for FR2 OTA reference sensitivity level, OTA ACS, OTA in-band blocking, and OTA out-of-band blocking.

Table A1-1: 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
NOTE 1: *DL-DMRS-config-type* = 1 with *DL-DMRS-max-len* = 1, *DL-DMRS-add-pos* = pos2 with l_0 = 2, l = 6 and 9 as per Table 7.4.1.1.2-3 of TS 38.211 [3]. NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity				

Table A1-2: FRC parameters for FR2 reference sensitivity level for IAB-MT.

Reference channel	G-FR2-A1-21	G-FR2-A1-22	G-FR2-A1-23
Subcarrier spacing (kHz)	60	120	120
Allocated resource blocks	66	32	66
CP-OFDM Symbols per slot (Note 1)	9	9	9
Modulation	QPSK	QPSK	QPSK
Code rate (Note 2)	1/3	1/3	1/3
NOTE 1: DM-RS configuration type = 1 with DM-RS duration = single-symbol DM-RS, additional DM-RS position = pos2 with l_0 = 2, l = 6 and 9 as per Table 7.4.1.1.2-3 of TS 38.211 [3]. NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size.			

Annex B (informative): IAB-DU Error Vector Magnitude (FR1)

The Annex B in in TS 38.104 [2] apply to FR1 IAB-DU.

Annex C (normative): IAB-DU Error Vector Magnitude (FR2)

The Annex C in in TS 38.104 [2] apply to FR2 IAB-DU.

Annex D (normative): IAB-MT Error Vector Magnitude (FR1)

Void

Annex E (normative): IAB-MT Error Vector Magnitude (FR2)

Void

Annex F (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
09/2019	RAN4#92	R4-1910404				Initial TS skeleton	0.0.1
06/2020	RAN4#95-e	R4-2007467				Update of IAB TS with agreed TP in RAN4#95-e: R4-2007991 TP to TS 38.174 v0.0.1: Adding references related to IAB R4-2008769 TP to TS 38.174: system parameter R4-2006275 TP for TS 38.174: IAB-DU Transmitted signal quality R4-2008778 TP for TS 38.174: Transmit ON/OFF power R4-2008788 TP to TS 38.174: IAB RX IM requirement (section 7.7 and 10.8) R4-2008791 TP to TS 38.174: IAB ICS requirement (section 7.8 and 10.9) R4-2008795 TP to TS 38.174: OTA ACS R4-2008796 TP to TS 38.174: OTA RX spurious R4-2008798 TP to TS 38.174: OTA Inband blocking R4-2008799 TP to TS 38.174: Conducted RX spurious R4-2008800 TP to TS 38.174 -IAB-DU RX sensitivity R4-2008801 TP to TS 38.174 -IAB-DU Rx dynamic range R4-2009063 TP to TS 38.174 -IAB-DU TX dynamic range R4-2008596 TP to 38174 RRM IAB TS R4-2008597 TP to TS 38.174 v0.0.1: Updates to RRC re-establishment requirements for IAB MT R4-2008598 TP to TS 38.174 v0.0.1: Updates to RRC re-direction requirements for IAB MT R4-2008599 TP to TS 38174 Transmit Timing requirements for IAB-MT R4-2008600 TP for IAB RLM R4-2008601 TP to TS 38.174 v0.0.1: Beam Candidate Detection Requirements for IAB MT R4-2008611 TP to TS 38.174 on BFD requirements of IAB-MTs	0.1.0
09/2020	Ran4#96-e	R4-2012566				Update of IAB TS with agreed TPs in RAN4#96-e R4-2012108: Removing editor's notes and replacing TBD with appropriate numbers R4-2012234: RLM requirements for IAB MTs R4-2012614: IAB-MT classes, applicability of requirements, requirements for contiguous and non-contiguous spectrum R4-2012618: Output power dynamics, Radiated transmit power, OTA output power R4-2012620: IAB Output power, Radiated transmit power R4-2012621: Output power dynamics, OTA output power dynamics R4-2012622: Appendices, frequency error, modulation quality, OTA frequency error, OTA modulation quality R4-2012624: Unwanted emissions, OTA unwanted emissions R4-2012626: Transmitter intermodulation, OTA transmitter intermodulation R4-2012628: Reference sensitivity level, dynamic range, OTA sensitivity, OTA dynamic range, fixed reference channels for reference sensitivity R4-2012631: In-band selectivity and blocking, out-of-band blocking, OTA out-of-band blocking R4-2012633: Receiver intermodulation, OTA receiver intermodulation R4-2012760: IAB-MT receiver spurious emissions, OTA IAB-MT receiver spurious emissions	0.2.0
2020-09	RAN#89	RP-01909				Draft version for information purposes to the RAN Plenary	1.0.0
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