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Technical Report

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
NR;
Background for Integrated access and backhaul radio transmission and reception
(Release 16)

A GLOBAL INITIATIVE

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Contents

Foreword

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

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

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x the first digit:

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

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

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

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

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

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

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

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

can indicates that something is possible

cannot indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

1 Scope

The present document is the Technical Report for the Work Item on Integrated Access and Backhaul for NR. The present document captures the background and the decisions on IAB requirements.

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 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".

[7] 3GPP TS 38.817-02: "General aspects for Base Station (BS) Radio Frequency (RF) for NR".

[8] 3GPP TS 38.174: "NR; Integrated Access and Backhaul (IAB) radio transmission and reception"

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

[10] Recommendation ITU-R SM.1539-1: "Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and ITU-R SM.329".

[11] CISPR 32: "Electromagnetic compatibility of multimedia equipment – Emission requirements".

[12] 3GPP TS 38.113: "NR; Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

IAB type 1-H: IAB-MT and IAB-DU operating at FR1 with a requirement set holding requirements defined at the respective TAB and OTA requirements defined at the respective RIB

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

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

3.2 Symbols

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

A_A	The composite *antenna array* pattern in dB
A_E	The *array element* pattern in dB
BeW_Θ	The Beam width in Θ
BeW_ϕ	The Beam width in ϕ

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].

EMC	Electromagnetic Compatibility
ESD	Electrostatic discharge
IAB	Integrated Access and backhaul
IAB-DU	Integrated Access and Backhaul Distributed Unit
IAB-MT	Integrated Access and Backhaul Mobile Termination
LA	Local Area
MR	Medium Range
OTA	Over The Air
RB	Resource Block
RDN	Radio Distribution Network
REFSENS	Reference Sensitivity
RIB	Radiated Interface Boundary
RX	Receiver
RXU	Receiver Unit
TRP	Total Radiated Power
TRXU	Transceiver Unit
TRXUA	Transceiver Unit Array
TXU	Transmitter Unit
WA	Wide Area

4 General aspect

4.1 Relation with other core specification

IAB (Integrated Access and backhaul) node is a RAN node that supports wireless access to Ues and wirelessly backhauls the access traffic. Direct application of only Base station RF requirements is not appropriate enabler for both the wireless backhaul and wireless access and thus a new TS spec 38.174[8] will be specified.

In R16 IAB WI, the wireless backhaul technology is based on NR Uu so the 3GPP terminology will be reused to define the wireless backhaul RF specification. In Figure 6.3.1-1 reference diagram of architecture in 38.874, IAB node is functional splitted with IAB-DU and IAB-MT. IAB-DU has interface with UE and IAB-MT so it is representing the Base Station functionality. IAB-MT has interface with IAB-DU only and thus is representing the UE functionality.

3GPP TS 38.174[8] is a Single RAT NR IAB specification. The single RAT IAB means the same RAT will apply to both IAB-DU and IAB-MT. It is expected to capture IAB-DU and IAB-MT requirements for the following aspects:

Tx, Rx and demodulation core requirements for NR IAB-DU and NR IAB-MT

- Conducted and radiated sets of core requirements for the above listed categories (i.e. Tx, Rx and IAB demodulation),
- Requirements for FR1 and FR2 frequency ranges
    - FR1: Both conducted and OTA requirements will be required for Range 1. The applicability may depend on the requirements.
        - Requirement set 1-H: Conducted requirements and OTA requirements for FR1 hybrid IAB-DU and IAB-MT (which includes antenna functionality).
        - Requirement set 1-O: OTA requirements for FR1 OTA IAB-DU and OTA IAB-MT (which includes antenna functionality).
    - FR2: Only OTA requirements are defined for FR2.
        - Requirement set 2-O: OTA requirements for FR2 OTA IAB-DU and OTA IAB-MT.

3GPP TS 38.104 [2] is a Single RAT NR BS specification. IAB-DU shall reuse the relevant requirements from spec in TS 38.104 [2]. Where applicable, the IAB-MT may also re-use requirements from 38.104 [2].

3GPP TS 38.101-1/2 [3] [4] is a Single RAT NR UE specification. Where applicable, IAB-MT may reuse requirements from the spec in TS 38.101-1/2 [3] [4].

4.2 RF Requirements reference points

The requirement reference points for BS is defined as below:

Table 4.2-1: BS requirement sets

BS type / Requirement set	BS Description	Additional information
1-H	A BS operating at FR1 with a requirement set holding requirements defined at the TAB and OTA requirements defined at RIB.	The requirement set is like the one defined for Hybrid AAS BS. Following the approach used in 3GPP TS 37.105
1-O	A BS operating at FR1 with a requirement set consisting only OTA requirements defined at the RIB.	Following the approach developed in Eaas and documented in 3GPP TR 37.843.
2-O	A BS operating at FR2 with a requirement set consisting only of OTA requirements defined at the RIB.	This requirement set is relevant for AAS BS and does not require access to RF connectors.

The test and reference point of RF requirement for BS should be reused and thus the test spec will not be impacted.

The IAB-Du and IAB_MT may share the same hardware implementation, of so the reference points for the IAB-DU and the IAB-MT may be different.

Table 4.2-2: IAB requirement sets

IAB type / Requirement set	IAB Description	Additional information
1-H	IAB-MT and IAB-DU operating at FR1 with a requirement set holding requirements defined at the respective TAB and OTA requirements defined at the respective RIB	The requirement set for both IAB-DU and IAB-MT.
1-O	IAB-MT and IAB-DU operating at FR1 with a requirement set consisting only of OTA requirements defined at the respective RIB.	The requirement set for both IAB-DU and IAB-MT.
2-O	IAB-MT and IAB-DU operating at FR2 with a requirement set consisting only of OTA requirements defined at the respective RIB.	The requirement set for both IAB-DU and IAB-MT.

4.3 IAB classification

IAB-MT classification and IAB-DU classification will be defined separately.

For IAB-DU the classification will be the same as NR BS classification in TS 38.104 [2] to support Wide Area IAB-DU, Medium Range IAB-DU and Local Area IAB-DU with the same deployment scenarios for each class as for BS. The same criteria and exactly the same parameter of NR BS classification, e,g, BS to UE minimum distance on the ground for BS without connector, IAB-DU to UE minimum coupling loss for BS with connector, will be applied for IAB-DU with modification as IAB-DU to UE minimum distance on the ground for IAB-DU type 2-O/1-O and IAB-DU minimum coupling loss depends on IAB-DU type 1-H.

For IAB-MT multiple classes will be defined based on deployment scenario as well.

4.4 Void

4.5 IAB architecture

The logical architecture (considering the RF interfaces) of the IAB is as follows:

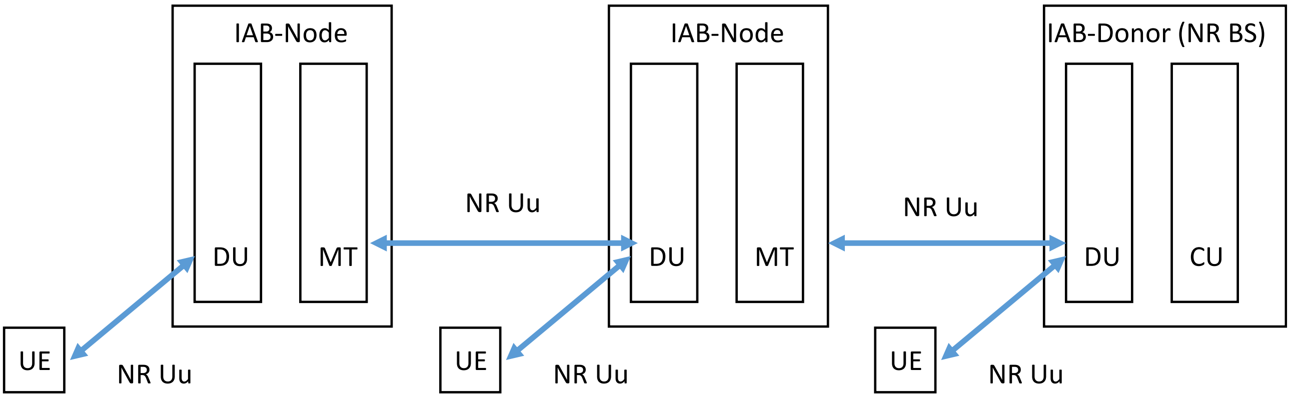

Figure 4.5-1: Logical IAB functions showing RF interfaces

In the RF specification these logical functions have been separated into the HW entities the IAB-DU and the IAB-MT IAB-DU. The HW entities may be implemented in the same radio hardware as shown in Figure 4.5-2 or separate radio hardware as shown in Figure 4.5-3, the diagrams show the OTA architecture but the same applies for the hybrid architecture.

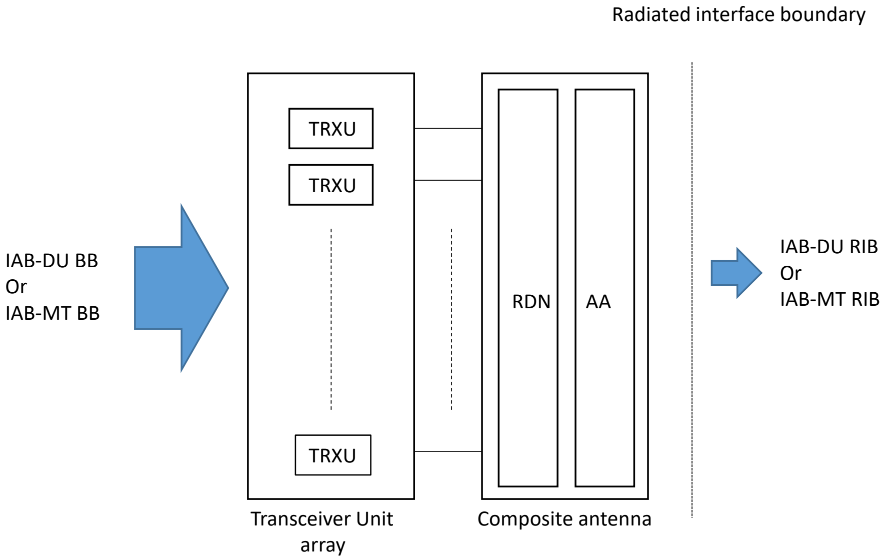

Figure 4.5-2: Shared IAB hardware

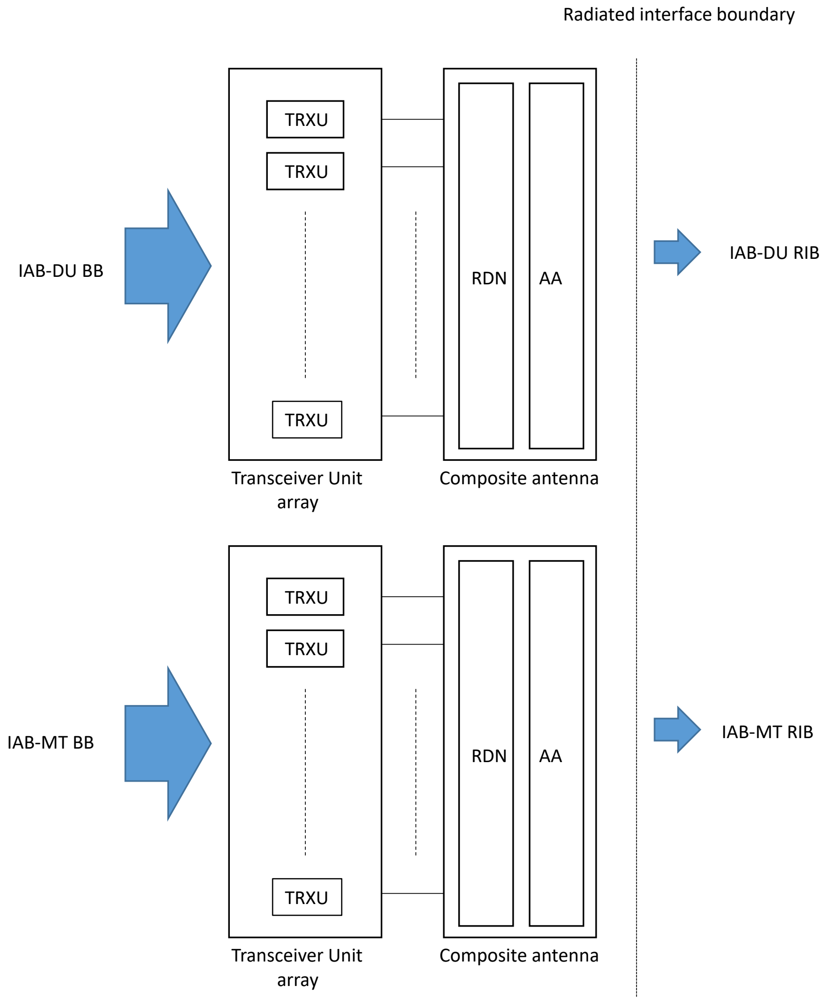

Figure 4.5-3: Separate IAB hardware

The figures show the hardware as either completely shared or completely separate, there are of course many levels of possible integration in between these 2 extremes.

When considering the OTA architecture and specifications the nature of HW is not relevant as the node can be treated as a black box, however in deriving the requirements for the IAB nodes it is important to consider both implementations so that both can be implemented if required.

5 Operating band and channel arrangement

5.1 General

The Frequency range definitions for IAB will be the same as for the NR BS in TS 38.104 [2].

5.2 Operating bands

Operating bands will be added to the IAB specification as they are approved, no bands are precluded at this stage and can be added based on consensus. Currently the FR1 bands shown in table 5.2-1 and all Rel-15 FR2 bands shown in table 5.2-2 are to be included in the IAB specification.

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

NR *operating band*	Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive $F_{UL,low}$ – $F_{UL,high}$ $F_{DL,low}$ – $F_{DL,high}$	Duplex mode
n41	2496 MHz – 2690 MHz	TDD
n77	3300 MHz – 4200 MHz	TDD
n78	3300 MHz – 3800 MHz	TDD
n79	4400 MHz – 5000 MHz	TDD

Table 5.2-2: NR *operating bands* in FR2

NR *operating band*	Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive $F_{UL,low}$ – $F_{UL,high}$ $F_{DL,low}$ – $F_{DL,high}$	Duplex mode
n257	26500 MHz – 29500 MHz	TDD
n258	24250 MHz – 27500 MHz	TDD
n260	37000 MHz – 40000 MHz	TDD
n261	27500 MHz – 28350 MHz	TDD

5.3 Channel bandwidth

Channel bandwidth covers definitions on the transmission bandwidth configuration, minimum guard band, RB alignment and channel bandwidth per operating band. For the transmission bandwidth configuration and minimum guard band, existing NR definition for BS and UE for each frequency range is the same. And they should be applied for IAB as it is. For RB alignment the IAB-DU should follow NR BS definition, And IAB-MT should follow NR UE definition. Regarding Channel bandwidth per operating band, it is agreed to incorporate only the bands and associated channel bandwidth to be supported for IAB in IAB specification.

5.4 Channel arrangement

Channel arrangement includes channel spacing, channel raster and sync raster. The introduction of IAB node should be transparent to UE from IAB-DU perspective. And it is not expected to impact on existing fundamental NR design on global channel raster and sync raster as well. Hence the channel raster, channel raster and sync raster definition in existing NR specification, which is identical in BS and UE, will be applied for IAB.

6 Co-existence study

6.1 System layout and scenario

6.1.1 Layout for co-existence study

For Layout 1 considered in IAB co-existence study the details are provided in Table 6.1.1-1 and figure 6.1.1-1 as below.

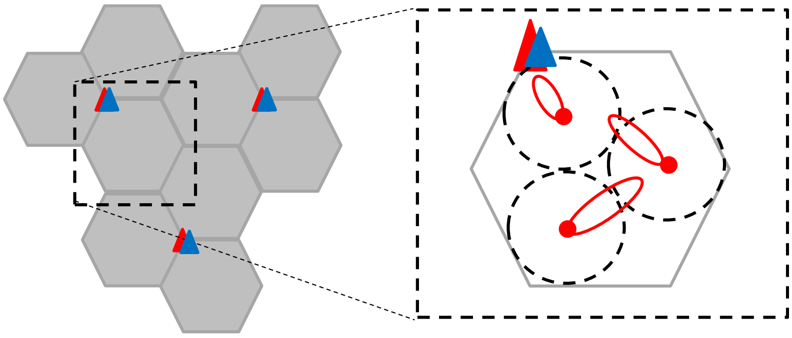

Figure 6.1.1-1: Layout 1

Table 6.1.1-1: Parameters for Layout 1

Parameters	Values and remarks
Layout for nodes	IAB network: Two layer Macro layer: Hex. Grid (3 sector) (all macro BSs are IAB-donors) 19 sites Micro layer: 1 micro BSs per macro BS 1. Random drop (All micro BSs are all outdoor and are IAB-nodes) 2. Drop micro nodes in a circle with center at 40m and radius of 20m Victim network 1. Macro layer: Hex grid 3 sector coordinated layout (0% grid shift) – Rel.15 legacy network 2. Same as aggressor Orientation: Highest gain towards donor
Inter-BS distance	Macro layer: 200m FR2, 500m FR1
Minimum distance between Micro BS	40m,50m, 60m

Minimum distance between Macro BS and UE	10m
Minimum distance between Micro BS and UE	10m

For Layout 2 considered in IAB co-existence study the details are provided in Table 6.1.1-2 and figure 6.1.1-2 as below.

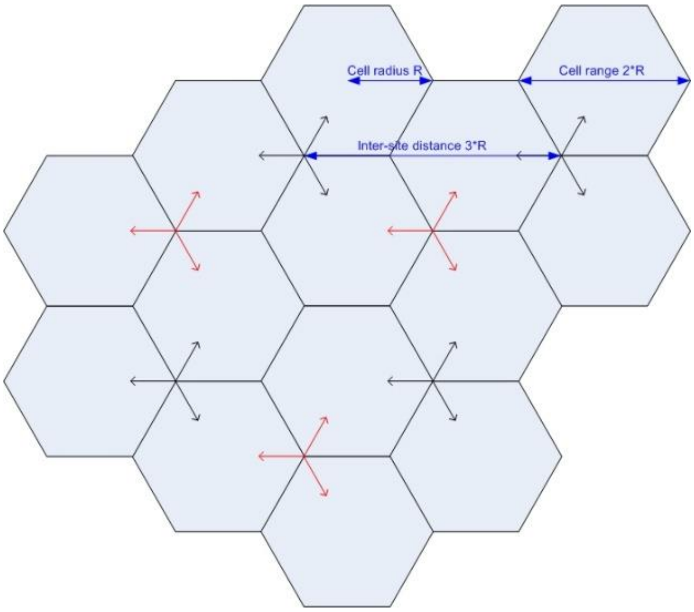

Figure 6.1.1-2: Layout 2

Table 6.1.1-2: Parameters for Layout 2

Parameters	Values and remarks
Layout for nodes	IAB network: Micro layer: Hex tri-sectorial Number of IAB-donors (Ndonor): 1 Number of IAB-nodes is 19 – Ndonor Victim network 1. Micro layer: Hex tri-sectorial – grid shift derived from minimum distance (20meters and 40 meters) 2. same as aggressor IAB-node and Micro BS are assumed to have 3 panels with 120 degree shift relative to each other.
Inter-BS distance	Micro layer: 200m

Layout 1: All micro IAB nodes are IAB-MTs and study will investigate at least interference on UL to the macro gNB receivers.

Layout 2: IAB nodes transmitting BH in UL slots or DL slots

For Victim system

Legacy Rel.15 NR (no IAB nodes) : All micro IAB nodes are IAB-MTs and study will investigate at least interference on UL to the macro gNB receivers

Same layout as aggressor with IAB nodes deployed: study will investigate at least IAB-MTs DL reception

6.1.2 Scenarios for co-existence study

There are two scenarios considered in co-existence study as shown in table 6.1.2-1.

Table 6.1.2-1: IAB co-existence scenarios

Scenario	Details
Scenario 1	In case of TDM operation the following mapping of IAB node transmission/reception to a TDD pattern (DL/UL/F resources) is assumed: IAB DU transmission / IAB MT reception: DL time slots IAB MT transmission / IAB DU reception: UL time slots
Scenario 2 for Layout 2 Only	In case of TDM operation the following mapping of IAB node transmission/reception to a TDD pattern (DL/UL/F resources) is assumed: IAB DU transmission / IAB MT reception: DL time slots IAB MT transmission / IAB DU reception: DL time slots

The following half duplex constraints will apply to all the IAB nodes of the network:

1. MT and DU operations (resource usage) are TDM-ed at each site
2. Each site is only Tx-ing or Rx-ing on different interfaces – Layout 2 and Scenario 2
3. DU is able to support multiple cells (and therefore multiple sectors) only if the cells are synchronized, i.e. different sectors of the same site cannot be simultaneously transmitting and receiving.

For IAB operation mode it is agreed as table 6.1.2-2, 6.1.2-3 and 6.1.2-4, with the same TDD pattern is assumed between two adjacent channel operators.

Table 6.1.2-2: Aggressor: IAB Network, Victim: NR Network

Layout	Scenario	Aggressor system	Victim system
1	**1**	UL: (IAB-MT) -> (IAB-Donor)	UL: UE -> gNB
2	**1**	UL: (IAB-MT) & UE ->(IAB-DU/IAB-Donor)	UL: UE -> gNB
		DL: (IAB-DU/IAB-Donor)->(IAB-MT) & UE	DL: gNB->UE
	2	DL: (IAB-MT) ->(IAB-DU/IAB-Donor)& DL: (IAB-DU/IAB-Donor)->(IAB-MT & UE)	DL: gNB->UE
Assumption for all scenarios		1 MT and 3 Dus per site (1 DU per sector)	

Table 6.1.2-3: Aggressor: NR Network, Victim: IAB Network

Layout	Scenario	Aggressor system	Victim system
1	1	UL: UE -> gNB	UL: (IAB-MT) -> (IAB-Donor)
		DL: gNB->UE	DL: (IAB-Donor)->(IAB-MT)
2	1	UL: UE -> gNB	UL: (IAB-MT) & UE ->(IAB-DU/IAB-Donor)
		DL: gNB->UE	DL: (IAB-DU/IAB-Donor)->(IAB-MT) & UE
	2	DL: gNB->UE	DL: (IAB-MT) ->(IAB-DU/IAB-Donor) & DL: (IAB-DU/IAB-Donor)->(IAB-MT & UE)
Assumption for all scenarios		1 MT and 3 Dus per site (1 DU per sector)	

Table 6.1.2-4: Aggressor: NR Network, Victim: IAB Network

Layout	Scenario	Aggressor system	Victim system
1	1	UL: (IAB-MT) -> (IAB-Donor)	UL: (IAB-MT) -> (IAB-Donor)
2	1	UL: (IAB-MT) & UE ->(IAB-DU/IAB-Donor)	UL: (IAB-MT) & UE ->(IAB-DU/IAB-Donor)
		DL: (IAB-DU/IAB-Donor)->(IAB-MT) & UE	DL: (IAB-DU/IAB-Donor)->(IAB-MT) & UE
	2	DL: (IAB-MT) ->(IAB-DU/IAB-Donor)& DL: (IAB-DU/IAB-Donor)->(IAB-MT & UE)	DL: (IAB-MT) ->(IAB-DU/IAB-Donor)& DL: (IAB-DU/IAB-Donor)->(IAB-MT & UE)
Assumption for all scenarios:		1 MT and 3 Dus per site (1 DU per sector)	

6.1.3 Co-location

An IAB node is capable of transmitting in the DL (IAB-DU) or the UL (IAB-MT). When acting as an IAB-MT there are 2 possible co-location interference scenarios between the IAB-MT and a BS.

- Aggressor IAB-MT transmitting in UL, victim BS receiving in UL
- Aggressor BS transmitting in DL, victim IAB-MT receiving in DL

For co-location, the interference is given by:

$$P_{interference} = 10 * log_{10}\left(10^{\frac{P_{ACLR}}{10}} + 10^{\frac{P_{ACS}}{10}}\right)$$

Where:

P_{ACLR} = Ptx_aggressor – $ACLR_{aggressor}$ – coupling

P_{ACS} = Ptx_aggressor – ACS_{victim} – coupling

A conservative estimate for the coupling between two co-located systems is; 30Db for FR1 and 45Db for FR2.

NOTE: this figure is used only for this analysis. It is not an agreed FR2 isolation figure.

For a micro BS scenario:

Table 6.1.3-1: Co-location interference between BS and IAB-MT for FR1 and FR2

Parameters		IAB		BS	
	unit	FR1	FR2	FR1	FR2
P_{tx}	dBm	30	30	33	33
ACLR	dB	45 (Note1)	28 (Note1)	45	28
Sensitivity (FR2 approx. equivalent conducted sensitivity)	dBm	-96.5 (4.5MHz) (Note2)	17hannon. -85 (50MHz) (Note2)	-96.5 (4.5MHz)	17hannon. -85 (50MHz)
ACS	dB	45	24	45	24
Coupling	dB	30	45 (Note3)	30	45 (Note3)
IAB to BS interference (UL)	dBm	-	-	-42.0	-37.5
BS to IAB interference (DL)	dBm	-41.9	-34.5	-	-
Note1: the ACLR figures used are BS values, it has not been agreed to use BS figure for IAB, and however UE figures will result in worse interference. Note 2: sensitivity values based on NF assumption in co-location simulation see clause 8.2 and 10.2. Note 3: coupling figures for FR2 are not formally agreed, assumption used only for this example					

Note for FR2 there are no conducted requirements so the coupling and the sensitivity are estimated to a virtual conducted point for the purposes of comparison.

It can be seen that for both FR1 and FR2 significant additional isolation (50 to 60Db) is required if the systems are to be co-located.

The issue exists for both scenario 1 and scenario 2 (see clause 6.1.2) as it occurs in both the UL and the DL.

6.2 Simulation assumption

6.2.1 Propagation model

RAN4 study on IAB co-existence reuse the pathloss model between parent/donor IAB node DU and child IAB node MT agreed in RAN1 in TR 38.874.

The path loss for links between the IAB-node and candidate serving IAB-nodes/donors is determined based on N independent large-scale channel realizations (taking into account LOS/NLOS probability and shadow fading). The realization that results in the minimum pathloss between the IAB-node and the associated serving IAB-node/donor is selected.

- N=3 intra-operator serving cell
- N=1 for all others

6.2.2 Antenna configuration

6.2.2.1 General

Since some parameters required by the array antenna model are not independent, arbitrary parameter values are not supported. If parameters are selected arbitrary the model will produce incorrect gain characteristics.

We define arrays using the number of columns, rows, the separation between them as well as the definition of the element radiation pattern and its gain.

Clearly the element cannot be physically larger than the space between the elements. The element beam width parameters are directly related to the available unit area for the element. Also, the element gain is directly related to the element directivity via the selected beam widths. Therefore, parameters for G_{Emax}, φ_{3Db} and θ_{3Db} cannot be selected arbitrary.

The array spacing, the element gain and the element beam width must therefore all be aligned.

The element peak gain will be determined by the available physical area as:

$$G_{E,max} \leq 10\log_{10}\left(\frac{4\pi A}{\lambda^2}\right) - L_E$$

, where A is the area available for a single element. The area can be expressed as:

$$A = d_h d_v$$

Also, the maximum achieved peak element gain for given wide symmetrical beam with can be expressed as [3]:

$$G_{E,max} \approx 10\log_{10}\left(\frac{52525}{\varphi_{3dB}\theta_{3dB}}\right) - L_E$$

6.2.2.2 FR1

The FR1 antenna is defined as:

Table 6.2.2.2-1 FR1 IAB antenna model for macro scenario

Parameter	Values
Composite Array radiation pattern in Db $A_A(\theta,\varphi)$	$A_A(\theta,\varphi) = A_E''(\theta,\varphi) + 10log_{10}\left(1 + \rho * \left(\left\lvert\sum_{n=1}^{N}\sum_{m=1}^{M} w_{n,m} * v_{n,m}\right\rvert^2 - 1\right)\right)$ the steering matrix components are given by $v_{n,m} = exp\left(i * 2\pi\left((m-1) * \frac{d_M}{\lambda}cos(\theta) + (n-1) * \frac{d_N}{\lambda}sin(\theta)sin(\varphi)\right)\right)$ $n = 1,2,\dots N, m = 1,2,\dots M$ the weighting factor is given by $w_{n,m} = \frac{1}{\sqrt{NM}}exp\left(1 * 2\pi\left((m-1)\frac{d_M}{\lambda}sin(\theta) - (n-1)\frac{d_N}{\lambda}cos(\theta)sin(\varphi)\right)\right)$ $n = 1,2,\dots N, m = 1,2,\dots M$
Antenna element vertical radiation pattern (Db)	$A_{E,V}(\theta'') = -min\left\{12\left(\frac{\theta''-90°}{\theta_{3dB}}\right)^2, SLA_V\right\}, \theta_{3dB} = 65°, SLA_V = 30dB$
Antenna element horizontal radiation pattern (Db)	$A_{E,H}(\varphi'') = -min\left\{12\left(\frac{\varphi''}{\varphi_{3dB}}\right)^2, A_m\right\}, \varphi_{3dB} = 130°, A_m = 30dB$
Combining method for 3D antenna element pattern (Db)	$A_E''(\theta'',\varphi'') = -min\{-[A_{E,V}(\theta'') + A_{E,H}(\varphi'')], A_m\}$

Maximum directional gain of an antenna element $G_{E,max}$	5 dBi
Antenna loss /Efficiency	1.8 Db
BS antenna configuration	$(M_g, N_g, M, N, P) = (1, 1, 8, 8, 1)$ Note 1,2
(d_v, d_h)	(0.8λ, 0.5λ)
Mechanical down tilt	10°
Note 1: Mg = number of antenna panels in elevation, Ng – number of antenna panels in azimuth, M = number of antenna elements/subarrays in elevation, N= number of antenna elements/subarrays in azimuth, P = number of polarizations. Note 2: single polarization simulated under the assumption of polarization match.	

The element spacing is and hence the maximum element size is 0.8λ, 0.5λ, this corresponds to an element gain or 19hannon.:

$$G_{ANT\_element} \approx 10 * log_{10}\left(\frac{4\pi * d_v, * d_h}{\lambda^2}\right) - Loss \approx 10 * log_{10}\left(\frac{4\pi * 0.8\lambda, * 0.5\lambda}{\lambda^2}\right) - 1.8 \approx 5dBi$$

The radiation pattern for the 0.8λ, 0.5λ element has a beam width of 19hannon. 65° in elevation and 130° in azimuth.

6.2.2.3 FR2

The FR2 BS antenna is defined as:

Table 6.2.2.3-1. FR2 IAB antenna model for macro scenario

Parameter	Values
Composite Array radiation pattern in Db $A_A(\theta,\varphi)$	$A_A(\theta,\varphi) = A_E''(\theta,\varphi) + 10log_{10}\left(1 + \rho * \left(\left\lvert\sum_{n=1}^{N}\sum_{m=1}^{M} w_{n,m} * v_{n,m}\right\rvert^2 - 1\right)\right)$ the steering matrix components are given by $v_{n,m} = exp\left(i * 2\pi\left((m-1) * \frac{d_M}{\lambda}cos(\theta) + (n-1) * \frac{d_N}{\lambda}sin(\theta)sin(\varphi)\right)\right)$ $n = 1,2, \dots N, m = 1,2, \dots M$ the weighting factor is given by $w_{n,m} = \frac{1}{\sqrt{NM}}exp\left(1 * 2\pi\left((m-1)\frac{d_M}{\lambda}sin(\theta) - (n-1)\frac{d_N}{\lambda}cos(\theta)sin(\varphi)\right)\right)$ $n = 1,2, \dots N, m = 1,2, \dots M$
Antenna element vertical radiation pattern (Db)	$A_{E,V}(\theta'') = -min\left\{12\left(\frac{\theta''-90°}{\theta_{3dB}}\right)^2, SLA_V\right\}, \theta_{3dB} = 130°, SLA_V = 30dB$
Antenna element horizontal radiation pattern (Db)	$A_{E,H}(\varphi'') = -min\left\{12\left(\frac{\varphi''}{\varphi_{3dB}}\right)^2, A_m\right\}, \varphi_{3dB} = 130°, A_m = 30dB$

Combining method for 3D antenna element pattern (Db)	$A''(\theta'',\varphi'') = -min\{-[A_{E,V}(\theta'') + A_{E,H}(\varphi'')], A_m\}$
Maximum directional gain of an antenna element $G_{E,max}$	3 dBi (assuming 1.8Db loss)
Antenna loss /Efficiency	1.8 Db
BS antenna configuration	$(M_g, N_g, M, N, P) = (1, 1, 8, 16, 1)$ Note 1,2
(d_v, d_h)	(0.5λ, 0.5λ)
Mechanical down tilt	10°
Note 1: Mg = number of antenna panels in elevation, Ng – number of antenna panels in azimuth, M = number of antenna elements/subarrays in elevation, N= number of antenna elements/subarrays in azimuth, P = number of polarizations. Note 2: single polarization simulated under the assumption of polarization match.	

In this case the element spacing is and hence the maximum element size is 0.5λ, 0.5λ, this corresponds to an element gain or 20hannon.:

$$G_{ANT\_element} \approx 10 * log_{10}\left(\frac{4\pi * d_v, * d_h}{\lambda^2}\right) - Loss \approx 10 * log_{10}\left(\frac{4\pi * 0.5\lambda, * 0.5\lambda}{\lambda^2}\right) - 1.8 \approx 3dBi$$

The radiation pattern for the 0.5λ, 0.5λ element has a beam width of 20hannon. 130° in elevation and 130° in azimuth.

The UE antenna is defined as:

Table 6.2.2.3-2. FR2 UE antenna model

Parameter	Values
Composite Array radiation pattern in Db $A_A(\theta,\varphi)$	$A_A(\theta,\varphi) = A_E''(\theta,\varphi) + 10log_{10}\left(1 + \rho * \left(\left\|\sum_{n=1}^{N}\sum_{m=1}^{M} w_{n,m} * v_{n,m}\right\|^2 - 1\right)\right)$ the steering matrix components are given by $v_{n,m} = exp\left(i * 2\pi\left((m-1) * \frac{d_M}{\lambda}cos(\theta) + (n-1) * \frac{d_N}{\lambda}sin(\theta)sin(\varphi)\right)\right)$ $n = 1,2, \ldots N, m = 1,2, \ldots M$ the weighting factor is given by $w_{n,m} = \frac{1}{\sqrt{NM}}exp\left(1 * 2\pi\left((m-1)\frac{d_M}{\lambda}sin(\theta) - (n-1)\frac{d_N}{\lambda}cos(\theta)sin(\varphi)\right)\right)$ $n = 1,2, \ldots N, m = 1,2, \ldots M$
Antenna element vertical radiation pattern (Db)	$A_{E,V}(\theta'') = -min\left\{12\left(\frac{\theta''-90°}{\theta_{3dB}}\right)^2, SLA_V\right\}, \theta_{3dB} = 130°, SLA_V = 25dB$

Antenna element horizontal radiation pattern (Db)	$A_{E,H}(\varphi'') = -min\left\{12\left(\frac{\varphi''}{\varphi_{3dB}}\right)^2, A_m\right\}, \varphi_{3dB} = 130°, A_m = 25dB$
Combining method for 3D antenna element pattern (Db)	$A''(\theta'', \varphi'') = -min\{-[A_{E,V}(\theta'') + A_{E,H}(\varphi'')], A_m\}$
Maximum directional gain of an antenna element $G_{E,max}$	3 dBi (assuming 1.8Db loss)
Antenna loss /Efficiency	1.8 Db
UE antenna configuration	$(M_g, N_g, M, N, P) = (1, 1, 2, 2, 1)$
(d_v, d_h)	$(0.5\lambda, 0.5\lambda)$
UE orientation	Random orientation in the azimuth domain: uniformly distributed between -90 and 90 degrees* Fixed elevation: 90 degrees
NOTE: This is done to emulate two panels: the configuration is equivalent to 2 panels with 180 shift in horizontal orientation and UE orientation uniformly distributed in the azimuth domain between -180 and 180 degrees.	

The element definition is the same as that of the BS but the array is smaller.

By combining the element and array patterns this gives a composite gain of:

$$G_{ANT\_composite} \approx 10 * log_{10}\left(\frac{4\pi * d_v, * d_h}{\lambda^2}\right) - Loss \approx 10 * log_{10}(M * N) + G_{ANT_{element}} 6 + 3 \approx 9dBi$$

6.2.3 Other simulation assumption

The remaining simulation assumptions such as link level assumption, system level assumption, and simulation methodology are captured in this clause.

Table 6.2.3-1: Link level assumptions

Parameter	Details
Target SNR	IAB node-MT: SNR target: 22dB [upper limit of 21hannon curve] $\gamma = 1$ Legacy NR UE: SNR target: 15 dB $\gamma = 1$
Power control	MT for UL transmissions: Yes DU for DL transmission: No
Throughput mapping	Map SINR into throughput with the 21hannon equation

Table 6.2.3-2: System level assumptions

Parameter	Details
Duplex mode	TDD

Frequency range	FR1: 4.9GHz – FR2: 30GHz
Beamforming	FR1: Yes – FR2: Yes
Simulation bandwidth	100MHz for FR1 200MHz for FR2
Number of Ues in the network	FR2: 1 active UE/sector FR1: 3 active Ues/sector
gNB Tx power	33 dBm for FR2 macro and micro 46 dBm for FR1
IAB node Tx power	33 dBm for FR2, PC is TBD for Scenario 2 for MT link 38dBm for FR1 (medium range power limit)
IAB MT min TX power	-10dBm, 0dBm, 10dBm, 20dBm TRP
gNB antenna height	25m for macro cells and 10m for micro cells
IAB node antenna height	25m for macro cells and 10m for micro cells
gNB receiver noise figure	10dB for FR2 5dB for FR1
IAB node receiver noise figure	10dB for FR2 5dB for FR1
UE Tx power (dBm)	FR2: 22.4dBm EIRP (13.4dBm conducted) FR1: 23dBm (conducted)
UE noise figure (dB)	10

Table 6.2.3-3: Simulation methodology

Parameter	Details
Layout 1	Optimum orientation between parent and child
Layout 2	Antenna orientation based on planned macro layout
Topology	based on RSRP (based on pathloss and element antenna gain)
Activity factor	Up to company

6.3 Simulation result

Simulation result provided for IAB co-existence study is summarized in Annex A.

6.4 Void

7 Conducted transmitter characteristics

7.1 General

Conducted transmitter characteristics were defined for IAB-MT type 1-H and IAB-DU type 1-H. Requirements were agreed not to be defined for type 1-C, as type 1-H can also support only one TAB connector. Another reason is that, the IAB expects directional antennas, therefore, only AAS types were considered. The general principles of type 1-H requirements are the same as defined for NR base stations, i.e. full set of transceiver units are used in evaluating the conducted transmitter characteristics, unless stated otherwise, and when calculating conducted TX emission limits, the requirements defined as basic limits can be scaled up to 8x depending on the number of active transmitter units and number of cells.

7.2 IAB output power

IAB output power limits are defined for each IAB-DU and IAB-MT class. For each class the rated power per carrier at TAB connector and sum of rated power per carrier over all TAB connectors need to be aligned with specified limits.

For IAB-DU the limits are exactly the same as defined for NR BS type 1-H.

For IAB-MT only two classes, local area and wide area IAB-MT, were agreed to be specified. The IAB-MT output power limits for local area IAB-MT are the same as defined for local area IAB-DU and limits for wide area IAB-MT are the same as defined for wide area IAB-DU. Therefore, no upper power limit is specified for wide area IAB-MT.

7.3 Output power dynamics

7.3.1 Power control

The power control requirements are not defined to the wide area IAB-MT, as the tolerances for power control are large compared to the minimum requirement for dynamic range.

For the local area IAB-MT, the absolute power tolerance was not defined as the dynamic range defined for the local area IAB-MT is not large enough compared to the tolerance value from UE requirement.

For local area IAB-MT, the relative and aggregate power tolerance requirements are taken into use with the requirement values to be modified compared to the UE specification.

7.4 Transmit ON/OFF power

Transmit ON/OFF power requirements include two parts: transmitter off power and transmitter transient period. For IAB-DU, it's straightforward to reuse BS's both requirements because IAB-DU behaviour is the same as BS.

For IAB-MT, reusing BS or UE requirements for both OFF power and transient period are the candidates. Comparing BS OFF power and UE OFF power requirements, BS FR1 requirements are more stringent than UE but FR2 visa verse. It is unlikely there will be many IAB nodes in close proximity so a relaxed requirement compared to Ues should not cause a rise in overall interference in the system. Therefore, IAB-MT can reuse BS off power. Regarding transient period requirements, the general profiles for BS and UE are similar but FR2 BS transient period length is shorter than UE. UE has many specific profiles requirements to explicitly define the transient period location for different physical layers and different test cases. As IAB-MT implementation has less restriction than commercial UE, it is expected that IAB-MT can meet BS more stringent transient period length requirements. Thus IAB-MT general profile requirements can reuse BS requirements. For the UE specific profiles, they are not needed for IAB-MT because IAB-MT should know UE behaviour when different physical channels are transmitted.

Based the above analysis, both IAB-DU and IAB-MT reuse BS ON/OFF power requirements including the OFF power and transient period.

7.5 Transmitted signal quality

7.5.1 IAB-DU transmitted signal quality

As the IAB-DU behavior is very similar with BS, all of the transmitted signal quality requirements can be imported from BS. Therefore, the frequency error, modulation quality and time alignment error requirements in clause 6.5.1, 6.5.2, 6.5.3 for BS type 1-H in TS 38.104 [2] apply to IAB-DU type 1-H.

7.5.2 IAB-MT transmitted signal quality

7.5.2.1 Frequency error

As IAB-MT function is more like a UE, UE frequency error correction can be a reference. When BS transmits DL signal to UE, UE does frequency error correction algorithm to make sure UE follows BS with a relative low residual frequency error.The residual frequency error after compensation should be less than one percent of the subcarrier interval.

If 15KHz SCS is used, one percent is 150 Hz which is 0.1 ppm for 1.5 GHz and less than 0.1 ppm of the higher carrier frequency. For higher modulation such as 256 QAM, the residual frequency error should be much smaller. Therefore, in order to support high modulation, UE frequency offset correction algorithm should make the residual frequency error less than +/- 0.1ppm. The UE frequency offset correction algorithm follows BS carrier frequency through DL signals that's why the UE frequency error should be defined as relative frequency error not absolute frequency error.

When IAB-MT receives IAB-DU DL signal, the similar frequency error correction algorithm may be used to make high modulation support possible. Therefore, IAB-MT frequency error requirement is defined to reuse UE requirements as ± 0.1 PPM compared to the carrier frequency received from the parent node

7.5.2.2 Error Vector Magnitude

EVM performance is the SNR performance of the transmitted signal. In order to have the same link performance, IAB-MT output signal quality should have the same performance as UE then guarantee the link quality. UE requirements are reused by IAB-MT EVM requirements. The difference is that BPSK EVM requirement is removed considering BPSK modulation is not likely to be used by the backhaul link. As IAB-MT is part of IAB node which is a network node, the principle of EVM frame structure for IAB-MT measurement can reuse BS EVM frame structure.

7.6 Unwanted emissions

Unwanted emissions cover the definitions and requirements for OOB boundary, occupied bandwidth, ACLR including also absolute ACLR, OBUE, and spurious emissions.

For IAB-DU type 1-H all unwanted emissions requirements, except for the protection of the BS receiver of own or different BS, are the same as specified for NR BS type 1-H. The background for these requirements can be found from TR 38.817-02 [7]. The requirement for the own or other receiver is not specified, as for NR BS the requirement applies only for FDD operation and no FDD band is defined for IAB.

All the requirements are the same for IAB-MT and IAB-DU based on class so that wide area IAB-MT requirements were agreed to be the same as defined for wide area IAB-DU and requirements for local area IAB-MT were agreed to be the same as defined for local area IAB-DU.

7.7 Transmitter intermodulation

For conducted transmitter intermodulation, it is agreed to reuse the base station framework for both IAB-DU and IAB-MT.

8 Conducted receiver characteristics

8.1 Void

8.2 Reference sensitivity level

8.2.1 IAB-DU Reference sensitivity

The IAB-DU conducted reference sensitivity requirement is the same as the BS conducted sensitivity requirement.

8.2.2 IAB-MT Reference sensitivity

The IAB-MT uses similar assumptions for antenna architecture and gain as the IAB-DU, it is also assumed that the front end HW is similar and has the same NF.

As such the IAB-MT reference sensitivity will be derived using the same assumptions as the BS. The IAB-MT sensitivity is given by:

$$P_{REFSENS}(dBm) = -174dBm + 10 \times \log_{10} BW + N_F + I_M + SNR$$

Where:

- BW is the maximum transmission bandwidth for the FRC
- N_F is the noise figure
- I_M is the implementation margin.
- SNR is the SNR value for which we reach 95% throughput. Each company provided simulation results, and average will be done for each BW.

The NF and the IM margin are hardware dependent and taken from the BS:

NF = 5dB for wide area IAB-MT and 13dB for local area IAB-MT

IM is 2dB

As the IAB-MT operated on the DL the FRC's and the associated SNR requirements could be based on the UE FRCs. There are many more FRC's for the UE for each of the channel BW's however it is sufficient to specify a limited number of FRC's in the same way as the BS. For each BS FRC there is a UE FRC of the same transmission BW and hence these can be used for the IAB-MT as shown in table 8.2.2-1.

The UE FRC definition is more complex than the BS and includes some parameters which require communication between eth UE and the BS test emulator. The method for conformance for the IAB-MT has not yet been agreed and hence the definition of the FRC is simplified in order to avoid any test implications. As such we keep the MCS, PRB allocation, SCS and CHBW information in FRC for core requirements; further discuss other detailed parameters in conformance phase

In addition for the current IAB FR1 bands only TDD are specified so there is no need for 15 kHz SCS at this release.

Table 8.2.2-1: FRC's for the FR1 IAB-MT

BS Reference channel	equivalent UE reference channel (TS 38.101-1 [3], Annex A3.3)
G-FR1-A1-2	Table A.3.3.2-2, 5MHz CBW
G-FR1-A1-3	Table A.3.3.2-3, 10MHz CBW
G-FR1-A1-5	Table A.3.3.2-2, 20MHz CBW

G-FR1-A1-6	Table A.3.3.2-3, 20MHz CBW

The SNR for the BS varies between -0.8dB to -1.2dB for each of the BS FRC's, however the UE uses a figure of -1dB for all FRC's. As the SNR is dependent on the modulation the UE figure is used.

Applying these number to the equation gives:

Table 8.2.2-2: NR Wide Area IAB-MT reference sensitivity levels

IAB-MT channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel Ref TS 38.101-1 [3] Annex A	signal BW	IM	SNR	NF	IAB-MT reference sensitivity power level
			MHz	dB	dB	dB	dBm
10, 15	30	Table A.3.3.2-2, 5MHz CBW	3.96	2	-1	5	-102.0
10, 15	60	Table A.3.3.2-3, 10MHz CBW	7.92	2	-1	5	-99.0
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	Table A.3.3.2-2, 20MHz CBW	18.36	2	-1	5	-95.4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	Table A.3.3.2-3, 20MHz CBW	17.28	2	-1	5	-95.6

Table 8.2.2-3: NR Local Area IAB-MT reference sensitivity levels

IAB-MT channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel Ref TS 38.101-1 [3] Annex A	signal BW	IM	SNR	NF	IAB-MT reference sensitivity power level
			MHz	dB	dB	dB	dBm
10, 15	30	Table A.3.3.2-2, 5MHz CBW	3.96	2	-1	13	-94.0
10, 15	60	Table A.3.3.2-3, 10MHz CBW	8.92	2	-1	13	-91.0
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	Table A.3.3.2-2, 20MHz CBW	18.36	2	-1	13	-87.4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	Table A.3.3.2-3, 20MHz CBW	17.28	2	-1	13	-87.6

The simplified FRCs are defined as follows:

Table 8.2.2-4: 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 **Error! Reference source not found.**. NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity				

8.3 Dynamic range

The IAB-DU receiver dynamic range requirement is the same as the BS.

There is no IAB-MT receiver dynamic range requirement.

8.4 In-band selectivity and blocking

For IAB-MT it is agreed to reuse gNB requirement with update on interfering signal type as CP-OFDM.

8.5 Out-of-band blocking

Considering the deployment scenario of IAB node, it is agreed to reuse the same gNB requirement for both IAB-MT and IAB-DU.

8.6 Receiver spurious emissions

8.6.1 IAB-MT Receiver spurious for IAB type 1-H

To protect the coexisting service, the spurious level generated from receiver should be limited. For example, for the synchronized protected service, this could be the case of protecting IAB-MT receiving from IAB node#1 as shown in Figure 8.6-1. The RX spurious generated from IAB-MT receiver at IAB node #2 will impact the UE receiving camped to the parent IAB node#1 cell but not on the UE camped to IAB-DU cell of IAB node#2. This is because IAB-DU and IAB-MT will be operated in TDM manner and thus there is no IAB-DU transmitting in IAB node#2 when IAB-MT receiver is enabled. Compared with the traditional coexisting distance of 5m for outdoor deployment for UE to UE interference analysis, the distance between IAB-MT to victim UE at parent IAB cell is larger as it will be installed at site similar to BS. Therefore, there is not necessary to reuse the UE Rx spurious requirement.

For the unsynchronized co-existing service, IAB-MT spurious level does not need to be tighter than IAB-DU receiver spurious requirement.

From protection of both synchronized or unsynchronized coexisting service, the IAB-DU receiver spurious for receiver spurious could be reused for IAB-MT.

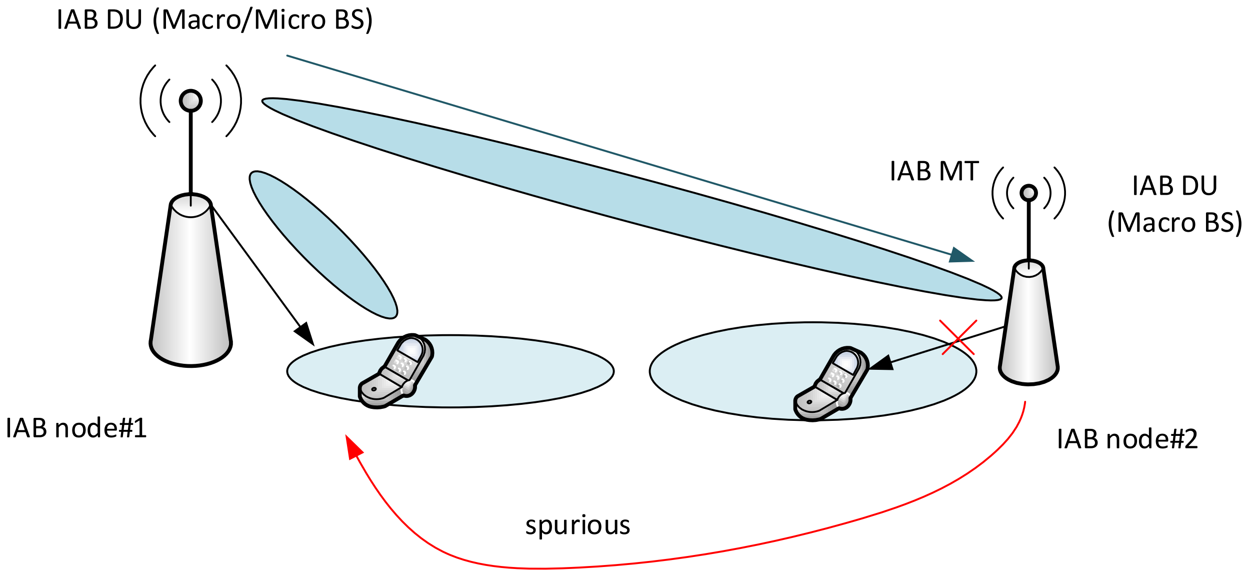

Figure 8.6-1: coexisting service interference when IAB-MT receiving from parent IAB

8.7 Receiver intermodulation

For IAB-MT *type 1-H*, as IBB requirement is agreed to reuse BS requirements and interfering signal power of RX IMD requirement is close to that of IBB requirements in general, therefore it's agreed to reuse BS RX IMD requirement for IAB-MT.

8.8 In-channel selectivity

For IAB-MT, similar as legacy NR UE, there is no RX in-channel selectivity requirement defined in TS 38.101, therefore it is agreed that no in-channel selectivity will be defined for IAB-MT.

9 Radiated transmitter characteristics

9.1 General

Radiated transmitter characteristics were defined for IAB-MT and IAB-DU types 1-O and 2-O. Additionally IAB-MT and IAB-DU type 1-H needs to meet the radiated transmit power requirement. IAB-DU type 1-O and type 2-O requirements are the same as defined for NR BS. For IAB-MT type 1-O no minimum number of transceivers have been defined, allowing type 1-O IAB-MT to have any number of transceivers. Therefore, IAB-MT type 1-O requirements are defined using basic limits and scaling of basic limits following the same principles as type 1-H requirements.

9.2 Radiated transmit power

For configured maximum power it was discussed how the UE requirement is adapted to fit the characteristic of IAB-MT. The factors like MPR/A-MPR are included in the UE requirements, but they are not specified for the IAB-MT. Therefore, they do not need to be defined for the IAB-MT P_{CMAX}. Similarly, as IAB-MT Tx power is declared by the manufacturer using same framework as BS Tx power declaration, hence power class related factors $P_{PowerClass}$ and $\Delta P_{PowerClass}$ are not included in P_{CMAX} definition. Other factors like $P_{EMAX,c}$, and the factors related to Interband CA, SUL, and SRS are not included in the P_{CMAX} definition.

The P_{CMAX} requirement was agreed to be aligned with the output power declaration, which includes also the declared back off power. Using TRP or EIRP was discussed, and EIRP was agreed to be used, as it is defined for all IAB-MT types and the relevant metric for link budget.

Radiated transmit power is the EIRP level for a declared beam at a specified beam peak direction. For each declared beam, the manufacturer declared EIRP level needs to be achieved within a specified accuracy.

9.3 IAB OTA output power

IAB OTA output power is a TRP requirement, defined for a RIB. For IAB-MT and IAB-DU type 1-O, the TRP limits are different for each class. IAB-DU type 1-O limits were defined to be the same as for NR BS. For local area IAB-MT, due to no minimum required number of transmitters, the rated carrier TRP limits can be scaled from 24 dBm to 33 dBm, depending on the number of active transmitter units. No upper limit for OTA output power is specified for wide area IAB-MT and IAB-DU.

For IAB-MT and IAB-DU type 2-O no absolute power limits are associated with IAB OTA output power requirements and only accuracy requirement towards to declared value is specified.

9.4 OTA output power dynamics

For IAB-MT to enable the adjustment UL transmission power to maintain proper link level, it is agreed to define 5dB power dynamaic range for Wide Area IAB-MT without corresponding power control requirement. And for Local Area IAB-MT the power dynamic range is agreed as 10dB with relative and aggregated power tolerance defined as stated in 7.3.1.

9.5 OTA transmit ON/OFF power

According to the analysis in 7.4, both IAB-DU and IAB-MT reuse BS radiated ON/OFF power requirements including the OFF power and transient period.

9.6 OTA transmitted signal quality

9.6.1 IAB-DU OTA transmitted signal quality

As the IAB-DU behavior is very similar with BS, all of the transmitted signal quality requirements can be imported from BS. Therefore, the frequency error, modulation quality and time alignment error requirements in clause 9.6.1, 9.6.2 and 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.

9.6.2 IAB-MT OTA transmitted signal quality

9.6.2.1 Frequency error

IAB-MT OTA transmitted signal quality requirement analysis is the same as the conducted requirements in 7.5.2.1. The IAB-MT frequency must be within a certain error limit relative to of the parent node's center frequency. IAB-MT type 1-O and type 2-O OTA frequency error reuses UE requirements to be +/-0.1 PPM relative to received signal from parent node.

9.6.2.2 Error Vector Magnitude

IAB-MT OTA EVM requirement analysis is the same as the conducted requirement in 7.5.2.2. IAB-MT type1-O EVM requirements should be the same with conducted requirements. IAB-MT type2-O EVM requirement reuses UE FR2 EVM requirements with the exception that BPSK requirement is removed. The IAB-MT frequency must be within a certain error limit relative to of the parent node's center frequency.

9.7 OTA unwanted emissions

OTA Unwanted emissions cover the definitions and requirements for OOB boundary, occupied bandwidth, ACLR including also absolute ACLR, OBUE, and spurious emissions.

For IAB-DU all unwanted emissions requirements, except for the protection of the BS receiver of own or different BS, are the same as specified for NR BS. The background for these requirements can be found from TR 38.817-02 [7]. The requirement for the own or other receiver is not specified, as for NR BS the requirement applies only for FDD operation and no FDD band is defined for IAB.

Wide area IAB-MT requirements were agreed to be the same as defined for wide area IAB-DU both in FR1 and FR2. In FR1 also local area IAB-MT requirements were agreed to be the same as defined for local area IAB-DU but in FR2 it was agreed that 24 dBc ACLR is sufficient, otherwise requirements for local area IAB-MT were agreed to be the same as defined for local area IAB-DU. It is agreed that when type 2-O local area IAB-MT transmit during DL time slot, the ACLR requirement will be the same as local area IAB-DU.

9.8 OTA transmitter intermodulation

9.8.1 IAB DU intermodulation

For FR1 the IAB node could be co-located if the IAB TDD pattern for transmission and receiving is the same for both IAB-DU and IAB-MT of both co-located nodes, i.e. just coordinating the UL/DL timeslots is not sufficient but the actual Tx and Rx time instants of both IAB-DU and IAB-MT need to be aligned. IAB DU intermodulation requirement shall be reused from BS spec.

Therefore *IAB-DU type 1-O* will reuse the framework of OTA TX intermodulation requirement defined in TS 38.104 [2] clause 9.8 for *NR BS type 1-O*.

There is no OTA TX intermodulation requirement for IAB-DU type 2-O *as there is no TX IMD requirement for* BS type 2-O.

9.8.2 IAB MT intermodulation

The co-location scenario of IAB is listed below as:

- co-located with another IAB-Node in same band

This scenario shall be further considered as if the IAB-DU and IAB-MT of one IAB-Node don't transmit simultaneously, there will exist the scenario that during UL timeslot one is transmitting in the backhaul link and the other is receiving in the access link, and correspondingly during DL timeslot one can be transmitting in the access link and another is receiving in the backhaul link. In this case, the excessive interference will prevent the two IAB nodes to be co-located. Hence co-location scenario can only be considered for the following case:

- co-located as IAB-DU and IAB-MT of one IAB-Node transmit simultaneously in the same band with same TDD pattern as the other co-located BS and/or IAB-Node.

- In case of two co-located IAB-Nodes, all IAB-MTs and IAB-Dus need to follow same TDD pattern.

In this case, the co-location scenario is similar to a base station co-located with another base station in same band, hence the intermodulation requirement shall be reused from BS spec.

- co-located with another IAB-DU/BS in another band

With the above co-location scenarios, it is proposed to use the framework of base stationTX intermodulation requirement for IAB MT with certain co-location scenarios. Considering the large coupling loss, there is no TX IMD requirement for *IAB-MT type 2-O*.

9.9 Beam correspondence for IAB-MT

For IAB-MT, it is agreed no explicitly RF core requirement will be defined for beam correspondence.

10 Radiated receiver characteristics

10.1 Void

10.2 OTA sensitivity

10.2.1 IAB-DU OTA sensitivity

The IAB-DU OTA sensitivity for IAB-DU type 1-H and 1-O is the same as the BS.

There is no OTA sensitivity requirement for IAB-DU type 2-O.

10.2.2 IAB-MT OTA sensitivity

As with the conducted reference sensitivity requirements as the IAB-MT antenna and receiver front end is similar to the BS the BS OTA sensitivity requirement is derived using the same assumptions as the BS.

The FR1 OTA sensitivity requirement is declared over a declared RoAoA without any boundaries and is used as both a minimum sensitivity requirement and reference level for some of the interference requirements (ACS, in-band blocking, oob blocking, colocations blocking, RX IMD) as such the requirement is almost the same as the BS requirement (with the same declarations required from TS 38.141-2 [6]). However as the IAB-MT receives the DL the FRC's used are from the UE specification as described in table 8.2.2-1.

There is no OTA sensitivity requirement for IAB-MT type 2-O.

10.3 OTA reference sensitivity level

10.3.1 IAB-DU OTA reference sensitivity

The IAB-DU OTA sensitivity for IAB-DU type 1-H, 2-O and 2-O is the same as the BS.

10.3.2 IAB-MT OTA reference sensitivity

10.3.2.2 FR1

The IAB-MT antenna and front end is similar to that of a BS so the OTA reference sensitivity requirements will be based upon the same assumptions as the BS. As with the other IAB-MT sensitivity requirements however the FRC's and the associated SNR requirement will be taken from the UE. The UE FRC's will be of the same signal BW as the associated BS FRC's for the requirement.

The FR1 OTA reference sensitivity level is calculated based on the required equivalent passive antenna gain if a receiver were to meet the conducted reference sensitivity requirements and cover a declared OTA reference sensitivity RoAoA (see TS 38.141-2 [6]).

The FR1 IAB-MT reference sensitivity therefore uses the same set of declarations as the BS, however the calculation is modified to correspond to the DL FRC's and their associated SNR values. The OTA reference sensitivities are hence offset from the conducted reference sensitivity values given in tables 8.2.2-1 and 8.2.2-2 as shown in tables 10.3.2.1-1 and 10.3.2.1-2.

Table 10.3.2-1: Wide Area IAB-MT reference sensitivity levels

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel Ref TS 38.101-1 [3] Annex A	OTA reference sensitivity level, $EIS_{REFSENS}$ (dBm)
10, 15	30	Table A.3.3.2-2, 5MHz CBW	$-102.0 – \Delta_{OTAREFSENS}$
10, 15	60	Table A.3.3.2-3, 10MHz CBW	$-99.0 – \Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	Table A.3.3.2-2, 20MHz CBW	$-95.4 – \Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	Table A.3.3.2-3, 20MHz CBW	$-95.6 – \Delta_{OTAREFSENS}$

Table 10.3.2-2: Local Area IAB-MT reference sensitivity levels

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel Ref TS 38.101-1 [3] Annex A	OTA reference sensitivity level, $EIS_{REFSENS}$ (dBm)
10, 15	30	Table A.3.3.2-2, 5MHz CBW	$-94.0 – \Delta_{OTAREFSENS}$
10, 15	60	Table A.3.3.2-3, 10MHz CBW	$-91.0 – \Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	Table A.3.3.2-2, 20MHz CBW	$-87.4 – \Delta_{OTAREFSENS}$
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	Table A.3.3.2-3, 20MHz CBW	$-87.6 – \Delta_{OTAREFSENS}$

The FRCs are the same as those defined for conducted reference sensitivity in clause 8.2.2.

10.3.2.1 FR2

The FR2 IAB-MT antenna and front end is similar to that of a BS so the OTA reference sensitivity requirements will be based upon the same assumptions as the BS.The BS FR2 OTA reference sensitivity level is based on a declared EIS value within a specified range, the range is calculated based on the useful range of antenna gains expected for the BS class. And is calculated as follows:

Hence for a wide area BS

$$EIS_{REFSENS} = P_{kT} + 10 * \log_{10}(BW) + NF + IM + SNR - G \quad (dBm)$$

Where: BW is the noise BW of the FRC, NF is the noise figure, IM is implantation margin not related to antenna array, SNR is the required SNR for demodulation and G is the antenna gain and RF losses.

The expected gain range is the same as the BS, however as there is no medium range IAB-MT the local area gain range is expanded to cover the medium range also:

Table 10.3.2.2-1: G assumptions for calculating FR2 WA and LA OTA REFSENS range

IAB-MT class	G	
	30 GHz (24.25 – 33.4 GHz)	45GHz (37 – 52.6 GHz)
WA	10 to 33 dBi	12 to 35 dBi
LA	0 to 28 dBi	2 to 30 dBi

The FRC's and the associated SNR values are also based on the DL values used for the UE. There are UE FRC's defined which have the same signal BW as the BS FRC's as shown un table 10.3.2.2-2

Table 10.3.2.2-2 FR2 equivalent IAB-MT FRC's

BS Reference channel	equivalent UE reference channel (TS 38.101-2[4], Annex A3.3)
G-FR2-A1-1	Table A.3.3.2-1, 50MHz CBW

G-FR2-A1-2	Table A.3.3.2-2, 50MHz CBW
G-FR2-A1-3	Table A.3.3.2-3, 100MHz CBW

The SNR for the BS FRCs range from -1.1 to -1.2 dB , the UE SNR assumption is -1dB, however as the declaration ranges and declared values are rounded to integer values this makes no difference to the final range. As such the FR2 IAB-MT range is the same as the BS, as follows:

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.

The FR2 IAB-MT FRC definitions in the core specification in a similar way to the FR1 RFCs as explained in clause 8.2.2. The simplified FR2 FRCs are defined as follows:

Table 10.3.2.2-3: 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 **Error! Reference source not found.**. NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size.			

10.4 OTA Dynamic range

The IAB-DU receiver dynamic range requirement is the same as the BS.

There is no IAB-MT receiver dynamic range requirement.

10.5 OTA in-band selectivity and blocking

10.5.1 ACS for IAB MT of IAB type 2-O

The ACS requirement for IAB-MT is agreed as 24 dB in 24.25 – 33.4 GHz BS and 23 dB in 37 – 52.6 GHz. IAB-MT is expected to have better adjacent carrier selectivity than UE ACS due to the limited physical separation distance to the aggressor BS. Generically BS has higher ACS selectivity compared to UE thus BS type of ACS number can be used for IAB-MT.

10.5.2 In-band blocking for IAB-MT

Traditionally for UTRA the in-band blocker is set according to the 99.99% probability of interferer cdf curve. It is recommended in [7] that between 99% and 99.9% could be considered due to the NR OFDMA scheme does not suffer greatly as for WCDMA.

As the interfere level to IAB-MT receiver relates to the distance between victim IAB and aggressor BS, coexisting simulation is done assuming the 40m, 50m , 60m and 80m and companies result is captured in Table 10.5.3-1.

Table 10.5.2-1: Coexisting simulation result for In-band blocking level comparison

Company	Blocker level @99 Percentile point (dBm)	Blocker level @ 99.9 perncentile point (dBm)	Physical distance to Agressor BS (m)	Simulation scenario (Acc. To R4-1907825)	RAN4 contribution
Ericsson	-67.5	-65.5	40	Layout 2 for FR2	R4-2001873
	-75	-66	50		
	-81	-75	60		
	-55	-48	40	Layout 2 for FR1	
Nokia	-52	-45	40	Layout 2 for FR2	R4-2001432
	-55	-54	Max grid shift		
QUALCOMM incorporation	-45		40	Layout 2 for FR2	R4-2001282
	-49		60		
	-53		80		
Huawei	-64		40	Layout 2 for FR2 (element OTA result)	R4-1914757
	-69		60		
ZTE	-42		40	Layout 2 for FR1(element OTA result)	R4-2000977

It is concluded from the coexisting simulation results in Table 10.5.2-1 that IAB-MT can reuse the OTA BS blocking requirement with CP-OFDM interferer signal. Therefore, the inband blocking level for wide area IAB-MT of type 2-O is specified with 33 dB higher than OTA REFSENS power level with inteferer signal of CP-OFDM waveform. The inband blocking level for local area IAB-MT of type 2-O is specified with 35.5 dB higher than OTA REFSENS power level with inteferer signal of CP-OFDM waveform for bands n257, n258, n261. The inband blocking level for local area IAB-MT of type 2-O is specified with 34.5 higher than OTA REFSENS power level with CP-OFDM waveform of inteferer signal for bands n260.

10.6 OTA Out-of-band blocking

Considereing the deployment scenario of IAB node, it is agreed to reuse the same gNB requirement for both IAB-MT and IAB-DU.

10.7 OTA receiver spurious emissions

10.7.1 IAB-MT OTA Receiver spurious for IAB type 1-O and 2-O

The UE receiver spurious requirement can be relaxed as the distance to the protected service will be increased and this follows the same analysis in chapter 8.6.1. For protecting unsynchronized coexisting service, IAB-MT OTA spurious level does not need to be tighter than IAB-DU receiver requirement and as such the BS specification for OTA Receiver spurious can be specified for IAB-MT for IAB type 1-O and 2-O.

10.8 OTA receiver intermodulation

For *IAB-MT type 2-O*, similar as legacy FR2 NR UE, there is no RX intermodulation requirement defined in TS 38.101-2[4], therefore it is agreed that no RX intermodulation is defined for FR2 IAB-MT.

For IAB-MT *type 1-O* similar as IAB-MT *type 1-H*, as IBB requirement is agreed to reuse BS requirements and interfering signal power of RX IMD requirement is close to that of IBB requirements in general, therefore it's agreed to reuse BS RX IMD requirement for IAB-MT.

10.9 OTA in-channel selectivity

For IAB-MT, similar as legacy NR UE, there is no RX in-channel selectivity requirement defined in TS 38.101-1/2[3][4], therefore it is agreed that no in-channel selectivity will be defined for IAB-MT.

11 IAB RRM requirements

11.1 General

In Rel-16, the WI on IAB is considered for physically fixed deployment only. In light of the characteristic of Rel-16 IAB (e.g. fixed operation) and the differences between UE and IAB-MT (e.g. power saving consideration and seeking for higher throughput), selected RRM requirements in TS 38.133 are considered fundamentals and defined for Rel-16 IAB. Based on this background the RRM requirements defined for Rel-16 IAB are agreed as table 11-1.

Table 11-1: Summary on RRM requirement applicability for IAB-MT

Requirement	Items	Comments	Applicability
RRC Connection Mobility Control	• RRC re-establishment • Random access • RRC release with redirection	To make sure IAB can remain RRC connection after link failure with original parent node.	Apply for both Local Area and Wide Area IAB-MT.
Radio Link Monitoring	• Requirements for radio link monitoring	Feature to maintain PCell's MT link with parent node.	Apply for Local Area IAB-MT only. Requirements are defined for no-DRX only.
Link Recovery Procedures	• Requirements for beam failure detection • Requirements for candidate beam detection	Feature to maintain PCell's MT beam management with parent node.	Apply for Local Area IAB-MT only. Requirements are defined for no-DRX only.
MT Timing related requirements	• MT transmit timing • Timing Advance	The same as UE related requirement which is reused for IAB-MT	Apply for both Local Area and Wide Area IAB-MT.
DU Timing related requirements	• Cell phase synchronization accuracy	Reuse the requirement 3 µs in TS38.133	Apply for IAB-DU.

For other UE or BS RRM requirements in TS38.133, including handover, interruptions, (de)activation delay, addition/release delay, active BWP switching, measurement related requirements and so forth, are not defined or not decided for IAB in Rel-16 due to various reasons such as fixed IAB operation where the link remains comparatively stable for longer periods of time. The requirements which are not defined not necessarily indicate the corresponding features are not supported by IAB.

12 IAB EMC requirements

12.1 IAB EMC Emission requirements

EMC emissions testing covers both conducted and radiated emissions. . Test methods and levels for conducted emissions, harmonic and voltage fluctuations and flicker testing defined by IEC/CISPR are independent of the product (IAB) characteristics and features, including the operating frequency or the Radio Access Technology (RAT). It is agreed that the applicable requirements for EMC conducted emissions of IAB nodes are the ones defined for NR BS in TS 38.113[12].

EMC radiated emissions test involves measuring the electromagnetic field strength of the emissions that are unintentionally generated by a product (an IAB node in this case). Emissions are inherent to the switching voltages and currents within any digital circuit. In this case, the radiated emission requirements as well as the test methods that apply are defined by IEC and CISPR subcommittee in the Standard CISPR 32 [11]. Testing and limits of emissions intentionally generated by the BS are covered by ITU-R recommendations SM.329 [9] and SM.1539 [10].

3GPP has agreed that for IAB type 1-O and IAB type 2-O, the radiated emission is covered by radiated spurious emission requirement in TS 38.174 [8], conforming to the test requirement in TS 38.174 [8].

12.2 IAB EMC immunity requirements

12.2.1 Radiated Immunity requirements

12.2.1.1 One enclosure case

The IAB node is a network node with similar outside radio frequency electromagnetic environment as base station. So in this case, it is reasonable to apply base station test levels to the IAB node.

12.2.1.2 Different enclosure case

For different enclosure cases, the radiated immunity requirement apply for each enclosure. Still the test level as reusing the base station requirement applies as the electromagnetic environment is similar to BS.

12.2.1.4 Summary

The base station requirement as 3V/m from 80MHz to 6000MHz is used as a starting point and the exclusion band for Radiated immunity test is FFS.

12.2.2 Other Immunity requirements

It is agreed that similar working environment as for a base station applies to an IAB node. So it is agreed to reuse the BS requirements for IAB node, for the following immunity requirements as listed below.

- ESD test
- Fast transient common mode
- RF common mode 0.15 – 80 MHz
- Voltage dips and interruption

- Surge

Annex A (normative): Co-existence simulation results

This clause contains references to contributions submitted during Rel-16 IAB WI containing co-existence evaluation results for IAB mainly based on the simulation assumptions provided in Clause 6. Details of the simulation parameters and observations can be found in the corresponding referenced contributions:

- R4-1908843 FR1 IAB co-existence study, CMCC
- R4-1908075 Co-existence simulation result for layout 1, Samsung
- R4-1908076 Co-existence simulation result for layout 2, Samsung
- R4-1908586 simulation results for FR1 IAB coexistence study, ZTE
- R4-1908587 simulation results for FR2 IAB coexistence study, ZTE
- R4-1908733 IAB simulation results for Layout 1 Huawei, HiSilicon
- R4-1908872 Simulation results for the homogeneous scenario in FR2, Qualcomm Incorporated
- R4-1908873 Simulation results for the heterogeneous scenario in FR2, Qualcomm Incorporated
- R4-1909272 Initial IAB-Node coexistence simulation results, Nokia, Nokia Shanghai Bell
- R4-1909389 coexistence simulation results for IAB network, Ericsson
- R4-1910838 FR1 IAB co-existence study, CMCC
- R4-1911332 Simulation results on the minimum Tx power of IAB MT and ACIR, Huawei, HiSilicon
- R4-1911395 Updated simulation result for layout 2, Samsung
- R4-1911638 IAB-Node coexistence and dynamic range requirements, Nokia, Nokia Shanghai Bell
- R4-1911639 IAB-Node coexistence simulation results, Nokia, Nokia Shanghai Bell
- R4-1911735 simulation results for FR1 IAB coexistence study, ZTE Corporation
- R4-1911736 simulation results for FR2 IAB coexistence study, ZTE Corporation
- R4-1912891 simulation results for FR2 IAB coexistence study, ZTE Corporation
- R4-1912008 Coexistence simulation results updates for FR2 – layout 1, Ericsson
- R4-1912009 Coexistence simulation results for FR1 – layout 1, Ericsson
- R4-1912010 Coexistence simulation results for FR2 - layout 2, Ericsson
- R4-1912011 Coexistence simulation results for FR1 - layout 2, Ericsson
- R4-1913334 Further simulation on IAB-MT ACLR and TX min power, Samsung
- R4-1914162 Simulation results for IAB in FR2, Huawei, HiSilicon
- R4-1914163 Simulation results for IAB in FR1, Huawei, HiSilicon
- R4-1914222 Min Tx power simulation results updates- layout 1, Ericcson
- R4-1914235 simulation results for FR2 IAB coexistence study, ZTE Corporation
- R4-1914236 simulation results for FR1 IAB coexistence study, ZTE Corporation
- R4-1914260 IAB-Node coexistence simulation results, Nokia, Nokia Shanghai Bell
- R4-2000972 simulation results for FR1 IAB coexistence study, ZTE Corporation

- R4-2000973 simulation results for FR2 IAB coexistence study, ZTE Corporation
- R4-2000977 In-band blocking for FR1 IAB MT, ZTE Corporation
- R4-2000978 In-band blocking for FR2 IAB MT, ZTE Corporation

Annex B (informative):
Change history

Change history							
Date	**Meeting**	**Tdoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2020-04	RAN4#94 bis-e	R4-2005458				Initial TR skeleton endorsed in R4-1912889 Updated TR to incorporate below TPs R4-1916003 [IAB] TP to TR 38.xxx Co-location scenarios R4-1916166 [IAB] TP to TR 38.xxx System parameter R4-1914761 [IAB] TP to TR 38.xxx Architecture R4-2002487 TP for TR _RF Requirements reference points R4-2002488 TP for TR _Spec organization R4-2002493 [IAB] TP to TR 38.xxx Antenna assumptions R4-2002497 TP for TR _9 IAB OTA transmitter intermodulation R4-2005480 Update on clause 4 and clause 5 based on latest agreement R4-2003758 TP to TR 38.xyz: Addition of antenna model and parameters in clause 6.2 R4-2005476 [IAB EMC] TP to TR IAB EMC immunity requirements	0.1.0
2020-06	RAN4#95 e	R4-2006378				Updated TR to incorporate below TPs approved during meeting: R4-2008768 TP to TR 38.809 – Correction of IAB-DU and IAB-MT permutation in clause 4.8. R4-2008777 TP for TR 38.809: Transmit ON/OFF power R4-2006274 TP for TR 38.809: IAB-DU Transmitted signal quality R4-2008787 TP to TR : IAB RX IM requirement (clause 8.7 and 10.8) R4-2008789 TP to TR: IAB ICS requirement (clause 8.8 and 10.9) R4-2009062 [IAB RF] TP to TR 38.809 IAB TX IMD R4-2008730 TP to TR 38.809 on IAB EMC Emissions R4-2008731 [IAB EMC]TP to TR IAB EMC immunity requirements	0.2.0
2020-08	RAN4#96 e	R4-2010223				Updated TR to incorporate below TPs approved during meeting: R4-2010146 TP for TR38.809: IAB co-existence simulation R4-2012617 TP for TR 38.809: IAB-MT Pcmax and power control R4-2012619 TP to TR 38.809 Completing IAB-MT power related requirements R4-2012623 TP for TR 38.809: IAB-MT Transmit signal quality R4-2012625 TP to TR 38.809 IAB-MT unwanted emission requirements R4-2010148 TP for TR38.809: conclusion on IAB-MT BC requirement R4-2012629 TP to TR 38.809 -IAB RX sensitivity R4-2012632 TP to TR 38.809: ACS and IBB R4-2012756 TP to TR 38.809 IAB-MT RX IMD R4-2012634 TP to TR 38.809: RX spurious R4-2012637 TP to TR 38.809 on IAB EMC emission requirements	0.3.0
2020-09	RAN#89e	RP-201638				Editorial update Present to RAN-P for approval	1.0.0
		RP-201980				Further editorial update on: Symbol and abbreviation Reference Clean up for empty clause	1.0.1
2020-09	RAN#89					Approved by plenary – Rel-16 spec under change control	16.0.0
2020-12	RAN#90	RP-202504	0001	1	F	Correction CR on TR38.809	16.1.0