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TECHNICAL REPORT

**5G;  
Requirements for simultaneous Rx/Tx band combinations for  
NR CA/DC, NR SUL and LTE/NR DC  
(3GPP TR 38.793 version 19.0.0 Release 19)**



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# Foreword

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

- shall** indicates a mandatory requirement to do something
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- need not** indicates permission not to do something

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- 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

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

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# 1 Scope

The present document is a technical report for simultaneous Rx/Tx band combinations in Rel-19. The TR includes technical analysis of identified issues related to specific band combinations, with particular focus on the applicable requirements necessary to support simultaneous Rx/Tx operation for the respective band combinations.

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# 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.
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- [1] 3GPP TR 21.905: “Vocabulary for 3GPP Specifications”.
  - [2] RP-222648, “New WID: Simultaneous Rx/Tx inter-band combinations for NR CA/DC, NR SUL and LTE/NR DC in Rel-18”.
  - [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”..
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# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

## 3.2 Symbols

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

<symbol>	<Explanation>
$\Delta R_{IB,c}$	Allowed reference sensitivity relaxation due to support for CA or DC operation, for serving cell <i>c</i> .
$\Delta T_{IB,c}$	Allowed maximum configured output power relaxation due to support for CA or DC operation, for serving cell <i>c</i>
$F_C$	<i>RF reference frequency</i> for the carrier center on the channel raster
$F_{DL\_low}$	The lowest frequency of the downlink <i>operating band</i>
$F_{DL\_high}$	The highest frequency of the downlink <i>operating band</i>
$F_{UL\_low}$	The lowest frequency of the uplink <i>operating band</i>
$F_{UL\_high}$	The highest frequency of the uplink <i>operating band</i>
$F_{OOB}$	The boundary between the NR out of band emission and spurious emission domains
$L_{CRB}$	Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resource blocks

Max()	The largest of given numbers
Min()	The smallest of given numbers
NR <sub>ACLR</sub>	NR ACLR
N <sub>RB</sub>	Transmission bandwidth configuration, expressed in units of resource blocks
N <sub>RB_agg</sub>	The number of the aggregated RBs within the fully allocated aggregated channel bandwidth $N_{RB\_agg} = \sum_1^j N_{RB_j} * 2^{\mu_j}$ for carrier 1 to j, where $\mu$ is defined in TS 38.211 [13]
N <sub>RB,c</sub>	The transmission bandwidth configuration of component carrier c, expressed in units of resource blocks $N_{RB,cj} = N_{RB_j} * 2^{\mu_j}$ for carrier j, where $\mu$ is defined in TS 38.211 [13]
P <sub>CMAX</sub>	The configured maximum UE output power
RB <sub>start</sub>	Indicates the lowest RB index of transmitted resource blocks
W <sub>gap</sub>	The sub-block gap between the two sub-blocks

### 3.3 Abbreviations

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

ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
A-MPR	Additional Maximum Power Reduction
BCS	Bandwidth Combination Set
CA	Carrier Aggregation
CC	Component Carrier
DC	Dual Connectivity
EIRP	Equivalent Isotropically Radiated Power
EN-DC	E-UTRA/NR DC
EVM	Error Vector Magnitude
FDM	Frequency Division Multiplexing
FR	Frequency Range
ENBW	The aggregated bandwidth of an E-UTRA sub-block and an adjacent NR sub-block
ITS	Intelligent Transportation System
ITU-R	Radiocommunication Sector of the International Telecommunication Union
MBW	Measurement bandwidth defined for the protected band
MPR	Allowed maximum power reduction
MSD	Maximum Sensitivity Degradation
MCG	Master Cell Group
NR	New Radio
NS	Network Signalling
NSA	Non-Standalone, a mode of operation where operation of an other radio is assisted with an other radio
OOB	Out-of-band
OOBE	Out-of-band emission
OTA	Over The Air
PRB	Physical Resource Block
PSCCH	Physical Sidelink Control CHannel
PSSCH	Physical Sidelink Shared CHannel
RE	Resource Element
REFSENS	Reference Sensitivity
RF	Radio Frequency
Rx	Receiver
SCG	Secondary Cell Group
SCS	Subcarrier spacing
SEM	Spectrum Emission Mask
SL	Sidelink
SUL	Supplementary uplink
TDM	Time Division Multiplex
Tx	Transmitter
UE	User Equipment

UL MIMO      Up Link Multiple Antenna transmission  
ULSUP        Uplink sharing from UE perspective

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## 4 Background

### 4.1 Background information in Rel-17 and Rel-18

Simultaneous Rx/Tx capability for inter-band CA, SUL and EN-DC band combinations were introduced from Rel-15. Specifically, for inter-band CA and EN-DC combination, the capability is used for TDD-TDD and TDD-FDD band combinations. According to the description of the capability, it is conditional mandatory and the condition is described in the field, i.e. indicated in the RAN4 spec which combinations should mandatorily support simultaneous Rx/Tx. For the combinations which have no such indication, the capability is optional, i.e. for UE supporting simultaneous Rx/Tx, the capability should be reported, otherwise, the capability is absent or not reported. Since the capability is important for network scheduling, it should be reported accurately.

In Rel-17, the principles for judging the mandatory capability for a band combination have been discussed, and the cases include:

- FR1+FR1 FDD-TDD band combination
- FR1+FR1 TDD-TDD band combination
- FR1+FR2 FDD-TDD band combination
- FR1+FR2 TDD-TDD band combination
- FR2+FR2 TDD-TDD band combination

For some categories, the capability should be checked case by case. Therefore, to facilitate the analysis of specific band combinations, a dedicated WI is needed to avoid the ambiguity for application of the general principles agreed in Rel-17 and the analysis and conclusion should be captured in the TR.

In addition, as the capability is defined for CA, SUL, MR-DC and NR-DC band combinations, and applicability of the corresponding requirements cover different specifications, e.g. TS 38.101-1 and TS 38.101-3, the way to treat simultaneous Rx/Tx capability as well as the requirements should be aligned among the specifications.

The fallback rules are captured as below for reference:

- Request for additions of band combinations to this WI shall be provided using an agreed template and sent to the 3GPP\_TSG\_RAN\_WG4\_NR\_BANDS email reflector before a RAN4 Tdoc submission deadline and no new band combinations are allowed to be requested after the deadline except to correct the missing fallback and add more supporting companies for the proposed band combinations.
- When a proponent requests a new band combination, all the next level fallback configurations shall be listed and recorded in the request template and the status (“New”, “Ongoing”, “Completed”) of all the fallback configurations shall be declared accurately and clearly. For “New” fallback configurations, the proponent shall ensure these fallback configurations are also requested together with the higher order band combination in the same meeting.
- A band combination configuration can only be considered as completed when all of the fallback configurations are completed and specified in advance or at the same meeting. It is the responsibility of the proponent to ensure the status of all of the fallback mode configurations. Rapporteurs and other companies are encouraged to check the status of all of the fallback configurations once the higher order band combinations are declared as completed.

## 4.2 WI Objective in Rel-19

1. Identify the unnecessary Notes for simultaneous Rx-Tx applied to band combinations for NR CA/DC, NR SUL and LTE/NR DC. Focus on principles and specific methods of simplification on Notes to simultaneous Rx-Tx case by case.
2. Clarify in the specification on the simultaneous Rx-Tx feature for DC band combinations with same band but different configurations of carrier number.
3. Identify feasibility for each requested FDD-TDD and TDD-TDD band combinations for CA, SUL, MR-DC supporting simultaneous Rx/Tx capability/operation based on technical analysis, especially for those with large MSD values. If needed, specify the MSD requirements for the identified band combinations.

Note 1: Band combinations considered in this WI have to be introduced first via basket WIs (see 2.3) or completed in previous releases if necessary.

Note 2: Whether the simultaneous Rx-Tx capability could be supported or not depends on the evaluation of MSD for the requested band combinations case by case.

Note 3: Applicability of simultaneous Rx/Tx capability to FDD-TDD band pairs should be reviewed

4. Align the specification treatment of simultaneous Rx/Tx capability for CA, SUL, MR-DC and NR-DC band combinations.

## 4.3 Applicability of mandatory support of simultaneous Rx-Tx

During Rel-19 RAN4 has agreed the following applicability of mandatory support of simultaneous Rx-Tx which may aid as a guide to when requirements for simultaneous Rx/Tx band combinations for NR CA/DC, NR SUL and LTE/NR DC as captured in this TR is needed defined.

RAN4 has concluded simultaneous Rx/Tx requirements for different types of inter-band CA and SUL configurations:

- TDD + TDD -> Conditional mandatory support for simultaneous RxTx **with** signaling
- FDD + TDD -> Mandatory support for simultaneous RxTx **with** signaling
- TDD + SDL -> Mandatory support for simultaneous RxTx **with** signaling
- FDD/TDD + SUL -> Mandatory support for simultaneous RxTx **with** signaling
- FDD + FDD -> Mandatory support for simultaneous RxTx **without** signaling
- FDD + SDL -> Mandatory support for simultaneous RxTx **without** signaling

Conditional mandatory support means that explicit indication per band combinations such as e.g. in TS 38.101-1 Table 5.2A.2.1 by Note 1 is needed to mandate the support for simultaneous RxTx with signaling.

In case overlapping FDD band configurations are introduced, such cases will be handled in a case-by-case manner.

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# 5 Specific Band combinations

## 5.1 CA\_n40A-41A

### 5.1.1 Status of the band combination

#### 5.1.1.1 Operating bands for CA

The operating bands for CA\_n40-n41 are specified in Table 5.3.1.1-1.

**Table 5.3.1.1-1: Inter-band CA operating bands involving FR1**

NR CA Band	NR Band (Table 5.2-1)	DL interruption allowed (Note 8)
CA_n40-n41	n40, n41	No
NOTE 8: Applicable when dynamic Tx switching is conducted. The DL interruption requirement is specified in clause 8.2.2.2.10 of 38.133 [13].		

For CA\_n40-n41, the current spec only considers scenarios without simultaneous Rx/Tx, which are limited by the applicable requirements of  $\Delta T_{IB,c}$  and  $\Delta R_{IB,c}$ .

### 5.1.1.2 Power class of the BC

The UE Power Class for uplink CA\_n40A-n41A are specified in Table 5.3.1.2-1. The supported power class of the band combination would have impact on the MSD, if any, based on the following study.

**Table 5.3.1.2-1 UE Power Class for uplink CA\_n40A-n41A**

Uplink CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
CA_n40A-n41A			26 <sup>6,7</sup>	+2/-3	23	+2/-3		
NOTE 9: The UE supports either PC3 or PC2 within each NR TDD band.								

### 5.1.1.3 $\Delta T_{IB}$ and $\Delta R_{IB}$

The  $\Delta T_{IB,c}$  due to CA\_n40-n41 are specified in Table 5.3.1.3-1.

**Table 5.3.1.3-1:  $\Delta T_{IB,c}$  due to CA\_n40-n41**

Inter-band CA combination	NR Band	$\Delta T_{IB,c}$ (dB)
CA_n40-n41	n40	0.5
	n41	0.5

$\Delta R_{IB,c}$  due to CA\_n40-n41 is set to zero.

It is noted that  $\Delta T_{IB,c}$  and  $\Delta R_{IB,c}$  reflect the possible UE architecture to support the CA band combination.

## 5.1.2 MSD analysis for simultaneous Rx/Tx

**Table 1-1 PC3 MSD for simultaneous Rx-Tx CA\_n40A-n41A [1][2]**

UL band	DL band	UL F <sub>c</sub>	UL BW	SCS of UL band	UL RB Allocation	DL F <sub>c</sub>	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	L <sub>CRB</sub>	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RB <sub>start</sub> =5)	2565	100	[11.8]	>ACLR2
n41	n40	2565	100	30	270 (RB <sub>start</sub> =0)	2345	50	[28.6]	ACLR2

Table 1-2 PC2 MSD for simultaneous Rx-Tx CA\_n40A-n41A

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RBstart=5)	2565	100	[14.4]	>ACLR2
n41	n40	2565	100	30	270 (RBstart=0)	2345	50	[31.6]	ACLR2

Table 2-1 PC3 MSD for simultaneous Rx-Tx CA\_n40A-n41A test point [Apple R4-2500305]

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RBstart=5)	2565	100	12.7	>ACLR2
n41	n40	2565	100	30	270 (RBstart=0)	2345	50	28.9	ACLR2

Table 2-2 PC2 MSD for simultaneous Rx-Tx CA\_n40A-n41A test point

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RBstart=5)	2565	100	15.5	>ACLR2
n41	n40	2565	100	30	270 (RBstart=0)	2345	50	32.0	ACLR2

Table 3-1 PC3 MSD for simultaneous Rx-Tx CA\_n40A-n41A [Qualcomm R4-2501576]

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RBstart=5)	2565	100	12	>ACLR2
n41	n40	2565	100	30	270 (RBstart=0)	2345	50	26.8	ACLR2

Table 3-2 PC2 MSD for simultaneous Rx-Tx CA\_n40A-n41A

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RBstart=5)	2565	100	14.7	>ACLR2
n41	n40	2565	100	30	270 (RBstart=0)	2345	50	29.8	ACLR2

Table 4-1 PC3 MSD for simultaneous Rx\Tx CA\_n40A-n41A [Skyworks R4-2501953]

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41 <sup>x</sup>	2345	50	30	128 (RBstart=5)	2565	100	[5.7]	>ACLR2
n41	n40 <sup>x</sup>	2565	100	30	270 (RBstart=0)	2345	50	[18.4]	ACLR2

Note X: The exceptional UL/DL configurations account for regional spectrum allocation considerations.

**Table 4-2 PC2 1Tx MSD for simultaneous Rx\Tx CA\_n40A-n41A**

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41 <sup>x</sup>	2345	50	30	128 (RBstart=5)	2565	100	[7.7]	>ACLR2
n41	n40 <sup>x</sup>	2565	100	30	270 (RBstart=0)	2345	50	[21.4]	ACLR2

Note X: The exceptional UL/DL configurations account for regional spectrum allocation considerations.

### 5.1.3 Requirements for simultaneous Rx/Tx

**Table 3-1-9 PC3 MSD for simultaneous Rx-Tx CA\_n40A-n41A**

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RBstart=5)	2565	100	11.2	>ACLR2
n41	n40	2565	100	30	270 (RBstart=0)	2345	50	27.1	ACLR2

**Table 3-1-10 PC2 MSD for simultaneous Rx-Tx CA\_n40A-n41A**

UL band	DL band	UL Fc	UL BW	SCS of UL band	UL RB Allocation	DL Fc	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	LCRB	(MHz)	(MHz)	(dB)	
n40	n41	2345	50	30	128 (RBstart=5)	2565	100	13.9	>ACLR2
n41	n40	2565	100	30	270 (RBstart=0)	2345	50	30.1	ACLR2

Note 1: The exceptional UL/DL configurations account for regional spectrum allocation considerations.

## 5.2 CA\_n5-n8

### 5.2.1 Common for 1 band UL and 2 bands UL CA

#### 5.2.1.1 Operating bands for CA

**Table 5.2.1.1-1: CA band combination of band nX+nY**

NR Band	Uplink (UL) band		Downlink (DL) band		Duplex mode
	BS receive / UE transmit		BS transmit / UE receive		
	F <sub>UL_low</sub> – F <sub>UL_high</sub>		F <sub>DL_low</sub> – F <sub>DL_high</sub>		
n5	824 MHz – 849 MHz		869 MHz – 894 MHz		FDD
n8	880 MHz – 915 MHz		925 MHz – 960 MHz		FDD

### 5.2.1.2 Channel bandwidths per operating band for CA

**Table 5.2.1.2-1: Supported bandwidths per CA band combination of band nX+nY**

NR CA configuration	Uplink CA configuration or single uplink carrier	NR Band	Channel bandwidth (MHz)	Bandwidth combination set
CA_n5A-n8A	n5A <sup>15</sup> , CA_n5A-n8A <sup>19</sup>	n5	5, 10	0
		n8	5, 10	

NOTE 15: Uplink is only in n5 for CA\_n5A-n8A.

NOTE 19: When UL CA\_n5A-n8A is supported, some restrictions may be needed to avoid simultaneous n5DL and n8 UL during UL CA\_n5A-n8A with DL CA\_n5A-n8A configuration. The UE and/or NW behaviors are not specified in the 3GPP specifications when there is a conflict between n5DL and n8UL including dynamic scheduling, semi-static signals and unspecified transitions between n5DL and n8UL.

### 5.2.1.3 UE co-existence studies for 1 band UL

The UL/DL harmonics/harmonic mixing analysis and cross band isolation can be found in the clause 5.1.2 of TR 38.872.

### 5.2.1.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For CA\_n5-n8, the  $\Delta T_{IB,c}$  and  $\Delta R_{IB,c}$  values are given in the tables below, which have been specified in the spec.

**Table 5.2.1.4-1:  $\Delta T_{IB,c}$**

Inter-band CA combination	$\Delta T_{IB,c}$ for NR bands (dB) <sup>*</sup>	
	Component band in order of bands in configuration <sup>**</sup>	
CA_n5-n8	0.5	0.5
NOTE <sup>*</sup> : “.” denotes $\Delta T_{IB,c} = 0$ .		
NOTE <sup>**</sup> : The component band order in the configuration should be listed by the order of NR bands, such as for CA_n1-n3 the band order from left to right is n1 and n3.		

**Table 5.2.1.4-2:  $\Delta R_{IB,c}$**

Inter-band CA combination	$\Delta R_{IB,c}$ for NR bands (dB) <sup>*</sup>	
	Component band in order of bands in configuration <sup>**</sup>	
CA_n5-n8	0.4	0.4
NOTE <sup>*</sup> : “.” denotes $\Delta R_{IB,c} = 0$ .		
NOTE <sup>**</sup> : The component band order in the configuration should be listed by the order of NR bands, such as for CA_n1-n77 the band order from left to right is n1 and n77.		

### 5.2.1.5 REFSSENS requirements

The MSD due to cross band isolation for DL band n8 from aggressor UL n5 has been specified in the spec.

**Table 5.2.1.5-1: MSD due to cross band isolation for CA\_n5-n8**

UL band	DL band	UL F <sub>c</sub>	UL BW	SCS of UL band	UL RB Allocation	DL F <sub>c</sub>	DL BW	MSD	Cross-band Interference source
		(MHz)	(MHz)	(kHz)	L <sub>CRB</sub>	(MHz)	(MHz)	(dB)	
n5	n8	844	10	15	25 (RBstart=27)	951.5	5	2.8	>ACLR2

As there is no concurrent between UL n8 and n5 DL, there is no need to specify the MSD due to cross band isolation for DL band n5 from aggressor UL n8.

### 5.2.1.6 OOB blocking exception requirements

There is no OOB blocking exception requirements for CA\_n5-n8.

## 5.2.2 Specific for 2 bands UL CA

### 5.2.2.1 Maximum output power for inter-band CA

**Table 5.2.2.1-1: UE Power Class for uplink inter-band CA**

Uplink CA Configuration	Power Class 3 (dBm)	Tolerance (dB)
CA_n5A-n8A	23	+2/-3

### 5.2.2.2 UE co-existence studies for 2 bands UL

Table 5.2.2.2-1 lists Band n5 + Band n8 2 bands UL CA(2CC) 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> order IMD for the UE-to-UE coexistence analysis.

**Table 5.2.2.2-1: Band n5 and Band n8 for 2CC UL IMD products**

UE UL carriers	$f_{x\_low}$	$f_{x\_high}$	$f_{y\_low}$	$f_{y\_high}$
2nd order IMD products	$ f_{y\_low} - f_{x\_high} $	$ f_{y\_high} - f_{x\_low} $	$ f_{y\_low} + f_{x\_low} $	$ f_{y\_high} + f_{x\_high} $
IMD frequency limits (MHz)	91	69	1728	1750
Two-tone 3 <sup>rd</sup> order IMD products	$ 2*f_{x\_low} - f_{y\_high} $	$ 2*f_{x\_high} - f_{y\_low} $	$ 2*f_{y\_low} - f_{x\_high} $	$ 2*f_{y\_high} - f_{x\_low} $
IMD frequency limits (MHz)	973	1006	733	766
Two-tone 3 <sup>rd</sup> order IMD products	$ 2*f_{x\_low} + f_{y\_low} $	$ 2*f_{x\_high} + f_{y\_high} $	$ 2*f_{y\_low} + f_{x\_low} $	$ 2*f_{y\_high} + f_{x\_high} $
IMD frequency limits (MHz)	2632	2665	2552	2585
Two-tone 4 <sup>th</sup> order IMD products	$ 3*f_{x\_low} - 1*f_{y\_high} $	$ 3*f_{x\_high} - 1*f_{y\_low} $	$ 3*f_{y\_low} - 1*f_{x\_high} $	$ 3*f_{y\_high} - 1*f_{x\_low} $
IMD frequency limits (MHz)	1877	1921	1557	1601
Two-tone 4 <sup>th</sup> order IMD products	$ 2*f_{x\_low} - 2*f_{y\_high} $	$ 2*f_{x\_high} - 2*f_{y\_low} $		
IMD frequency limits (MHz)	138	182		
Two-tone 4 <sup>th</sup> order IMD products	$ 3*f_{x\_low} + 1*f_{y\_low} $	$ 3*f_{x\_high} + 1*f_{y\_high} $	$ 3*f_{y\_low} + 1*f_{x\_low} $	$ 3*f_{y\_high} + 1*f_{x\_high} $
IMD frequency limits (MHz)	3536	3580	3376	3420
Two-tone 4 <sup>th</sup> order IMD products	$ 2*f_{x\_low} + 2*f_{y\_low} $	$ 2*f_{x\_high} + 2*f_{y\_high} $		
IMD frequency limits (MHz)	3456	3500		
Two-tone 5 <sup>th</sup> order IMD products	$ f_{x\_low} - 4*f_{y\_high} $	$ f_{x\_high} - 4*f_{y\_low} $	$ f_{y\_low} - 4*f_{x\_high} $	$ f_{y\_high} - 4*f_{x\_low} $
IMD frequency limits (MHz)	2436	2381	2836	2781
Two-tone 5 <sup>th</sup> order IMD products	$ 2*f_{x\_low} - 3*f_{y\_high} $	$ 2*f_{x\_high} - 3*f_{y\_low} $	$ 2*f_{y\_low} - 3*f_{x\_high} $	$ 2*f_{y\_high} - 3*f_{x\_low} $
IMD frequency limits (MHz)	697	642	1097	1042
Two-tone 5 <sup>th</sup> order IMD products	$ f_{x\_low} + 4*f_{y\_low} $	$ f_{x\_high} + 4*f_{y\_high} $	$ f_{y\_low} + 4*f_{x\_low} $	$ f_{y\_high} + 4*f_{x\_high} $
IMD frequency limits (MHz)	4200	4255	4440	4495
Two-tone 5 <sup>th</sup> order IMD products	$ 2*f_{x\_low} + 3*f_{y\_low} $	$ 2*f_{x\_high} + 3*f_{y\_high} $	$ 2*f_{y\_low} + 3*f_{x\_low} $	$ 2*f_{y\_high} + 3*f_{x\_high} $
IMD frequency limits (MHz)	4280	4335	4360	4415

NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered.

Based on Table 5.2.2.2-1, there is no IMD issue for CA\_n5-n8 with the following frequency range restriction.

n5                      UL: 824 MHz – 835 MHz                      DL: 869 MHz – 880 MHz;

n8                      UL: 904 MHz – 915 MHz                      DL: 949 MHz – 960 MHz.

However, IMD3 may fall into the DL band n8 if both band n5 and n8 transmit the signal without frequency restriction.

For CA\_n5-n8, although PHS frequency range 1884.5-1915.7MHz is as protected band of band n5, due to this combination will not be deployed in the PHS region, there is no need to add PHS frequency range as protected band for CA\_n5-n8. Thus no protected bands are needed.

### 5.2.2.3 REFSSENS requirements

Referring to the IMD3 MSD value from CA\_n8-n20, 25dB MSD can be specified for UL CA\_n5-n8 without frequency range restriction by implementing non-concurrent n5 DL and n8 UL solution.

**Table 5.2.2.3-1: MSD test parameters due to the two UL IMD3**

Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode								Source of IMD
NR CA band combination	NR band	UL F <sub>c</sub> (MHz)	UL/DL BW (MHz)	UL L <sub>CRB</sub>	DL F <sub>c</sub> (MHz)	MSD (dB)	Duplex mode	
CA_n5-n8	n5	837.5	5	25	882.5	N/A	FDD	N/A
	n8	882.5	5	25	927.5	25	FDD	IMD3

## Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	C R	Rev	Cat	Subject/Comment	New version
2025-02	RAN4#114	R4-2500148				TR skeleton	0.0.1
2025-02	RAN4#114	R4-2503018				TP for TR 38.793 CA_n40A-n41A	
2025-04	RAN4#114bis	R4-2503143				TR v0.1.0	0.1.0
2025-08	RAN4#116	R4-2511899				TP to TR 38.793 on applicability of mandatory support of simultaneous Rx-Tx	
2025-09	RAN4#116	R4-2510471				TR v0.2.0	0.2.0
2025-11	RAN4#117	R4-2522453				TP to TR 38.793 to introduce UL CA_n5-n8	
2025-11	RAN4#117	R4-2520609				TR v0.3.0	0.3.0
2025-12	RAN#110	RP-253482				TR 38.793 v1.0.0	1.0.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2025-12	RAN#110					Approved by plenary – Rel-19 spec under change control	19.0.0

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## History

<b>Version</b>	<b>Date</b>	<b>Status</b>
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