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Technical Report

3rd Generation Partnership Project;

Technical Specification Group Radio Access Network;

Rel-17 NR inter-band Carrier Aggregation/Dual connectivity for 3 bands DL with 2 bands UL

(Release 17)

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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:

Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

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

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

In 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 a technical report for NR inter-band CA and DC for 3 bands DL with 2 bands UL under Rel-17 time frame. The purpose is to gather the relevant background information and studies in order to address NR inter-band CA and DC for 3 bands DL with 2 bands UL for the Rel-17 band combinations.

This TR contains a general part and band specific combination part. The actual requirements are added to the corresponding technical specifications.

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 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[3]   3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[4]   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".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Aggregated Channel Bandwidth: The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

Carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

Inter-band carrier aggregation: Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

3.2 Symbols

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

$\Delta R_{IB,c}$ Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell c.
$\Delta T_{IB,c}$ Allowed maximum configured output power relaxation due to support for inter-band CA

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].

BS   Base Station
CA   Carrier Aggregation
DC   Dual Connectivity
DL   DownLink
FDD   Frequency Division Duplex
IMD   Inter-modulation
MSD   Maximum Sensitivity Deduction
SCS   Subcarrier spacing
TDD   Time Division Duplex
UE   User Equipment
UL   UpLink

4 Background

The present document is a technical report for NR inter-band CA and DC for 3 bands DL with 2 bands UL under Rel-17 time frame. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

4.1 TR Maintenance

A single company is responsible for introducing all approved TPs in the current TR, i.e. TR editor. However, it is the responsibility of the contact person of each band combination to ensure that the TPs related to the band combination have been implemented.

5 inter-band Carrier Aggregation for 3 bands DL with 2 bands UL: Specific Band Combination Part

5.1 inter-band within FR1

5.1.1 CA_n39-n40-n79

5.1.1.1 Operating bands for CA

Table 5.1.1.1-1: CA band combination of band n39+n40+n41

NR Band	NR Band	Uplink (UL) band		Downlink (DL) band		Duplex mode
		BS receive / UE transmit		BS transmit / UE receive		
		$F_{UL\_low} - F_{UL\_high}$		$F_{DL\_low} - F_{DL\_high}$		
CA_n39A-n40A-n79A	n39	1880 MHz –	1920 MHz	1880 MHz –	1920 MHz	TDD
	n40	2300 MHz –	2400 MHz	2300 MHz –	2400 MHz	TDD
	n79	4400 MHz –	5000 MHz	4400 MHz –	5000 MHz	TDD

5.1.1.2 Channel bandwidths per operating band for CA

Table 5.1.1.2-1: Supported channel bandwidths per CA configuration for band n39+n40+n41

NR CA configuration	Uplink CA configuration	NR Band	SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz	Bandwidth combination set
CA_n39A-n40A-n79A	CA_n39A-n40A CA_n40A-n79A CA_n39A-n79A	n39	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes							0
			30		Yes	Yes	Yes	Yes	Yes	Yes							
			60		Yes	Yes	Yes	Yes	Yes	Yes							
		n40	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes			
			60		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes			
		n79	15							Yes	Yes						
			30							Yes	Yes	Yes		Yes		Yes	
			60							Yes	Yes	Yes		Yes		Yes	

5.1.1.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Actually, the co-existence studies for dual uplink operation of two bands, i.e. CA_n39A-n40A, CA_n39A-n79A and CA_n40A-n79A have been captured in TR38.716-02-00, where:

- IMD4 products produced by Band 39 and Band n40 that impact the reference sensitivity of NR band n79.

- No IMD products produced by Band 39 and Band n79 that impact the reference sensitivity of NR band n40.

- IMD4 and IMD5 products produced by Band 40 and Band n79 that impact the reference sensitivity of NR band n39.

5.1.1.4 REFSENS requirements

According to clause 5.1.1.3, some IM3 produces of dual uplink operation of two bands will falling into the DL of the third band. However, considering the requirements for TDD-TDD NR CA combinations of CA_n39-n40 are defined without simultaneous Rx/Tx capability in TS38.101-1, i.e. synchronous operation. Therefore it is no need to defined MSD requirements for band n39 due to IMD4 and IMD5 products produced by Band 40 and Band n79.

For the MSD for NR band n79 caused by IMD4 products of Band 39 and Band n40, since the CA_n39-n79 and CA_n40-n79 are operated with mandatory simultaneous Rx/Tx capability in TS38.101-1, i.e. asynchronous operation. Therefore it is need to defined MSD requirements for band n79 due to IMD4 products produced by Band 39 and Band n40.

The required MSD is shown in the table 5.1.1.4-1, where the MSD of EN-DC_39A_n40A-n79A are re-used.

Table 5.1.1.4-1: MSD due to IMD4

NR CA Configuration	Band / Channel bandwidth / N_{RB} / Duplex mode							Source of IMD
	NR band	UL F_c (MHz)	UL/DL BW (MHz)	UL C_{LRB}	DL F_c (MHz)	MSD (dB)	Duplex mode	
CA_n39A-n40A-n79A	n39	1917.5	5	25	1917.5	N/A	TDD	N/A
	n40	2302.5	5	25	2302.5	N/A	TDD	N/A
	n79	4980	40	216	4980	5.8	TDD	IMD4

5.1.2 CA_n39-n40-n41

5.1.2.1 Operating bands for CA

Table 5.1.2.1-1: CA band combination of band n39+n40+n41

NR Band	NR Band	Uplink (UL) band		Downlink (DL) band		Duplex mode
		BS receive / UE transmit		BS transmit / UE receive		
		$F_{UL\_low} - F_{UL\_high}$		$F_{DL\_low} - F_{DL\_high}$		
CA_n39A-n40A-n41A	n39	1880 MHz –	1920 MHz	1880 MHz –	1920 MHz	TDD
	n40	2300 MHz –	2400 MHz	2300 MHz –	2400 MHz	TDD
	n41	2496 MHz –	2690 MHz	2496 MHz –	2690 MHz	TDD

5.1.2.2 Channel bandwidths per operating band for CA

Table 5.1.2.2-1: Supported channel bandwidths per CA configuration for band n39+n40+n41

NR CA configuration	Uplink CA configuration	NR Band	SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz	Bandwidth combination set

NR CA Band	NR CA combos	NR Band	BW (MHz)														MSD
CA_n39A-n40A-n41A	CA_n39A-n40A CA_n39A-n41A CA_n40A-n41A	n39	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes							0
			30		Yes	Yes	Yes	Yes	Yes	Yes							
			60		Yes	Yes	Yes	Yes	Yes	Yes							
		n40	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes			
			60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes			
		n41	15		Yes	Yes	Yes			Yes	Yes						
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes	
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes	

5.1.2.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Actually, the co-existence studies for dual uplink operation of two bands, i.e. CA_n39A-n40A, CA_n39A-n41A and CA_n40A-n41A have been captured in TR38.716-02-00, where:

- IMD3 products produced by Band n39 and n40 that impact the reference sensitivity of NR band n41.

- No IMD3 products produced by Band n39 and n41 that falling into the band n41 Rx.

- 2nd and 5rd products produced by Band n40 and n41 may falling into the band n39 Rx.

5.1.2.4 REFSENS requirements

According to clause 5.1.2.3, some IM3 produces of dual uplink operation of two bands will falling into the DL of the third band. However, considering the requirements for TDD-TDD NR CA combinations of CA_n39-n40, CA_n39-n41 and CA_n40-n41 are defined without simultaneous Rx/Tx capability in TS38.101-1, i.e. synchronous operation. Therefore it is no need to defined MSD requirements due to IMD3 issues, i.e. no specific REFSENS requirements for this combination in 3DL/2UL NR CA operation.

5.1.3 CA_n5-n25-n66

5.1.3.1 Operating bands for CA

Table 5.1.3.1-1: Inter-band CA operating bands

NR CA Band	NR Band	Uplink (UL) operating band BS receive / UE transmit $F_{UL\_low} - F_{UL\_high}$			Downlink (DL) operating band BS transmit / UE receive $F_{DL\_low} - F_{DL\_high}$			Duplex Mode
CA_n5-n25-n66	n5	824 MHz	–	849 MHz	869 MHz	–	894 MHz	FDD
	n25	1850 MHz	–	1915 MHz	1930 MHz	–	1995 MHz	FDD
	n66	1710 MHz	–	1780 MHz	2110 MHz	–	2200 MHz	TDD

5.1.3.2 Channel bandwidths per operating band for CA

Table 5.1.3.2-1: Supported bandwidths per CA band combination of band n5+n25+n66

NR CA Configuration	UL Config	NR Band	SCS [kHz]	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz	Bandwidth combination set
CA_n5A-n25A-n66A	CA_n5A-n25A CA_n5A-n66A CA_n25A-n66A	n5	15	Yes	Yes	Yes	Yes									0
			30		Yes	Yes	Yes									
			60													
		n25	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes						
			60		Yes	Yes	Yes	Yes	Yes	Yes						
		n66	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes						
			60		Yes	Yes	Yes	Yes	Yes	Yes						
CA_n5A-n25(2A)-n66A	CA_n5A-n25A CA_n5A-n66A CA_n25A-n66A	n5	15	Yes	Yes	Yes	Yes									0
			30		Yes	Yes	Yes									
			60													
		n25		See CA_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1												
		n66	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes						
			60		Yes	Yes	Yes	Yes	Yes	Yes						
CA_n5A-n25A-n66(2A)	CA_n5A-n25A CA_n5A-n66A CA_n25A-n66A	n5	15	Yes	Yes	Yes	Yes									0
			30		Yes	Yes	Yes									
			60													
		n25	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes						
			60		Yes	Yes	Yes	Yes	Yes	Yes						
		n66		See CA_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1												
CA_n5A-n25(2A)-n66(2A)	CA_n5A-n25A CA_n5A-n66A CA_n25A-n66A	n5	15	Yes	Yes	Yes	Yes									0
			30		Yes	Yes	Yes									
			60													
		n25		See CA_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1												
		n66		See CA_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1												

5.1.3.3 UE co-existence studies

For UE coexistence study of Band n5 + Band n25, Band n5 + Band n66, and Band n25 + band n66, the 2nd, 3rd, 4th and 5th order harmonics are already analyzed in 3DL/1UL WI, where no harmonic issue is identified. The 2nd, 3rd, 4th and 5th order intermodulation products are calculated and presented in Table 5.1.3.3-1, 5.1.3.3-2 and 5.1.3.3-3, respectively.

Table 5.1.3.3-1: Harmonic and IMD analysis for n5+n25

UE UL carriers	f1_low	f1_high	f2_low	f2_high
UL frequencies (MHz)	824	849	1850	1915
2nd harmonic	2* f1_low	2*f1_high	2*f2_low	2*f2_high
harmonic frequency limit (MHz)	1648	1698	3700	3830
3rd harmonic	3* f1_low	3*f1_high	3*f2_low	3*f2_high
harmonic frequency limit (MHz)	2472	2547	5550	5745
2nd order IMD products	f2_low − f1_high	f2_high − f1_low	f2_low + f1_low	f2_high + f1_high
IMD frequency limit (MHz)	1001	1091	2674	2764
3rd order IMD products	2*f1_low − f2_high	2*f1_high − f2_low	2*f2_low − f1_high	2*f2_high − f1_low
IMD frequency limit (MHz)	-267	-152	2851	3006

3rd order IMD products	2*f1_low + f2_low	2*f1_high + f2_high	2*f2_low + f1_low	2*f2_high + f1_high
IMD frequency limit (MHz)	3498	3613	4524	4679
4th order IMD products	3*f1_low – f2_high	3*f1_high – f2_low	3*f2_low – f1_high	3*f2_high – f1_low
IMD frequency limit (MHz)	557	697	4701	4921
4th order IMD products	3*f1_low + f2_low	3*f1_high + f2_high	3*f2_low + f1_low	3*f2_high + f1_high
IMD frequency limit (MHz)	4322	4462	6374	6594
4th order IMD products	2*f1_low – 2*f2_high	2*f1_high – 2*f2_low	2*f1_low + 2*f2_low	2*f1_high + 2*f2_high
IMD frequency limit (MHz)	-2182	-2002	5348	5528
5th order IMD products	f1_low – 4*f2_high	f1_high – 4*f2_low	f2_low – 4*f1_high	f2_high – 4*f1_low
IMD frequency limit (MHz)	-6836	-6551	-1546	-1381
5th order IMD products	f1_low + 4*f2_low	f1_high + 4*f2_high	f2_low + 4*f1_low	f2_high + 4*f1_high
IMD frequency limit (MHz)	8224	8509	5146	5311
5th order IMD products	2*f1_low – 3*f2_high	2*f1_high - 3*f2_low	2*f2_low – 3*f1_high	2*f2_high – 3*f1_low
IMD frequency limit (MHz)	-4097	-3852	1153	1358
5th order IMD products	2*f1_low + 3*f2_low	2*f1_high + 3*f2_high	2*f2_low + 3*f1_low	2*f2_high + 3*f1_high
IMD frequency limit (MHz)	7198	7443	6172	6377

Table 5.1.3.3-2: Harmonic and IMD analysis for n5+n66

UE UL carriers	f1_low	f1_high	f2_low	f2_high
UL frequencies (MHz)	824	849	1710	1780
2nd harmonic	2* f1_low	2*f1_high	2*f2_low	2*f2_high
harmonic frequency limit (MHz)	1648	1698	3420	3560
3rd harmonic	3* f1_low	3*f1_high	3*f2_low	3*f2_high
harmonic frequency limit (MHz)	2472	2547	5130	5340
2nd order IMD products	f2_low – f1_high	f2_high – f1_low	f2_low + f1_low	f2_high + f1_high
IMD frequency limit (MHz)	861	956	2534	2629
3rd order IMD products	2*f1_low – f2_high	2*f1_high – f2_low	2*f2_low – f1_high	2*f2_high – f1_low
IMD frequency limit (MHz)	-132	-12	2571	2736
3rd order IMD products	2*f1_low + f2_low	2*f1_high + f2_high	2*f2_low + f1_low	2*f2_high + f1_high
IMD frequency limit (MHz)	3358	3478	4244	4409
4th order IMD products	3*f1_low – f2_high	3*f1_high – f2_low	3*f2_low – f1_high	3*f2_high – f1_low
IMD frequency limit (MHz)	692	837	4281	4516
4th order IMD products	3*f1_low + f2_low	3*f1_high + f2_high	3*f2_low + f1_low	3*f2_high + f1_high
IMD frequency limit (MHz)	4182	4327	5954	6189
4th order IMD products	2*f1_low – 2*f2_high	2*f1_high – 2*f2_low	2*f1_low + 2*f2_low	2*f1_high + 2*f2_high
IMD frequency limit (MHz)	-1912	-1722	5068	5258
5th order IMD products	f1_low – 4*f2_high	f1_high – 4*f2_low	f2_low – 4*f1_high	f2_high – 4*f1_low
IMD frequency limit (MHz)	-6296	-5991	-1686	-1516
5th order IMD products	f1_low + 4*f2_low	f1_high + 4*f2_high	f2_low + 4*f1_low	f2_high + 4*f1_high
IMD frequency limit (MHz)	7664	7969	5006	5176
5th order IMD products	2*f1_low – 3*f2_high	2*f1_high - 3*f2_low	2*f2_low – 3*f1_high	2*f2_high – 3*f1_low

IMD frequency limit (MHz)	-3692	-3432	873	1088
5th order IMD products	2*f1_low + 3*f2_low	2*f1_high + 3*f2_high	2*f2_low + 3*f1_low	2*f2_high + 3*f1_high
IMD frequency limit (MHz)	6778	7038	5892	6107

Table 5.1.3.3-2: Harmonic and IMD analysis for n25+n66

UE UL carriers	f1_low	f1_high	f2_low	f2_high
UL frequencies (MHz)	1710	1780	1850	1915
2nd order IMD products	f2_low – f1_high	f2_high – f1_low	f2_low + f1_low	f2_high + f1_high
IMD frequency limit (MHz)	70	205	3560	3695
3rd order IMD products	2*f1_low – f2_high	2*f1_high – f2_low	2*f2_low – f1_high	2*f2_high – f1_low
IMD frequency limit (MHz)	1505	1710	1920	2120
3rd order IMD products	2*f1_low + f2_low	2*f1_high + f2_high	2*f2_low + f1_low	2*f2_high + f1_high
IMD frequency limit (MHz)	5270	5475	5410	5610
4th order IMD products	3*f1_low – f2_high	3*f1_high – f2_low	3*f2_low – f1_high	3*f2_high – f1_low
IMD frequency limit (MHz)	3215	3490	3770	4035
4th order IMD products	3*f1_low + f2_low	3*f1_high + f2_high	3*f2_low + f1_low	3*f2_high + f1_high
IMD frequency limit (MHz)	6980	7255	7260	7525
4th order IMD products	2*f1_low – 2*f2_high	2*f1_high – 2*f2_low	2*f1_low + 2*f2_low	2*f1_high + 2*f2_high
IMD frequency limit (MHz)	-410	-140	7120	7390
5th order IMD products	f1_low – 4*f2_high	f1_high – 4*f2_low	f2_low – 4*f1_high	f2_high – 4*f1_low
IMD frequency limit (MHz)	-5950	-5620	-5270	-4925
5th order IMD products	f1_low + 4*f2_low	f1_high + 4*f2_high	f2_low + 4*f1_low	f2_high + 4*f1_high
IMD frequency limit (MHz)	9110	9440	8690	9035
5th order IMD products	2*f1_low – 3*f2_high	2*f1_high - 3*f2_low	2*f2_low – 3*f1_high	2*f2_high – 3*f1_low
IMD frequency limit (MHz)	-2325	-1990	-1640	-1300
5th order IMD products	2*f1_low + 3*f2_low	2*f1_high + 3*f2_high	2*f2_low + 3*f1_low	2*f2_high + 3*f1_high
IMD frequency limit (MHz)	8970	9305	8830	9170

Co-existence studies shows that

- The 4th IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n66.

- The 2nd IMD generated by dual uplink of Band n5 + Band n66 may fall into own Rx of band n5.

- The 5th IMD generated by dual uplink of Band n5 + Band n66 may fall into own Rx of band n5.

- The 3rd IMD generated by dual uplink of Band n25 + Band n66 may fall into own Rx of band n25.

- The 3rd IMD generated by dual uplink of Band n25 + Band n66 may fall into own Rx of band n66.

- The 5th IMD generated by dual uplink of Band n25 + Band n66 may fall into own Rx of band n66.

5.1.3.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 4th IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n66. As this IMD4 issue is similar to CA_2A-5A-66A, the same MSD value is reused in Table 5.1.3.4-1.

Table 5.1.3.4-1: MSD for the CA configuration

EN-DC Configuration	EUTRA/NR band	UL F_c (MHz)	UL/DL BW (MHz)	UL L_{CRB}	DL F_c (MHz)	MSD (dB)	Duplex mode	IMD order
CA_n5A-n25A-n66A	n5	834	5	25	879	N/A	FDD	N/A
	n25	1900	5	25	1980	N/A		N/A
	n66	1712	5	25	2132	7.2		IMD4

5.1.4 CA_n5-n25-n78

5.1.4.1 Operating bands for CA

Table 5.1.4.1-1: Inter-band CA operating bands

NR CA Band	NR Band	Uplink (UL) operating band BS receive / UE transmit $F_{UL\_low} - F_{UL\_high}$			Downlink (DL) operating band BS transmit / UE receive $F_{DL\_low} - F_{DL\_high}$			Duplex Mode
CA_n5-n25-n78	n5	824 MHz	–	849 MHz	869 MHz	–	894 MHz	FDD
	n25	1850 MHz	–	1915 MHz	1930 MHz	–	1995 MHz	FDD
	n78	3300 MHz	–	3800 MHz	3300 MHz	–	3800 MHz	TDD

5.1.4.2 Channel bandwidths per operating band for CA

Table 5.1.4.2-1: Supported channel bandwidths per CA configuration

NR CA Configuration	UL Config	NR Band	SCS [kHz]	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz	Bandwidth combination set
CA_n5A-n25A-n78A	CA_n5A-n25A CA_n5A-n78A CA_n25A-n78A	n5	15	Yes	Yes	Yes	Yes										0
			30		Yes	Yes	Yes										
			60														
		n25	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes							
			30		Yes	Yes	Yes	Yes	Yes	Yes							
			60		Yes	Yes	Yes	Yes	Yes	Yes							
		n78	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
			60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
CA_n5A-n25(2A)-n78A	CA_n5A-n25A CA_n5A-n78A CA_n25A-n78A	n5	15	Yes	Yes	Yes	Yes										0
			30		Yes	Yes	Yes										
			60														
		n25	See CA_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1														
		n78	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
			30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
			60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
CA_n5A-n25A-n78(2A)	CA_n5A-n25A CA_n5A-n78A	n5	15	Yes	Yes	Yes	Yes										0
			30		Yes	Yes	Yes										

CA_n25A-n78A		60												
	n25	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes					
		30		Yes	Yes	Yes	Yes	Yes	Yes					
		60		Yes	Yes	Yes	Yes	Yes	Yes					
	n78	See CA_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1												

5.1.4.3   Co-existence studies

For UE coexistence study of Band n5 + Band n25, Band n5 + Band n78, and Band n25 + band n78, the 2nd, 3rd, 4th and 5th order harmonics are already analyzed in 3DL/1UL WI, where no harmonic issue is identified. The 2nd, 3rd, 4th and 5th order intermodulation products are calculated and presented in Table 5.1.4.3-1, 5.1.4.3-2 and 5.1.4.3-3, respectively.

Table 5.1.4.3-1: Harmonic and IMD analysis for n5+n25

UE UL carriers	f1_low	f1_high	f2_low	f2_high
UL frequencies (MHz)	824	849	1850	1915
2nd harmonic	2* f1_low	2*f1_high	2*f2_low	2*f2_high
harmonic frequency limit (MHz)	1648	1698	3700	3830
3rd harmonic	3* f1_low	3*f1_high	3*f2_low	3*f2_high
harmonic frequency limit (MHz)	2472	2547	5550	5745
2nd order IMD products	f2_low – f1_high	f2_high – f1_low	f2_low + f1_low	f2_high + f1_high
IMD frequency limit (MHz)	1001	1091	2674	2764
3rd order IMD products	2*f1_low – f2_high	2*f1_high – f2_low	2*f2_low – f1_high	2*f2_high – f1_low
IMD frequency limit (MHz)	-267	-152	2851	3006
3rd order IMD products	2*f1_low + f2_low	2*f1_high + f2_high	2*f2_low + f1_low	2*f2_high + f1_high
IMD frequency limit (MHz)	<mark>3498</mark>	<mark>3613</mark>	4524	4679
4th order IMD products	3*f1_low – f2_high	3*f1_high – f2_low	3*f2_low – f1_high	3*f2_high – f1_low
IMD frequency limit (MHz)	557	697	4701	4921
4th order IMD products	3*f1_low + f2_low	3*f1_high + f2_high	3*f2_low + f1_low	3*f2_high + f1_high
IMD frequency limit (MHz)	4322	4462	6374	6594
4th order IMD products	2*f1_low – 2*f2_high	2*f1_high – 2*f2_low	2*f1_low + 2*f2_low	2*f1_high + 2*f2_high
IMD frequency limit (MHz)	-2182	-2002	5348	5528
5th order IMD products	f1_low – 4*f2_high	f1_high – 4*f2_low	f2_low – 4*f1_high	f2_high – 4*f1_low
IMD frequency limit (MHz)	-6836	-6551	-1546	-1381
5th order IMD products	f1_low + 4*f2_low	f1_high + 4*f2_high	f2_low + 4*f1_low	f2_high + 4*f1_high
IMD frequency limit (MHz)	8224	8509	5146	5311
5th order IMD products	2*f1_low – 3*f2_high	2*f1_high - 3*f2_low	2*f2_low – 3*f1_high	2*f2_high – 3*f1_low
IMD frequency limit (MHz)	-4097	-3852	1153	1358
5th order IMD products	2*f1_low + 3*f2_low	2*f1_high + 3*f2_high	2*f2_low + 3*f1_low	2*f2_high + 3*f1_high
IMD frequency limit (MHz)	7198	7443	6172	6377

Table 5.1.4.3-2: Harmonic and IMD analysis for n5+n78

UE UL carriers	f1_low	f1_high	f2_low	f2_high
UL frequencies (MHz)	824	849	3300	3800

2nd harmonic	2* f1_low	2*f1_high	2*f2_low	2*f2_high
harmonic frequency limit (MHz)	1648	1698	6600	7600
3rd harmonic	3* f1_low	3*f1_high	3*f2_low	3*f2_high
harmonic frequency limit (MHz)	2472	2547	9900	11400
2nd order IMD products	f2_low – f1_high	f2_high – f1_low	f2_low + f1_low	f2_high + f1_high
IMD frequency limit (MHz)	2451	2976	4124	4649
3rd order IMD products	2*f1_low – f2_high	2*f1_high – f2_low	2*f2_low – f1_high	2*f2_high – f1_low
IMD frequency limit (MHz)	-2152	-1602	5751	6776
3rd order IMD products	2*f1_low + f2_low	2*f1_high + f2_high	2*f2_low + f1_low	2*f2_high + f1_high
IMD frequency limit (MHz)	4948	5498	7424	8449
4th order IMD products	3*f1_low – f2_high	3*f1_high – f2_low	3*f2_low – f1_high	3*f2_high – f1_low
IMD frequency limit (MHz)	<mark>-1328</mark>	<mark>-753</mark>	9051	10576
4th order IMD products	3*f1_low + f2_low	3*f1_high + f2_high	3*f2_low + f1_low	3*f2_high + f1_high
IMD frequency limit (MHz)	5772	6347	10724	12249
4th order IMD products	2*f1_low – 2*f2_high	2*f1_high – 2*f2_low	2*f1_low + 2*f2_low	2*f1_high + 2*f2_high
IMD frequency limit (MHz)	-5952	-4902	8248	9298
5th order IMD products	f1_low – 4*f2_high	f1_high – 4*f2_low	f2_low – 4*f1_high	f2_high – 4*f1_low
IMD frequency limit (MHz)	-14376	-12351	-96	504
5th order IMD products	f1_low + 4*f2_low	f1_high + 4*f2_high	f2_low + 4*f1_low	f2_high + 4*f1_high
IMD frequency limit (MHz)	14024	16049	6596	7196
5th order IMD products	2*f1_low – 3*f2_high	2*f1_high - 3*f2_low	2*f2_low – 3*f1_high	2*f2_high – 3*f1_low
IMD frequency limit (MHz)	-9752	-8202	4053	5128
5th order IMD products	2*f1_low + 3*f2_low	2*f1_high + 3*f2_high	2*f2_low + 3*f1_low	2*f2_high + 3*f1_high
IMD frequency limit (MHz)	11548	13098	9072	10147

Table 5.1.4.3-2: Harmonic and IMD analysis for n25+n78

UE UL carriers	f1_low	f1_high	f2_low	f2_high
UL frequencies (MHz)	1850	1915	3300	3800
2nd harmonic	2* f1_low	2*f1_high	2*f2_low	2*f2_high
harmonic frequency limit (MHz)	3700	3830	6600	7600
3rd harmonic	3* f1_low	3*f1_high	3*f2_low	3*f2_high
harmonic frequency limit (MHz)	5550	5745	9900	11400
2nd order IMD products	f2_low – f1_high	f2_high – f1_low	f2_low + f1_low	f2_high + f1_high
IMD frequency limit (MHz)	<mark>1385</mark>	<mark>1950</mark>	5150	5715
3rd order IMD products	2*f1_low – f2_high	2*f1_high – f2_low	2*f2_low – f1_high	2*f2_high – f1_low
IMD frequency limit (MHz)	-100	530	4685	5750
3rd order IMD products	2*f1_low + f2_low	2*f1_high + f2_high	2*f2_low + f1_low	2*f2_high + f1_high
IMD frequency limit (MHz)	7000	7630	8450	9515
4th order IMD products	3*f1_low – f2_high	3*f1_high – f2_low	3*f2_low – f1_high	3*f2_high – f1_low
IMD frequency limit (MHz)	1750	2445	7985	9550
4th order IMD products	3*f1_low + f2_low	3*f1_high + f2_high	3*f2_low + f1_low	3*f2_high + f1_high

IMD frequency limit (MHz)	8850	9545	11750	13315
4th order IMD products	2*f1_low – 2*f2_high	2*f1_high – 2*f2_low	2*f1_low + 2*f2_low	2*f1_high + 2*f2_high
IMD frequency limit (MHz)	-3900	-2770	10300	11430
5th order IMD products	f1_low – 4*f2_high	f1_high – 4*f2_low	f2_low – 4*f1_high	f2_high – 4*f1_low
IMD frequency limit (MHz)	-13350	-11285	-4360	-3600
5th order IMD products	f1_low + 4*f2_low	f1_high + 4*f2_high	f2_low + 4*f1_low	f2_high + 4*f1_high
IMD frequency limit (MHz)	15050	17115	10700	11460

Co-existence studies shows that

- The 3rd IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n78.

- The 4th IMD generated by dual uplink of Band n5 + Band n78 may fall into own Rx of band n5.

- The 2nd IMD generated by dual uplink of Band n25 + Band n78 may fall into own Rx of band n25.

- The 4th IMD generated by dual uplink of Band n25 + Band n78 may fall into own Rx of band n78.

- The 5th IMD generated by dual uplink of Band n25 + Band n78 may fall into own Rx of band n78.

5.1.4.4   REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 3rd IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n78. As this IMD issue is similar to CA_n3A-n8A-n78A where low and high FDD band IMD3 falls into n78, the same MSD value as 16.1 dB is reused.

Table 5.1.4.4-1: MSD for the CA configuration

EN-DC Configuration	EUTRA/NR band	UL F_c (MHz)	UL/DL BW (MHz)	UL L_{CRB}	DL F_c (MHz)	MSD (dB)	Duplex mode	IMD order
CA_n5A-n25A-n78A	n5	830	5	25	875	N/A	FDD	N/A
	n25	1900	5	25	1980	N/A		N/A
	n78	3560	10	50	3560	16.1	TDD	IMD3

5.2 inter-band within FR2

5.2.x CA_nX-nY-nZ

5.2.x.1 Operating bands for CA

Table 5.2.x.1-1: CA band combination of band nX+nY+nZ

NR Band	Uplink (UL) band BS receive / UE transmit $F_{UL\_low} - F_{UL\_high}$	Downlink (DL) band BS transmit / UE receive $F_{DL\_low} - F_{DL\_high}$	Duplex mode
nX	–	–	
nY	–	–	
nZ	–	–	

5.2.x.2 Channel bandwidths per operating band for CA

Table 5.2.x.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

< Editor's note: Align with the table format in TS38.101-2 later>

5.2.x.3 UE co-existence studies

< Edtor's note: Text will be added on whether there are IMD issues due to dual uplink operation falling into the DL of the third band. For example: for CA_nXA-nYA-nZA with 2UL CA_nXA-nYA, intermodulation due to Band nX and Band nY falling into Band nZ shall be verified.>

5.2.x.4 REFSENS requirements

< Editor's note: Text will be added on reference sensitivity exceptions if IMD issue due to dual uplink operation falling into DL of the third band are identified. >

5.3 inter-band between FR1 and FR2

5.3.1 CA_n1-n77-n257

5.3.1.1 Operating bands for CA

Table 5.3.1.1-1: 3DL Inter-band CA operating bands

NR CA Band	NR Band	Uplink (UL) operating band BS receive / UE transmit FUL_low – FUL_high			Downlink (DL) operating band BS transmit / UE receive FDL_low – FDL_high			Duplex Mode
CA_n1-n77-n257	n1	1920 MHz	–	1980 MHz	2110 MHz	–	2170 MHz	FDD
	n77	3300 MHz	–	4200 MHz	3300 MHz	–	4200 MHz	TDD
	n257	26500 MHz	–	29500 MHz	26500 MHz	–	29500 MHz	TDD

5.3.1.2 Channel bandwidths per operating band for CA

Table 5.3.1.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

NR CA config	UL config	NR Band	SCS (kHz)	5	10	15	20	25	30	40	50	60	70	80	90	100	200	400	Bandwidth combination set
CA_n1A-n77A-n257A	CA_n1A-n77A CA_n1A-n257A CA_n77A-n257A	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n77	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	60								Yes					Yes	Yes		
			120								Yes					Yes	Yes	Yes	
CA_n1A-n77A-n257G	CA_n1A-n77A CA_n1A-n257A CA_n1A-n257G CA_n77A-n257A CA_n77A-n257G	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n77	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	See CA_n257G in Table 5.5A.1-1 in TS 38.101-2																
CA_n1A-n77A-n257H	CA_n1A-n77A CA_n1A-n257A CA_n1A-n257G CA_n1A-n257H CA_n77A-n257A CA_n77A-n257G CA_n77A-n257H	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n77	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	See CA_n257H in Table 5.5A.1-1 in TS 38.101-2																
CA_n1A-n77A-n257I	CA_n1A-n77A CA_n1A-n257A CA_n1A-n257G CA_n1A-n257H CA_n1A-n257I CA_n77A-n257A CA_n77A-n257G CA_n77A-n257H CA_n77A-n257I	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n77	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	See CA_n257I in Table 5.5A.1-1 in TS 38.101-2																

5.3.1.3   UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA_n1-n77, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

5.3.1.4   REFSENS requirements

As mentioned in 5.3.1.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

5.3.2   CA_n1-n78-n257

5.3.2.1   Operating bands for CA

Table 5.3.2.1-1: 3DL Inter-band CA operating bands

NR CA Band	NR Band	Uplink (UL) operating band BS receive / UE transmit FUL_low – FUL_high			Downlink (DL) operating band BS transmit / UE receive FDL_low – FDL_high			Duplex Mode
CA_n1-n78-n257	n1	1920 MHz	–	1980 MHz	2110 MHz	–	2170 MHz	FDD
	n78	3300 MHz	–	3800 MHz	3300 MHz	–	3800 MHz	TDD
	n257	26500 MHz	–	29500 MHz	26500 MHz	–	29500 MHz	TDD

5.3.2.2　Channel bandwidths per operating band for CA

Table 5.3.2.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

NR CA config	UL config	NR Band	SCS (kHz)	5	10	15	20	25	30	40	50	60	70	80	90	100	200	400	Bandwidth combination set
CA_n1A-n78A-n257A	CA_n1A-n78A CA_n1A-n257A CA_n78A-n257A	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n78	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	60								Yes					Yes	Yes		
			120								Yes					Yes	Yes	Yes	
CA_n1A-n78A-n257G	CA_n1A-n78A CA_n1A-n257A CA_n1A-n257G CA_n78A-n257A CA_n78A-n257G	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n78	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	See CA_n257G in Table 5.5A.1-1 in TS 38.101-2															
CA_n1A-n78A-n257H	CA_n1A-n78A CA_n1A-n257A CA_n1A-n257G CA_n1A-n257H CA_n78A-n257A CA_n78A-n257G CA_n78A-n257H	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n78	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	See CA_n257H in Table 5.5A.1-1 in TS 38.101-2															
CA_n1A-n78A-n257I	CA_n1A-n78A CA_n1A-n257A CA_n1A-n257G CA_n1A-n257H CA_n1A-n257I CA_n78A-n257A CA_n78A-n257G CA_n78A-n257H CA_n78A-n257I	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n78	15		Yes	Yes	Yes			Yes	Yes								
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n257	See CA_n257I in Table 5.5A.1-1 in TS 38.101-2															

5.3.2.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA_n1-n78, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

5.3.2.4 REFSENS requirements

As mentioned in 5.3.2.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

5.3.3 CA_n1-n79-n257

5.3.3.1 Operating bands for CA

Table 5.3.3.1-1: 3DL Inter-band CA operating bands

NR CA Band	NR Band	Uplink (UL) operating band BS receive / UE transmit FUL_low – FUL_high			Downlink (DL) operating band BS transmit / UE receive FDL_low – FDL_high			Duplex Mode
CA_n1-n79-n257	n1	1920 MHz	–	1980 MHz	2110 MHz	–	2170 MHz	FDD
	n79	4400 MHz	–	5000 MHz	4200 MHz	–	5000 MHz	TDD
	n257	26500 MHz	–	29500 MHz	26500 MHz	–	29500 MHz	TDD

5.3.3.2 Channel bandwidths per operating band for CA

Table 5.3.3.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

NR CA config	UL config	NR Band	SCS (kHz)	5	10	15	20	25	30	40	50	60	70	80	90	100	200	400	Bandwidth combination set
CA_n1A-n79A-n257A	CA_n1A-n79A CA_n1A-n257A CA_n79A-n257A	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257	60								Yes					Yes	Yes		
			120								Yes					Yes	Yes	Yes	
CA_n1A-n79A-n257G	CA_n1A-n79A CA_n1A-n257A CA_n1A-n257G CA_n79A-n257A CA_n79A-n257G	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257	See CA_n257G in Table 5.5A.1-1 in TS 38.101-2																
CA_n1A-n79A-n257H	CA_n1A-n79A CA_n1A-n257A CA_n1A-n257G CA_n1A-n257H CA_n79A-n257A CA_n79A-n257G CA_n79A-n257H	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257	See CA_n257H in Table 5.5A.1-1 in TS 38.101-2																
CA_n1A-n79A-n257I	CA_n1A-n79A CA_n1A-n257A CA_n1A-n257G CA_n1A-n257H CA_n1A-n257I CA_n79A-n257A CA_n79A-n257G CA_n79A-n257H CA_n79A-n257I	n1	15	Yes	Yes	Yes	Yes												0
			30		Yes	Yes	Yes												
			60		Yes	Yes	Yes												
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257	See CA_n257I in Table 5.5A.1-1 in TS 38.101-2																

5.3.3.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA_n1-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

5.3.3.4 REFSENS requirements

As mentioned in 5.3.3.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

5.3.4 CA_n77-n79-n257

5.3.4.1 Operating bands for CA

Table 5.3.4.1-1: 3DL Inter-band CA operating bands

NR CA Band	NR Band	Uplink (UL) operating band BS receive / UE transmit FUL_low – FUL_high			Downlink (DL) operating band BS transmit / UE receive FDL_low – FDL_high			Duplex Mode
CA_n77-n79-n257	n77	3300 MHz	–	4200 MHz	3300 MHz	–	4200 MHz	TDD
	n79	4400 MHz	–	5000 MHz	4200 MHz	–	5000 MHz	TDD
	n257	26500 MHz	–	29500 MHz	26500 MHz	–	29500 MHz	TDD

5.3.4.2 Channel bandwidths per operating band for CA

Table 5.3.4.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

NR CA config	UL config	NR Band	SCS (kHz)	5	10	15	20	25	30	40	50	60	70	80	90	100	200	400	Bandwidth combination set
CA_n77A-n79A-n257A	CA_n77A-n79A CA_n77A-n257A CA_n79A-n257A	n77	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257	60								Yes					Yes	Yes		
			120								Yes					Yes	Yes	Yes	
CA_n77A-n79A-n257G	CA_n77A-n79A CA_n77A-n257A CA_n77A-n257G CA_n79A-n257A CA_n79A-n257G	n77	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257		See CA_n257G in Table 5.5A.1-1 in TS 38.101-2															
CA_n77A-n79A-n257H	CA_n77A-n79A CA_n77A-n257A CA_n77A-n257G CA_n77A-n257H CA_n79A-n257A CA_n79A-n257G CA_n79A-n257H	n77	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257		See CA_n257H in Table 5.5A.1-1 in TS 38.101-2															
CA_n77A-n79A-n257I	CA_n77A-n79A CA_n77A-n257A CA_n77A-n257G CA_n77A-n257H CA_n77A-n257I CA_n79A-n257A CA_n79A-n257G CA_n79A-n257H CA_n79A-n257I	n77	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257		See CA_n257I in Table 5.5A.1-1 in TS 38.101-2															

5.3.4.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA_n77-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

5.3.4.4 REFSENS requirements

As mentioned in 5.3.4.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

5.3.5 CA_n78-n79-n257

5.3.5.1 Operating bands for CA

Table 5.3.5.1-1: 3DL Inter-band CA operating bands

NR CA Band	NR Band	Uplink (UL) operating band BS receive / UE transmit FUL_low – FUL_high			Downlink (DL) operating band BS transmit / UE receive FDL_low – FDL_high			Duplex Mode
CA_n78-n79-n257	n78	3300 MHz	–	3800 MHz	3300 MHz	–	3800 MHz	TDD
	n79	4400 MHz	–	5000 MHz	4200 MHz	–	5000 MHz	TDD
	n257	26500 MHz	–	29500 MHz	26500 MHz	–	29500 MHz	TDD

5.3.5.2 Channel bandwidths per operating band for CA

Table 5.3.5.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

NR CA config	UL config	NR Band	SCS (kHz)	5	10	15	20	25	30	40	50	60	70	80	90	100	200	400	Bandwidth combination set
CA_n78A-n79A-n257A	CA_n78A-n79A CA_n78A-n257A CA_n79A-n257A	n78	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257	60								Yes					Yes	Yes		
			120								Yes					Yes	Yes	Yes	
CA_n78A-n79A-n257G	CA_n78A-n79A CA_n78A-n257A CA_n78A-n257G CA_n79A-n257A CA_n79A-n257G	n78	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257		See CA_n257G in Table 5.5A.1-1 in TS 38.101-2															
CA_n78A-n79A-n257H	CA_n78A-n79A CA_n78A-n257A CA_n78A-n257G CA_n78A-n257H CA_n79A-n257A CA_n79A-n257G CA_n79A-n257H	n78	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257		See CA_n257H in Table 5.5A.1-1 in TS 38.101-2															
CA_n78A-n79A-n257I	CA_n78A-n79A CA_n78A-n257A CA_n78A-n257G CA_n78A-n257H CA_n78A-n257I CA_n79A-n257A CA_n79A-n257G CA_n79A-n257H CA_n79A-n257I	n78	15		Yes	Yes	Yes			Yes	Yes								0
			30		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
			60		Yes	Yes	Yes			Yes	Yes	Yes		Yes	Yes	Yes			
		n79	15							Yes	Yes								
			30							Yes	Yes	Yes		Yes		Yes			
			60							Yes	Yes	Yes		Yes		Yes			
		n257		See CA_n257I in Table 5.5A.1-1 in TS 38.101-2															

5.3.5.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA_n78-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

5.3.5.4 REFSENS requirements

As mentioned in 5.3.5.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

6 Dual Connectivity with 3 bands DL: Specific Band Combination Part

6.X DC_nX-nY-nZ

< Editor's note: The texts for NR DC can only be added associated with the texts for the corresponding inter-band 2 bands UL CA above, which means contribution only to add pure NR DC texts is not allowed.>

6.x.1 Configurations for DC_nX-nY-nZ

Table 6.x.2-1: Inter-band NR DC configurations

NR DC configuration	Uplink NR DC configuration
DC_nXA-nYA-nZA	DC_nXA-nYA DC_nXA-nZA ...

Annex A:
Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2020-08	RAN4#96-e	R4-2010791				TR skeleton	0.0.1
2020-08	RAN4#96-e	R4-2010793				The following approved TPs in RAN4 96-e meeting are included: 1. R4-2011677 TP to TR 38.717-03-02: CA_n5-n25-n66, Nokia, Bell Mobility 2. R4-2010531 TP to TR 38.717-03-02: CA_n5-n25-n78, Nokia, Bell Mobility 3. R4-2010644 TP for TR38.717-03-02_CA_n39A-n40A-n79A, ZTE Corporation 4. R4-2010645 TP for TR38.717-03-02_CA_n39A-n40A-n41A, ZTE Corporation 5. R4-2009690 TP for CA_n1-n77-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 6. R4-2009691 TP for CA_n1-n78-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 7. R4-2009692 TP for CA_n1-n79-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 8. R4-2009693 TP for CA_n77-n79-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 9. R4-2009694 TP for CA_n78-n79-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC.	0.1.0