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Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; NR inter-band Carrier Aggregation / Dual Connectivity; for DL 4 bands and 2 UL bands; (Release 17)





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Foreword

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 - 2 presented to TSG for approval;
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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 somethingshall 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 possiblecannot 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

6

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 Carrier Aggregation (CA) and/or Dual Connectivity (EN-DC) of 4DL NR bands and 2UL NR bands 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/or DC for the Rel-17 band combinations in Table 1-1.

This TR contains a 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"

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].

Definition format (Normal)

<defined term>: <definition>.

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

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

Symbol format (EW)

<symbol> <Explanation>

3.3 Abbreviations

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

Abbreviation format (EW)

<ABBREVIATION> <Expansion>

4 Background

The present document is a technical report for NR inter-band Carrier Aggregation (CA) and/or Dual Connectivity (EN-DC) of 4 NR bands and 2 NR bands 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.

4 DL bands inter-band Carrier Aggregation with 2 UL bands: Specific Band Combination Part

5.1 Inter-band CA within FR1

5.1.x CA_nA-nB-nC-nD

5.1.x.1 Operating bands for CA

Table 5.1.x.1-1: Inter-band CA operating bands of CA_nA-nB-nC-nD

NR CA Band	NR Band (Table 5.2-1 in TS38.101- 1[2])

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

Table 5.1.x.2-1: Supported bandwidths per CA_nA-nB-nC-nD

NR CA config uration	Uplink CA config uration	N R Ba nd	% C % & ™ ~	5 M H z	10 M H z	15 M H z	20 M H z	25 M H z	30 M H z	40 M H z	50 M H z	60 M H z	70 M H z	80 M H z	90 M H z	10 0 M H z	Maxi mum Aggre gated band width [MHz]	Band width combi nation set
		^	15															
		nA	30															
			60															
			15															
CA 20		nΒ	30															
CA_nA- nB-nC-	CA_nA-		60															
nD	пB		15															
טוו		nC	30															
			60															
			15															
		nD	30															
			60															

< Editor Note: Sub-clause 5.1.x3, 5.1.x.4 and 5.1.x.5 are optional, since the study of corresponding lower-order combination can be applied>

- 5.1.x.3 UE co-existence study
- 5.1.x.4 ΔT_{IB} and ΔR_{IB} values
- 5.1.x.5 REFSENS requirements

5.2 Inter-band CA including RF2

- 5.2.1 CA_n3-n28-n77-n257
- 5.2.1.1 Operating bands for CA

Table 5.2.1.1-1: Inter-band CA operating bands of CA_n3-n28-n77-n257

	NR Band
NR CA Band	(Table 5.2-1 in TS38.101-
	1[2] and TS38.101-2[3])
CA_n3-n28-n77-n257	n3, n28, n77, n257

5.2.1.2 Channel bandwidths per operating bands for CA

Table 5.2.x.2-1: Supported channel bandwidths per CA configuration for 4DL/2UL inter-band CA

NR CA Configuration	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_n3A-		. 0	15	Yes									0						
n28A-n77A- n257A		n3	30 60		Yes	Yes	Yes	Yes	Yes	Yes									

			15	Yes	Yes	Yes	Yes		Yes										
	CA_n3A-	n28	30		Yes	Yes	Yes		Yes										
	n257A		60																
	CA_n28A-		15		Yes	Yes	Yes	Yes	Yes	Yes	Yes								
	n257A	n77	30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
	CA_n77A-		60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
	n257A	n257	60								Yes					Yes	Yes		
		11237	120								Yes					Yes	Yes	Yes	
	CA_n3A-		15	Yes	Yes	Yes	Yes	Yes	Yes	Yes									
	n257A	n3	30		Yes	Yes	Yes	Yes	Yes	Yes									
	CA_n28A-		60		Yes	Yes	Yes	Yes	Yes	Yes									
	n257A		15	Yes	Yes	Yes	Yes		Yes										
CA n3A-	CA_n77A-	n28	30		Yes	Yes	Yes		Yes										
n28A-n77A-	n257A		60																0
n257G	CA_n3A-		15		Yes	Yes	Yes	Yes	Yes	Yes	Yes								
	n257G	n77	30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
	CA_n28A- n257G		60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
	CA_n77A-	0.57					See	e CA_n	257G E	BCS0 ir	n Table	5.5A.1	-1 in T	S 38.10	1-2				
	n257G	n257																	
	CA_n3A-		15	Yes	Yes	Yes	Yes	Yes	Yes	Yes									
	n257A	n3	30	100	Yes	Yes	Yes	Yes	Yes	Yes									
	CA n28A-	110	60		Yes	Yes	Yes	Yes	Yes	Yes									
	n257A		15	Yes	Yes	Yes	Yes	100	Yes	100									
	CA_n77A-	n28	30	100	Yes	Yes	Yes		Yes										
	n257A	1120	60		103	103	103		103										
	CA_n3A-		15		Yes	Yes	Yes	Yes	Yes	Yes	Yes								
CA_n3A-	n257G	n77	30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
n28A-n77A-	CA_n28A-	1177	60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			0
n257H	n257G		- 00		103	103			257H E							103			U
1123711	CA_n77A-						000	0/_	207111		i i abic	0.071.1		5 00.10	, , <u>, , , , , , , , , , , , , , , , , </u>				
	n257G																		
	CA_n3A-																		
	n257H	n257																	
	CA_n28A-																		
	n257H																		
	CA_n77A- n257H																		
	CA_n3A-		15	Yes	Yes	Yes	Yes	Yes	Yes	Yes			l					1	
	n257A	n3	30	165	Yes	Yes	Yes	Yes	Yes	Yes									
	CA_n28A-	113	60		Yes	Yes	Yes	Yes	Yes	Yes									
	n257A		15	Yes	Yes	Yes	Yes	165	Yes	163									
	CA_n77A-	n28	30	165	Yes	Yes	Yes		Yes										
	n257A	1120	60		165	165	165		165										
	CA_n3A-		15		Yes	Voc	Yes	Yes	Yes	Yes	Yes								
	n257G	n77	30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Voc	Yes	Voc	Yes			
	CA_n28A-	117 7	60		Yes	Yes Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes Yes	Yes	Yes Yes	Yes			
	n257G		60		165	165	_									165			
CA_n3A-	CA_n77A-						Se	e CA_I	1257I B	C30 III	rabie	5.5A. I	. 1 111 13	36.10	1-2				
n28A-n77A-	n257G																		0
n257l	CA_n3A-																		U
112371	n257H																		
	CA_n28A-																		
	n257H																		
			1	i															
	CA_n77A-	n257																	
	n257H	n257																	
	n257H CA_n3A-	n257																	
	n257H CA_n3A- n257I	n257																	
	n257H CA_n3A- n257I CA_n28A-	n257																	
	n257H CA_n3A- n257I CA_n28A- n257I	n257																	
	n257H CA_n3A- n257I CA_n28A-	n257																	

5.2.1.3 UE co-existence studies

The coexistence studies have been captured into the constituent fallback modes in TR 38.716-03-02, there is no additional harmonic and intermodulation impact for the additional band receiver.

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

The $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ could reuse the values for CA_n3-n28-n77-n257 with 1UL that have been captured into TR38.716-04-01.

5.2.1.5 REFSENS requirements

There is no need to specify additional MSD requirement for this UL CA configuration.

5.2.2 CA_n3-n28-n78-n257

5.2.2.1 Operating bands for CA

Table 5.2.2.1-1: Inter-band CA operating bands of CA_n3-n28-n78-n257

NR CA Band	NR Band (Table 5.2-1 in TS38.101- 1[2] and TS38.101-2[3])
CA_n3-n28-n78-n257	n3, n28, n78, n257

5.2.2.2 Channel bandwidths per operating bands for CA

Table 5.2.2.2-1: Supported channel bandwidths per CA configuration for 4DL/2UL inter-band CA

R CA guration	UL Config	NR Band	SCS [kHz]	5	10	15	20	25	30	40	50	60	70	80	90	100	200	400	Bandy combines
			15	Yes	Yes	Yes	Yes	Yes	Yes	Yes									
		n3	30		Yes	Yes	Yes	Yes	Yes	Yes									
	CA_n3A-		60		Yes	Yes	Yes	Yes	Yes	Yes									•
_	n257A		15	Yes	Yes	Yes	Yes		Yes										•
_n3A-	CA_n28A-	n28	30		Yes	Yes	Yes		Yes										C
N-n78A-	n257A		60																
257A	CA_n78A-		15		Yes	Yes	Yes	Yes	Yes	Yes	Yes								
	n257A	n78	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			
		n257	60								Yes					Yes	Yes		
		11257	120								Yes					Yes	Yes	Yes	
	CA_n3A-		15	Yes	Yes	Yes	Yes	Yes	Yes	Yes									
	n257A	n3	30		Yes	Yes	Yes	Yes	Yes	Yes									
	CA_n28A-		60		Yes	Yes	Yes	Yes	Yes	Yes									
	n257A		15	Yes	Yes	Yes	Yes		Yes										
n3A-	CA_n78A-	n28	30		Yes	Yes	Yes		Yes										
 \-n78A-	n257A		60																0
257G	CA_n3A- n257G		15		Yes	Yes	Yes	Yes	Yes	Yes	Yes								
	CA_n28A-	n78	30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
	n257G		60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
	CA_n78A- n257G	n257				;	See CA	_n2570	G BCS	0 in Tal	ole 5.5 <i>F</i>	4.1-1 ir	1 TS 38	.101-2					
	CA_n3A-		15	Yes	Yes	Yes	Yes	Yes	Yes	Yes									
	n257A	n3	30		Yes	Yes	Yes	Yes	Yes	Yes									
	CA_n28A-		60		Yes	Yes	Yes	Yes	Yes	Yes									
	n257A		15	Yes	Yes	Yes	Yes		Yes										
	CA_n78A-	n28	30		Yes	Yes	Yes		Yes										
	n257A		60																
	CA_n3A-		15		Yes	Yes	Yes	Yes	Yes	Yes	Yes								
_n3A-	n257G CA_n28A-	n78	30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
\-n78A-	n257G		60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			0
257H	CA_n78A- n257G CA_n3A- n257H CA_n28A- n257H CA_n78A- n257H	n257				•	See CA	_n257l	H BCS) in Tal	ole 5.5 <i>f</i>	A.1-1 in	i TS 38	.101-2				Yes	
			15	Yes	Yes	Yes	Yes	Yes	Yes	Yes									
_n3A-	CA_n3A-	n3	30		Yes	Yes	Yes	Yes	Yes	Yes									1
- \-n78A-	n257A		60		Yes	Yes	Yes	Yes	Yes	Yes									0
0.571	——— CA_n28A-		4.5	\ /		1/	1/		1/										1

Yes

Yes

Yes

Yes

15

n257A

CA_n78A-		60														
n257A		15	Yes	Yes	Yes	Yes	Yes	Yes	Yes							
CA_n3A-	n78	30	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
n257G		60	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
CA_n28A-			•		See CA	n257	I BCS0	in Tab	le 5.5A	.1-1 in	TS 38.	101-2	•			
n257G						_										
CA_n78A-																
n257G																
CA_n3A-																
n257H																
CA_n28A-																
n257H	.057															
CA_n78A-	n257															
n257H																
CA_n3A-																
n257l																
CA_n28A-																
n257l																
CA_n78A-																
n257l																

5.2.2.3 UE co-existence studies

The coexistence studies have been captured into the constituent fallback modes in TR 38.716-03-02, there is no additional harmonic and intermodulation impact for the additional band receiver.

5.2.2.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

The $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ could reuse the values for CA_n3-n28-n78-n257 with 1UL that have been captured into TR38.716-04-01.

5.2.2.5 REFSENS requirements

There is no need to specify additional MSD requirement for this UL CA configuration.

5.2.x CA_nA-nB-nC-nD

5.2.x.1 Operating bands for CA

Table 5.2.x.1-1: Inter-band CA operating bands of CA_nA-nB-nC-nD

NR CA Band	NR Band (Table 5.2-1 in TS38.101- 1[2] and TS38.101-2[3])

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

Table 5.2.x.2-1: Supported bandwidths per CA_nA-nB-nC-nD

NR CA config uration	Uplink NR CA config uration	N R Ba nd	თ ∪ თ & <u>ਸ਼</u> ←	5 M H z	1 0 M H z	1 5 M H z	2 0 M H z	2 5 M H z	3 0 M H z	40 MH z	50 MH z	60 MH z	70 MH z	8 0 M H z	9 0 M H z	1 0 0 M H z	2 0 0 M H z	4 0 0 M H z	B C S
CA nA			15																
CA_nA -nB-	CA_nA -nB	nA	30																
nC-nD			60																

		15								
	nB	30								
		60								
		15								
	nC	30								
		60								
		60								
nD	12									
		0								

< Editor Note: Sub-clause 5.2.x3, 5.2.x.4 and 5.2.x.5 are optional, since the study of corresponding lower-order combination can be applied>

- 5.2.x.3 UE co-existence study
- 5.2.x.4 ΔT_{IB} and ΔR_{IB} values
- 5.2.x.5 REFSENS requirements

4 DL bands Dual Connectivity with 2 UL bands: Specific Band Combination Part

- 6.1 DC within FR1
- 6.1.x DC_nA-nB-nC-nD
- 6.1.x.1 Operating bands for DC

Table 6.1.x.1-1: Inter-band DC operating bands of DC_nA-nB-nC-nD

NR DC Band	NR Band (Table 5.2-1 in TS38.101- 1[2])

6.1.x.2 Configuration for DC

Table 6.1.x.2-1: Inter-band DC configuration of DC_nA-nB-nC-nD

Downlink NR DC configuration	Uplink NR DC configuration

6.2 DC including RF2

6.2.1 DC_n3-n28-n77-n257

6.2.1.1 Operating bands for DC

Table 6.2.1.1-1: Inter-band DC operating bands of DC_n3-n28-n77-n257

NR DC Band	NR Band (Table 5.2-1 in TS38.101- 1[2] and TS38.101-2[3])
DC_n3-n28-n77-n257	n3, n28, n77, n257

6.2.1.2 Configurations for DC

Table 6.2.1.2-1: Inter-band DC configuration of DC_n3-n28-n77-n257

Downlink NR DC configuration	Uplink NR DC configuration
	DC_n3A-n257A
DC_n3A-n28A-n77A-n257A	DC_n28A-n257A
	DC_n77A-n257A
	DC_n3A-n257A
	DC_n28A-n257A
DC_n3A-n28A-n77A-n257G	DC_n77A-n257A
	DC_n3A-n257G
	DC_n28A-n257G
	DC_n77A-n257G
	DC_n3A-n257A
	DC_n28A-n257A
	DC_n77A-n257A
	DC_n3A-n257G
DC_n3A-n28A-n77A-n257H	DC_n28A-n257G
	DC_n77A-n257G
	DC_n3A-n257H
	DC_n28A-n257H
	DC_n77A-n257H
DC_n3A-n28A-n77A-n257I	

Downlink NR DC configuration	Uplink NR DC configuration
	DC_n3A-n257A
	DC_n28A-n257A
	DC_n77A-n257A
	DC_n3A-n257G
	DC_n28A-n257G
	DC_n77A-n257G
	DC_n3A-n257H
	DC_n28A-n257H
	DC_n77A-n257H
	DC_n3A-n257I
	DC_n28A-n257I
	DC_n77A-n257I
NOTE 1: NR configuration for FR1 and FR [3] respectively.	2 are defined in TS 38.101-1 [2] and TS 38.101-2

6.2.2 DC_n3-n28-n78-n257

6.2.2.1 Operating bands for DC

Table 6.2.2.1-1: Inter-band DC operating bands of DC_n3-n28-n78-n257

NR DC Band	NR Band (Table 5.2-1 in TS38.101- 1[2] and TS38.101-2[3])
DC_n3-n28-n78-n257	n3, n28, n78, n257

6.2.2.2 Configurations for DC_n3-n28-n78-n257

Table 6.2.2.2-1: Inter-band DC configuration of DC_n3-n28-n78-n257

Downlink NR DC configuration	Uplink NR DC configuration
	DC_n3A-n257A
DC_n3A-n28A-n78A-n257A	DC_n28A-n257A
	DC_n78A-n257A
	DC_n3A-n257A
	DC_n28A-n257A
DC n2A n20A n70A n257C	DC_n78A-n257A
DC_n3A-n28A-n78A-n257G	DC_n3A-n257G
	DC_n28A-n257G
	DC_n78A-n257G
	DC_n3A-n257A
	DC_n28A-n257A
	DC_n78A-n257A
DC_n3A-n28A-n78A-n257H	DC_n3A-n257G
	DC_n28A-n257G
	DC_n78A-n257G
	DC_n3A-n257H

DC_n28A-n257H
DC_n78A-n257H
DC_n3A-n257A
DC_n28A-n257A
DC_n78A-n257A
DC_n3A-n257G
DC_n28A-n257G
DC_n78A-n257G
DC_n3A-n257H
DC_n28A-n257H
DC_n78A-n257H
DC_n3A-n257I
DC_n28A-n257I
DC_n78A-n257I
1

[3] respectively.

6.2.x DC_nA-nB-nC-nD

Operating bands for DC 6.2.x.1

Table 6.1.x.1-1: Inter-band DC operating bands of DC_nA-nB-nC-nD

NR DC Band	NR Band (Table 5.2-1 in TS38.101- 1[2] and TS38.101-2[3])

Configuration for DC 6.2.x.2

Table 6.2.x.2-1: Inter-band DC configuration of DC_nA-nB-nC-nD

Downlink NR DC	Uplink NR DC	
configuration	configuration	

Annex A (informative): Change history

	Change history						
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2020-08	RAN4#96 e	R4-2010222				Initial TR skeleton	0.0.1
2020-08	RAN4#96 e	R4-2011891				Updated TR to incorporate below TP approved in RAN4#96e with editorial update: R4-2010255 TP for TR 38.717-04-02 CA_n3-n28-n77-n257 and DC_n3-n28-n77-n257 R4-2010256 TP for TR 38.717-04-02 CA_n3-n28-n78-n257 and DC_n3-n28-n78-n257	0.1.0