

# Appendix D LTE Carrier Aggregation

## D.1 LTE Downlink Carrier Aggregation configurations

1. DL Inter Band(2CC)

E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Bandwidth					Max Aggregated BW
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	
2A-4A	(0)	Band 2	Yes	Yes	Yes	Yes	Yes	40
		Band 4			Yes	Yes	Yes	
		Band 2			Yes	Yes		
	(1)	Band 4			Yes	Yes		20
		Band 2			Yes	Yes	Yes	
		Band 4			Yes	Yes	Yes	
(2)	Band 2			Yes	Yes	Yes	40	
	Band 4			Yes	Yes	Yes		
2A-5A	(0)	Band 2			Yes	Yes	Yes	30
		Band 5			Yes	Yes		
2A-12A	(0)	Band 2			Yes	Yes	Yes	30
		Band 12			Yes	Yes		
		Band 2			Yes	Yes	Yes	
	(1)	Band 12		Yes				30
		Band 2			Yes	Yes		
		Band 2			Yes	Yes		
(2)	Band 12			Yes	Yes		20	
	Band 2			Yes	Yes			
2A-13A	(0)	Band 2			Yes	Yes	Yes	30
		Band 13			Yes	Yes		
		Band 2			Yes	Yes		
	(1)	Band 13			Yes	Yes		20
		Band 2			Yes	Yes	Yes	
		Band 13			Yes	Yes		
(2)	Band 2			Yes	Yes	Yes	20	
	Band 13			Yes	Yes			
2A-17A	(0)	Band 2			Yes	Yes		20
		Band 17			Yes	Yes		
2A-66A	(0)	Band 2	Yes	Yes	Yes	Yes	Yes	40
		Band 66			Yes	Yes	Yes	
		Band 2			Yes	Yes		
	(1)	Band 66			Yes	Yes		20
		Band 2			Yes	Yes	Yes	
		Band 66			Yes	Yes	Yes	
(2)	Band 66			Yes	Yes	Yes	40	
	Band 2			Yes	Yes			
4A-5A	(0)	Band 4			Yes	Yes		20
		Band 5			Yes	Yes		
		Band 4			Yes	Yes	Yes	
(1)	Band 5			Yes	Yes		30	
	Band 4			Yes	Yes	Yes		
4A-13A	(0)	Band 4			Yes	Yes	Yes	30
		Band 13			Yes	Yes		
	(1)	Band 4			Yes	Yes		20
		Band 13			Yes	Yes		
4A-17A	(0)	Band 4			Yes	Yes		20
		Band 17			Yes	Yes		
5A-41A	(0)	Band 5			Yes	Yes		30
		Band 41					Yes	
5A-66A	(0)	Band 5			Yes	Yes		30
		Band 66			Yes	Yes	Yes	
12A-66A	(0)	Band 12			Yes	Yes		20
		Band 66	Yes	Yes	Yes	Yes		
		Band 12			Yes	Yes		
	(1)	Band 66	Yes	Yes	Yes	Yes	Yes	30
		Band 12			Yes	Yes		
		Band 66	Yes	Yes	Yes	Yes	Yes	
	(2)	Band 12			Yes	Yes		30
		Band 66			Yes	Yes	Yes	
	(3)	Band 12			Yes	Yes		20
		Band 66			Yes	Yes		
	(4)	Band 12			Yes	Yes		30
		Band 66			Yes	Yes	Yes	
(5)	Band 12			Yes	Yes		20	
	Band 66			Yes	Yes	Yes		
26A-41A	(0)	Band 26			Yes	Yes	Yes	
		Band 41			Yes	Yes	Yes	35

2. DL Inter Band(3CC)

E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Bandwidth					Max Aggregated BW
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	
2A-4A-5A	(0)	Band 2			Yes	Yes	Yes	Yes
		Band 4			Yes	Yes	Yes	Yes
		Band 5			Yes	Yes		
2A-4A-13A	(0)	Band 2			Yes	Yes	Yes	Yes
		Band 4			Yes	Yes	Yes	Yes
		Band 13			Yes	Yes		
2A-5A-66A	(0)	Band 2			Yes	Yes	Yes	Yes
		Band 5			Yes	Yes		
		Band 66			Yes	Yes	Yes	Yes
4A-4A-12A	(0)	Band 4			4A-4A BCS 0			
		Band 12			Yes	Yes		
5A-66A-66A	(0)	Band 5			Yes	Yes		
		Band 66			66A-66A BCS 0			
12A-66A-66A	(0)	Band 12			Yes	Yes		
		Band 66			66A-66A BCS 0			
26A-41C	(0)	Band 26			Yes	Yes	Yes	
		Band 41			41C BCS 1			

3. DL Intra Band(non-contiguous)

E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Allowed Channel BW Per Carrier (MHz)				Max Aggregated BW
			1st Carrier	2nd Carrier	3rd Carrier	4th Carrier	
2A-2A	(0)	Band 2	5, 10, 15, 20	5, 10, 15, 20			40
4A-4A	(0)	Band 4	5, 10, 15, 20	5, 10, 15, 20			40
	(1)	Band 4	5, 10	5, 10			20
41A-41A	(0)	Band 41	10, 15, 20	10, 15, 20			40
	(1)	Band 41	5, 10, 15, 20	5, 10, 15, 20			40
41A-41C	(0)	Band 41	41C BCS 1	41C BCS 1			60
			5, 10, 15, 20	5, 10, 15, 20			
41A-41D	(0)	Band 41	41D BCS 0	41D BCS 0			80
			5, 10, 15, 20	5, 10, 15, 20			
41C-41C	(0)	Band 41	41C BCS 0	41C BCS 0			40
66A-66A	(0)	Band 66	5, 10, 15, 20	5, 10, 15, 20			40

4. DL Intra Band(contiguous)

E-UTRA CA configuration	Bandwidth Combination Set	E-UTRA Band	Allowed Channel BW Per Carrier (MHz)					Max Aggregated BW
			1st Carrier	2nd Carrier	3rd Carrier	4th Carrier	5th Carrier	
2C	(0)	Band 2	5	20				40
			10	15,20				
			15	10,15,20				
			20	5,10,15,20				
66B	(0)	Band 66	5	5, 10, 15				20
			10	5, 10				
			15	5				
66C	(0)	Band 66	5	20				40
			10	15,20				
			15	10,15,20				
			20	5,10,15,20				
			10	20				
41C	(0)	Band 41	15	15, 20				40
			20	5, 10, 15, 20				
			10	15, 20				
			20	10, 15, 20				
	(1)	Band 41	5, 10	20				40
			15	15, 20				
			20	5, 10, 15, 20				
			10	15, 20				
(2)	Band 41	15	10, 15, 20				40	
		20	10, 15, 20					
		10	20					
		20	20					
41E	(0)	Band 41	15, 20	15, 20	15, 20	20		80
			20	20				

## D.2 LTE Downlink Carrier Aggregation Combinations

The DL CA power measurement conditions for various CC's combinations were determined according LTE DL CA SAR Test Exclusion guidance in TCB workshop note (April 2018). Only yellow highlighted cells need power measurement. The following power measurements were performed with a single carrier uplink; CA for this particular project only supports one (1) uplink and up to four (5) downlinks.

### LTE Release 10 Carrier Aggregation

Index	2CC	Restriction	Completely Covered by Measurement Superset
2CC#1	2A-2A		
2CC#2	2C		
2CC#3	2A-4A		3CC#2
2CC#4	2A-5A		3CC#3
2CC#5	2A-12A		
2CC#6	2A-13A		3CC#2
2CC#7	2A-66A		3CC#3
2CC#8	4A-4A		3CC#4
2CC#9	4A-5A		
2CC#10	4A-12A		3CC#4
2CC#11	4A-13A		
2CC#12	5A-41A	41A SCC only	
2CC#13	5A-66A		3CC#5
2CC#14	12A-66A		3CC#6
2CC#15	26A-41A	41A SCC only	
2CC#16	41A-41A		
2CC#17	41C		3CC#7
2CC#18	66A-66A		3CC#6
2CC#19	66B		
2CC#20	66C		

Index	3CC	Restriction	Completely Covered by Measurement Superset
3CC#1	2A-4A-5A		
3CC#2	2A-4A-13A		
3CC#3	2A-5A-66A		
3CC#4	4A-4A-12A		
3CC#5	5A-66A-66A		
3CC#6	12A-66A-66A		
3CC#7	26A-41C	41C SCC only	
3CC#8	41A-41C		
3CC#9	41D		4CC#1

Index	4CC	Restriction	Completely Covered by Measurement Superset
4CC#1	41A-41D		
4CC#2	41C-41C		
4CC#3	41E		

#### Note:

Only yellow highlight cells need power measurement according to LTE DL CA SAR test Exclusion in TCB workshop (April.2018).

### LTE Release 10 Carrier Aggregation with 4x4 MIMO

Index	2CC	Restriction	Completely Covered by Measurement Superset	Index	3CC	Restriction	Completely Covered by Measurement Superset	Index	4CC	Restriction	Completely Covered by Measurement Superset
2CC#1	2A-[4A]		3CC#1	3CC#1	2A-[4A]-5A			4CC#1	[41A]-41D		
2CC#2	2A-[66A]		3CC#3	3CC#2	2A-[4A]-13A			4CC#2	[41C]-41C		
2CC#3	[4A]-4A		3CC#4	3CC#3	2A-5A-[66A]						
2CC#4	[4A]-[4A]		3CC#5	3CC#4	[4A]-4A-12A						
2CC#5	[4A]-5A		3CC#1	3CC#5	[4A]-[4A]-12A						
2CC#6	[4A]-12A		3CC#4	3CC#6	5A-[66A]-66A						
2CC#7	[4A]-13A		3CC#2	3CC#7	5A-[66A]-[66A]						
2CC#8	5A-[41A]			3CC#8	12A-[66A]-66A						
2CC#9	5A-[66A]		3CC#7	3CC#9	12A-[66A]-[66A]						
2CC#10	12A-[66A]		3CC#8	3CC#10	26A-[41C]	41A SCC only					
2CC#11	26A-[41A]	41A SCC only		3CC#11	[41A]-41C						
2CC#12	[41A]-41A			3CC#12	41A-[41C]						
2CC#13	[41A]-[41A]			3CC#13	[41A]-[41C]						
2CC#14	[41C]		3CC#12	3CC#14	[41D]		4CC#1				
2CC#15	[66A]-66A		3CC#8								
2CC#16	[66A]-[66A]		3CC#9								
2CC#17	[66B]										
2CC#18	[66C]										

**Note:**

Only yellow highlight cells need power measurement according to LTE DL CA SAR test Exclusion in TCB workshop (April.2018).

### Single Carrier Downlink 4x4 MIMO output power results

LTE Bands	Modulation	BW (MHz)	Channel	Freq. (MHz)	RB/Offset	LTE Rel 8 Tx. Power [dBm]	DL 4x4 MIMO Tx. Power [dBm]	Delta
4	QPSK	20	20175	1732.5	1/49	23.6	23.5	-0.09
41	QPSK	20	40620	2593	1/0	24.6	24.5	-0.10
66	QPSK	20	132322	1745	1/99	24.0	24.0	-0.04

**Note:**

According to LTE Test Conditions in TCB workshop (May, 2017), SAR is excluded for LTE downlink 4x4 MIMO operation when uplink output with DL MIMO does not exceed highest uplink output power configuration without DL MIMO by more than 1/4 dB. And for DL MIMO with carrier aggregation, the same SAR test exclusion procedure is considered.

### D.3 DL CA output power results

E-UTRA CA configuration (BCS)	Bands				UL										DL									LTE Rel 8 Tx. Power [dBm]	LTE Rel 10 Tx. Power [dBm]	Delta
	PCC	SCC1	SCC2	SCC3	PCC										SCC1			SCC2			SCC3					
	1st	2nd	3rd	4th	Mode	BW (MHz)	Channel	Freq. (MHz)	RB location	RB Offset	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)	BW (MHz)	Channel	Freq. (MHz)				
2A-2A	2A	2A			QPSK	20	18700	1860	1	99	20	700	1940	20	1100	1980								24.47	24.42	-0.05
2C	2C	2C			QPSK	20	18700	1860	1	99	20	700	1940	20	898	1959.8								24.47	24.35	-0.12
2A-12A	2A	12A			QPSK	20	18700	1860	1	99	20	700	1940	10	5095	737.5								24.47	24.37	-0.1
	12A	2A			QPSK	10	23095	707.5	1	0	10	5095	737.5	20	900	1960								23.9	23.75	-0.15
4A-5A	4A	5A			QPSK	20	20175	1732.5	1	49	20	2175	2132.5	10	2525	881.5								23.6	23.59	-0.01
	5A	4A			QPSK	10	20525	836.5	1	0	10	2525	836.5	20	2175	2132.5								23.99	23.92	-0.07
4A-13A	4A	13A			QPSK	20	20175	1732.5	1	49	20	2175	2132.5	10	5230	751								23.6	23.59	-0.01
	13A	4A			QPSK	10	23230	782	1	0	10	5230	751	20	2175	2132.5								23.79	23.74	-0.05
5A-41A	5A	41A			QPSK	10	20525	836.5	1	0	10	2525	836.5	20	40620	2593								23.99	23.96	-0.03
26A-41A	26A	41A			QPSK	15	26885	831.5	1	0	15	8865	876.5	20	40620	2593								23.87	23.72	-0.15
41A-41A	41A	41A			QPSK	20	40620	2593	1	0	20	40620	2593	20	41490	2680								24.63	24.62	-0.01
66B	66B	66B			QPSK	10	132322	1745	1	0	10	66786	2145	10	66885	2154.9								23.72	23.59	-0.13
66C	66C	66C			QPSK	20	132322	1745	1	99	20	66786	2145	20	66984	2164.8								24.02	24.01	-0.01
2A-4A-5A	2A	4A	5A		QPSK	20	18700	1860	1	99	20	700	1940	20	2175	2132.5	10	2525	881.5					24.47	24.36	-0.11
	4A	2A	5A		QPSK	20	20175	1732.5	1	49	20	2175	2132.5	20	900	1960	10	2525	881.5					23.6	23.56	-0.04
	5A	2A	4A		QPSK	10	20525	836.5	1	0	10	2525	836.5	20	900	1960	20	2175	2132.5					23.99	23.84	-0.15
2A-4A-13A	2A	4A	13A		QPSK	20	18700	1860	1	99	20	700	1940	20	2175	2132.5	10	5230	751					24.47	24.36	-0.11
	4A	2A	13A		QPSK	20	20175	1732.5	1	49	20	2175	2132.5	20	900	1960	10	5230	751					23.6	23.45	-0.15
	13A	2A	4A		QPSK	10	23230	782	1	0	10	5230	751	20	900	1960	20	2175	2132.5					23.79	23.71	-0.08
2A-5A-66A	2A	5A	66A		QPSK	20	18700	1860	1	99	20	700	1940	10	2525	881.5	20	66786	2145					24.47	24.34	-0.13
	5A	2A	66A		QPSK	10	20525	836.5	1	0	10	2525	836.5	20	900	1960	20	66786	2145					23.99	23.92	-0.07
	66A	2A	5A		QPSK	20	132322	1745	1	99	20	66786	2145	20	900	1960	10	2525	881.5					24.02	23.91	-0.11
4A-4A-12A	4A	4A	12A		QPSK	20	20175	1732.5	1	49	20	2175	2132.5	10	2005	2115.5	10	5095	737.5					23.6	23.57	-0.03
	12A	4A	4A		QPSK	10	23095	707.5	1	0	10	5095	737.5	20	2050	2120	20	2300	2145					23.9	23.81	-0.09
5A-66A-66A	5A	66A	66A		QPSK	10	20525	836.5	1	0	10	2525	836.5	20	66536	2120	20	67036	2170					23.99	23.84	-0.15
	66A	66A	5A		QPSK	20	132322	1745	1	99	20	66786	2145	20	67036	2170	10	2525	881.5					24.02	24	-0.02
	12A	66A	66A		QPSK	10	23095	707.5	1	0	10	5095	737.5	20	66536	2120	20	67036	2170					23.9	23.77	-0.13
	66A	66A	12A		QPSK	20	132322	1745	1	99	20	66786	2145	20	67036	2170	10	5095	737.5					24.02	23.95	-0.07
26A-41C	26A	41C	41C		QPSK	15	26865	831.5	1	0	15	8865	876.5	20	39750	2506	20	41490	2680					23.87	23.85	-0.02
	41A	41C	41C		QPSK	20	40620	2593	1	0	20	40620	2593	20	41490	2680	20	41292	2660.2					24.63	24.63	0
41A-41C	41C	41C	41A		QPSK	20	40620	2593	1	0	20	40620	2593	20	40422	2573.2	20	39750	2506					24.63	24.6	-0.03
	41A	41D	41D	41D	QPSK	20	40620	2593	1	0	20	40620	2593	20	39750	2506	20	39948	2525.8					24.63	24.59	-0.04
	41D	41D	41D	41A	QPSK	20	40620	2593	1	0	20	40620	2593	20	40422	2573.2	20	40818	2612.8					24.63	24.55	-0.08
41C-41C	41C	41C	41C	41C	QPSK	20	40620	2593	1	0	20	40620	2593	20	40422	2573.2	20	41490	2680					24.63	24.61	-0.02
41E	41E	41E	41E	41E	QPSK	20	40620	2593	1	0	20	40620	2593	20	40422	2573.2	20	40818	2612.8					24.63	24.54	-0.09

**Note:**

1. Per KDB 941225 D05A LTE Rel. 10 KDB Inquiry Sheet: SAR is excluded for Carrier Aggregation when measured power does not exceed LTE Release 8 by more than a 1/4 dB.
2. When the same frequency band is used for both contiguous and non-contiguous in DL CA Intra band, power was measured using the configuration with the largest aggregated bandwidth and maximum output power among the contiguous and non-contiguous in DL CA Intra band configurations.

