

APPENDIX I: LTE DOWNLINK ONLY CARRIER AGGREGATION TEST REDUCTION METHODOLOGY

SAR test exclusion for LTE downlink Carrier Aggregation is determined by power measurements according to the number of component carriers (CCs) supported by the product implementation. Per April 2018 TCBC Workshop Notes, the following test reduction methodology was applied to determine the combinations required for conducted power measurements.

LTE DLCA Test Reduction Methodology:

- The supported combinations were arranged by the number of component carriers in columns.
- Any limitations on the PCC or SCC for each combination were identified alongside the combination (e.g. CA_2A-2A-4A-12A, but B12 can only be configured as a SCC).
- Power measurements were performed for "supersets" (LTE CA combinations with multiple components carriers) and any "subsets" (LTE CA combinations with fewer component carriers) that were not completely covered by the supersets.
- Only subsets that have the exact same components as a superset were excluded for measurement.
- When there were certain restrictions on component carriers that existed in the superset that were not applied for the subset, the subset configuration was additionally evaluated.
- Both inter-band and intra-band downlink carrier aggregation scenarios were considered.
- Downlink CA combinations for SISO and 4x4 Downlink MIMO operations were measured independently, per May 2017 TCBC Workshop notes.

Table I-1 – Example of Exclusion Table for SISO Configurations

Index	BCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset	Index	BCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset	Index	BCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset
		CC1	CC2	CC3	CC4					CC1	CC2	CC3	CC4					CC1	CC2	CC3	CC4		
CC#1	CA_12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#1	CA_12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#1	CA_12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#1		
CC#2	CA_2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#2	CA_2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#2	CA_2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#2		
CC#3	CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#3	CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#3	CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#3		
CC#4	CA_2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#4	CA_2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#4	CA_2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#4		
CC#5	CA_2A-4A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#5	CA_2A-4A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#5	CA_2A-4A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#5		
CC#6	CA_2A-4A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#6	CA_2A-4A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#6	CA_2A-4A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#6		
CC#7	CA_2A-4A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#7	CA_2A-4A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#7	CA_2A-4A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#7		
CC#8	CA_2A-4A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#8	CA_2A-4A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#8	CA_2A-4A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#8		
CC#9	CA_2A-4A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#9	CA_2A-4A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#9	CA_2A-4A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#9		
CC#10	CA_2A-4A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#10	CA_2A-4A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#10	CA_2A-4A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#10		

Table I-2 – Example of Exclusion Table for 4x4 Downlink MIMO Configurations

Index	BCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset	Index	BCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset	Index	BCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset
		CC1	CC2	CC3	CC4					CC1	CC2	CC3	CC4					CC1	CC2	CC3	CC4		
CC#M1	CA_12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M1	CA_12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M1	CA_12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M1		
CC#M2	CA_2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M2	CA_2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M2	CA_2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M2		
CC#M3	CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M3	CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M3	CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M3		
CC#M4	CA_2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M4	CA_2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M4	CA_2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M4		
CC#M5	CA_2A-4A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M5	CA_2A-4A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M5	CA_2A-4A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M5		
CC#M6	CA_2A-4A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M6	CA_2A-4A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M6	CA_2A-4A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M6		
CC#M7	CA_2A-4A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M7	CA_2A-4A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M7	CA_2A-4A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M7		
CC#M8	CA_2A-4A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M8	CA_2A-4A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M8	CA_2A-4A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M8		
CC#M9	CA_2A-4A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M9	CA_2A-4A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M9	CA_2A-4A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M9		
CC#M10	CA_2A-4A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M10	CA_2A-4A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M10	CA_2A-4A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M10		
CC#M11	CA_2A-4A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M11	CA_2A-4A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M11	CA_2A-4A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M11		
CC#M12	CA_2A-4A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M12	CA_2A-4A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M12	CA_2A-4A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		CC#M12		

Note: [CC] indicates component carrier with 4x4 DL MIMO antenna configuration

I.1 LTE Downlink Only Carrier Aggregation Test Selection and Setup

SAR test exclusion for LTE downlink Carrier Aggregation is determined by power measurements according to the number component carriers (CCs) supported by the product implementation. For those configurations required by April 2018 TCBC Workshop Notes, conducted power measurements with LTE Carrier Aggregation (CA) (downlink

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only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink carrier aggregation is inactive on the PCC. Additional conducted output powers are measured with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation active measured among the channel bandwidth, modulation, and RB combinations in each frequency band.

Per FCC KDB Publication 941225 D05Av01r02, no SAR measurements are required for carrier aggregation configurations when the maximum average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive. All bands required for SAR testing per FCC KDB procedures were considered. Based on the measured maximum powers below, no additional SAR tests were required for DLCA SAR configurations.

General PCC and SCC configuration selection procedure

- PCC uplink channel, channel bandwidth, modulation and RB configurations were selected based on section C)3)b)ii) of KDB 941225 D05 V01r02. All LTE bandwidth conducted powers needed for PCC uplink configuration selection can be found in the RF Conducted Powers Section and LTE/NR Lower Bandwidth RF Conducted Power Appendix. The downlink PCC channel was paired with the selected PCC uplink channel according to normal configurations without carrier aggregation.
- To maximize aggregated bandwidth, highest channel bandwidth available for that CA combination was selected for SCC. For inter-band CA, the SCC downlink channels were selected near the middle of their transmission bands. For contiguous intra-band CA, the downlink channel spacing between the component carriers was set to multiple of 300 kHz less than the nominal channel spacing defined in section 5.4.1A of 3GPP TS 36.521. For non-contiguous intra-band CA, the downlink channel spacing between the component carriers was set to be larger than the nominal channel spacing and provided maximum separation between the component carriers.
- All selected PCC and SCC(s) remained fully within the uplink/downlink transmission band of the respective component carrier.

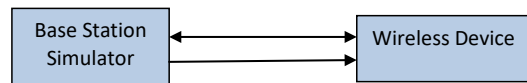


Figure I-1
DL CA Power Measurement Setup

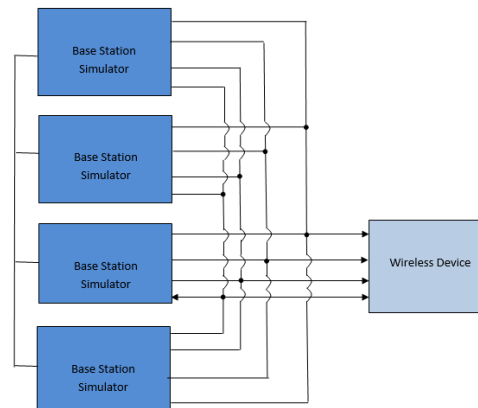


Figure I-2
DL CA with DL 4x4 MIMO Power Measurement Setup

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I.2 Downlink Carrier Aggregation RF Conducted Powers

I.2.1 LTE Band 12 as PCC

Table I-3
Maximum Output Powers

Combination	PCC								SCC 1				SCC 2				SCC 3				Power		
	PCC Band	PCC BW [MHz]	PCC (UL) Ch.	PCC (UL) Freq. [MHz]	Mod.	PCC UL# RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA_2A-12A (1)	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B2	20	900	1960	-	-	-	-	-	-	-	-	25.13	25.01
CA_4A-12A (1)	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B4	20	2175	2132.5	-	-	-	-	-	-	-	-	25.14	25.01
CA_4A-12A (2)	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B4	20	2175	2132.5	-	-	-	-	-	-	-	-	25.14	25.01
CA_12A-25A	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B05	20	8365	1802.5	-	-	-	-	-	-	-	-	25.09	25.01
CA_12A-66A (1)	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B66	20	66786	2145	-	-	-	-	-	-	-	-	25.12	25.01
CA_12A-66A (2)	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B66	20	66786	2145	-	-	-	-	-	-	-	-	25.12	25.01
CA_4A-4A-12A	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B4	20	2175	2132.5	LTE B4	10	2350	2150	-	-	-	-	24.87	25.01
CA_12A-66A-66A	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B66	20	66786	2145	LTE B66	20	67236	2190	-	-	-	-	24.98	25.01
CA_4A-4A-12A-12A	LTE B12	5	23035	701.5	QPSK	1	12	5035	731.5	LTE B12	5	5085	736.3	LTE B4	20	2175	2132.5	LTE B4	10	2350	2150	24.98	25.01

I.2.2 LTE Band 13 as PCC

Table I-4
Maximum Output Powers

Combination	PCC								SCC 1				SCC 2				Power					
	PCC Band	PCC BW [MHz]	PCC (UL) Ch.	PCC (UL) Freq. [MHz]	Mod.	PCC UL# RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)			
CA_2A-13A (2)	LTE B13	10	23230	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	-	-	-	-	-	-	-	24.87	24.74
CA_2A-4A-13A	LTE B13	10	23230	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B4	20	2175	2132.5	24.83	24.74			

I.2.3 LTE Band 26 as PCC

Table I-5
Maximum Output Powers

Combination	PCC								SCC 1				SCC 2				Power					
	PCC Band	PCC BW [MHz]	PCC (UL) Ch.	PCC (UL) Freq. [MHz]	Mod.	PCC UL# RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)			
CA_2A-26A	LTE B26	10	26990	844	QPSK	1	0	8990	889	LTE B2	20	900	1960	-	-	-	-	-	-	-	24.97	24.95
CA_26A-41A	LTE B26	10	26990	844	QPSK	1	0	8990	889	LTE B41	20	40620	2593	-	-	-	-	-	-	-	24.96	24.95
CA_26A-41C	LTE B26	10	26990	844	QPSK	1	0	8990	889	LTE B41	20	40620	2593	LTE B41	20	40422	2573.2	25.00	24.95			

I.2.4 LTE Band 66 as PCC

Table I-6
Maximum Output Powers

Combination	PCC								SCC 1				SCC 2				Power					
	PCC Band	PCC BW [MHz]	PCC (UL) Ch.	PCC (UL) Freq. [MHz]	Mod.	PCC UL# RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)			
CA_2A-66A	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B2	20	900	1960	-	-	-	-	-	-	-	25.31	25.13
CA_12A-66A (1)	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B12	10	5095	737.5	-	-	-	-	-	-	-	25.25	25.13
CA_12A-66A (2)	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B12	10	5095	737.5	-	-	-	-	-	-	-	25.25	25.13
CA_66B	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	15	66554	2121.8	-	-	-	-	-	-	-	25.26	25.13
CA_2A-5A-66A	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B2	20	900	1960	LTE B5	10	2525	881.5	25.17	25.13			
CA_2A-66A-66A	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	20	67236	2190	LTE B2	20	900	1960	25.24	25.13			
CA_5A-66A-66A	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	20	67236	2190	LTE B5	10	2525	881.5	25.18	25.13			
CA_5A-66C	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	20	66578	2124.2	LTE B5	10	2525	881.5	25.22	25.13			
CA_12A-66A-66A	LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	20	67236	2190	LTE B12	10	5095	737.5	25.19	25.13			

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I.2.5 LTE Band 25 as PCC

Table I-7
Maximum Output Powers

Combination	PCC									SCC 1			SCC 2			SCC 3			Power				
	PCC Band	PCC BW [MHz]	PCC (UL) Ch.	PCC (UL) Freq. [MHz]	Mod.	PCC UL RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	LTE Tx. Power with DL CA Enabled [dBm]	LTE Single Carrier Tx Power [dBm]
CA_12A-25A	LTE B25	10	26640	1910	QPSK	1	25	8640	1990	LTE B12	10	5096	737.5	-	-	-	-	-	-	-	-	25.24	25.19

I.2.6 LTE Band 41 as PCC

Table I-8
Maximum Output Powers

Combination	PCC									SCC 1			SCC 2			SCC 3			SCC 4			Power						
	PCC Band	PCC BW [MHz]	PCC (UL) Ch.	PCC (UL) Freq. [MHz]	Mod.	PCC UL RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	LTE Tx. Power with DL CA Enabled [dBm]	LTE Single Carrier Tx Power [dBm]	
CA_41A-41A (1)	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	41490	2680	-	-	-	-	-	-	-	-	-	-	-	-	24.62	24.70	
CA_41A-41C	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	41292	2660.2	LTE B41	20	41490	2680	-	-	-	-	-	-	-	-	-	24.75	24.70
CA_41A-41A	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	40764	2607.4	LTE B41	20	41490	2680	-	-	-	-	-	-	-	-	-	24.75	24.70
CA_41A-41D	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	41094	2640.4	LTE B41	20	41292	2660.2	LTE B41	20	41490	2680	-	-	-	-	-	24.79	24.70
CA_41D-41A	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	40476	2578.6	LTE B41	20	40764	2607.4	LTE B41	20	41490	2680	-	-	-	-	-	24.90	24.70
CA_41C-41C	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	40476	2578.6	LTE B41	20	41292	2660.2	LTE B41	20	41490	2680	-	-	-	-	-	24.79	24.70
CA_41E	LTE B41	15	40620	2593	QPSK	1	74	40620	2593	LTE B41	20	40449	2575.9	LTE B41	20	40791	2610.1	LTE B41	20	40989	2629.0	-	-	-	-	-	24.54	24.59
CA_41C-41D	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	40476	2578.6	LTE B41	20	41094	2640.4	LTE B41	20	41292	2660.2	LTE B41	20	41490	2680	24.67	24.76	
CA_41D-41C	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	LTE B41	20	40476	2578.6	LTE B41	20	40764	2607.4	LTE B41	20	41490	2680	24.68	24.70					

I.3 DL CA with DL 4x4 MIMO RF Conduction Powers

This device supports downlink 4x4 MIMO operations for some LTE bands. Uplink transmission is limited to a single output stream. When carrier aggregation was applicable, the general test selection and setup procedures described in Section I.1 were applied.

Per May 2017 TCB Workshop Notes, SAR for 4x4 DL MIMO was not needed since the maximum average output power in 4x4 DL MIMO mode was not more than 0.25 dB higher than the maximum output power with 4x4 DL MIMO inactive. Additionally, SAR for 4x4 MIMO Downlink Carrier Aggregation was not needed since the maximum average output power in 4x4 MIMO Downlink Carrier Aggregation mode was not more than 0.25 dB higher than the maximum output power with 4x4 MIMO Downlink and downlink carrier aggregation inactive.

I.3.1 LTE 4x4 MIMO DL Standalone Powers

Table I-9
Maximum Output Powers

LTE Band	Bandwidth [MHz]	Channel	Frequency [MHz]	Modulation	RB Size	RB Offset	4x4 DL MIMO Tx. Power [dBm]	Single Antenna Tx. Power [dBm]	Target Power [dBm]
66	5	131997	1712.5	QPSK	1	12	25.07	25.13	25.0
41	10	40620	2593	QPSK	1	25	24.67	24.70	25.0

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I.3.6 LTE Band 41 as PCC

**Table I-14
Maximum Output Powers**

Combination	PCC Band	PCC BW [MHz]	PCC [UL] Ch.	PCC [UL] Freq. [MHz]	Mod.	PCC				SCC 1				SCC 2				SCC 3				SCC 4				LTE Tx Power with DL CA Enabled	LTE Single Carrier Tx Power (dBm)								
						PCC UL# RB	PCC UL# RB Offset	PCC [DL] Freq. [MHz]	DL Ant. Config.	SCC Band	SCC BW [MHz]	SCC [DL] Ch.	SCC [DL] Freq. [MHz]	DL Ant. Config.	SCC Band	SCC BW [MHz]	SCC [DL] Ch.	SCC [DL] Freq. [MHz]	DL Ant. Config.	SCC Band	SCC BW [MHz]	SCC [DL] Ch.	SCC [DL] Freq. [MHz]	DL Ant. Config.	SCC Band			SCC BW [MHz]	SCC [DL] Ch.	SCC [DL] Freq. [MHz]	DL Ant. Config.				
CA_[41A]-[41A]_(1)	LTE B41	10	40620	2593	QPSK	1	25	40620	2593	4x4	LTE B41	20	41490	2680	2x2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24.65	24.70

I.4 Downlink Carrier Aggregation with Inter-band Uplink Carrier Aggregation Enabled

This device supports inter-band uplink carrier aggregation (ULCA) with additional Carrier Aggregation configurations active in the downlink. Power measurements were performed with inter-band ULCA active and additional CA configurations active in the downlink for the configuration per Fall 2017 TCB Workshop Notes.

Per FCC Guidance, additional SAR measurements for these configurations were not required since their maximum output power was not more than 0.25 dB higher than the maximum output power for with only ULCA active.

I.4.1 DL Carrier Aggregation with DL 4x4 MIMO RF Conducted Powers

Note: 4x4 DL MIMO is only operating in the downlink. Uplink transmission is limited to a single output stream for each component carrier of ULCA.

**Table I-15
Maximum Output Powers**

Combination	PCC Band	PCC Bandwidth [MHz]	PCC [UL] Channel	PCC [UL] Frequency [MHz]	Modulation	PCC UL# RB	PCC UL# RB Offset	PCC [DL] Channel	PCC [DL] Frequency [MHz]	DL Ant. Config.	SCC				DL Ant. Config.	Power								
											SCC Band	SCC Bandwidth [MHz]	SCC [UL] Ch.	SCC [UL] Frequency [MHz]		Modulation	SCC UL# RB	SCC UL# RB Offset	SCC [DL] Channel	SCC [DL] Frequency [MHz]	DL Ant. Config.	Interband ULCA Tx Power with add'l DL CA active (dBm)		LTE Interband ULCA Tx Power (dBm)
																PCC	SCC	PCC	SCC					
CA_5A-[66A]	LTE B5	10	20525	836.5	QPSK	50	0	2525	881.5	2x2	LTE B66	20	132322	1745	QPSK	100	0	66786	2145	4x4	23.04	20.90	23.03	20.95