

APPENDIX I: DOWNLINK LTE CA RF CONDUCTED POWERS

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	CC	Supported Channel Bandwidth (MHz)		Restriction	Completely Covered by Measurement Superset	Index	CC	Supported Channel Bandwidth (MHz)		Restriction	Completely Covered by Measurement Superset	Index	CC	Supported Channel Bandwidth (MHz)		Restriction	Completely Covered by Measurement Superset
		CC1	CC2					CC1	CC2					CC1	CC2		
RCC#1	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#1	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#1	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#2	CA [2A]	5, 10, 15, 20	5, 10		No	RCC#2	CA [2A]	5, 10, 15, 20	5, 10		No	RCC#2	CA [2A]	5, 10, 15, 20	5, 10		No
RCC#3	CA [2A]	5, 10, 15, 20	5, 10, 15		No	RCC#3	CA [2A]	5, 10, 15, 20	5, 10, 15		No	RCC#3	CA [2A]	5, 10, 15, 20	5, 10, 15		No
RCC#4	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#4	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#4	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#5	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#5	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#5	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#6	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#6	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#6	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#7	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#7	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#7	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#8	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#8	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#8	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#9	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#9	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#9	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#10	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#10	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#10	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#11	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#11	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#11	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#12	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#12	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#12	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#13	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#13	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#13	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#14	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#14	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#14	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#15	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#15	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#15	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#16	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#16	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#16	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#17	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#17	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#17	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#18	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#18	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#18	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#19	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#19	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#19	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#20	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#20	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#20	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#21	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#21	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#21	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#22	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#22	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#22	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#23	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#23	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#23	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#24	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#24	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#24	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#25	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#25	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#25	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#26	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#26	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#26	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#27	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#27	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#27	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#28	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#28	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#28	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#29	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#29	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#29	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#30	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#30	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#30	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#31	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#31	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#31	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#32	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#32	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#32	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#33	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#33	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#33	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#34	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#34	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#34	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#35	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#35	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#35	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#36	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#36	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#36	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#37	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#37	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#37	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#38	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#38	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#38	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#39	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#39	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#39	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#40	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#40	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#40	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#41	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#41	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#41	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#42	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#42	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#42	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#43	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#43	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#43	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#44	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#44	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#44	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#45	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#45	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#45	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#46	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#46	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#46	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#47	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#47	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#47	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#48	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#48	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#48	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#49	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#49	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#49	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No
RCC#50	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#50	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No	RCC#50	CA [2A]	5, 10, 15, 20	5, 10, 15, 20		No

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

Index	CC	Supported Channel Bandwidth (MHz)			Restriction	Completely Covered by Measurement Superset	Index	CC	Supported Channel Bandwidth (MHz)			Restriction	Completely Covered by Measurement Superset	Index	CC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset
		CC1	CC2	CC3					CC1	CC2	CC3					CC4					
RCC#M1	CA [2A]	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		No	RCC#M1	CA [2A]	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		No	RCC#M1	CA [2A]	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		No
RCC#M2	CA [2A]	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		No	RCC#M2	CA [2A]	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20		No	RCC#M2	CA [2A]	5, 10, 15, 20					

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 inactive 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.

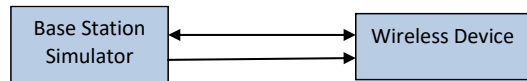


Figure I-1
DL CA Power Measurement Setup

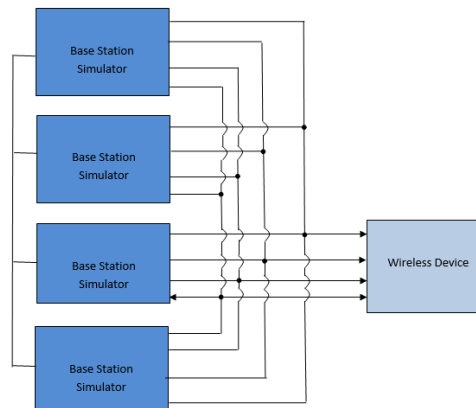


Figure I-2
DL CA with DL 4x4 MIMO Power Measurement Setup

FCC ID: A3LSMS928U	SAR EVALUATION REPORT	Approved by: Technical Manager
DUT Type: Portable Handset		APPENDIX I: Page 2 of 12

I.2 Downlink Carrier Aggregation RF Conducted Powers

I.2.1 LTE Band 71 as PCC

**Table I-3
Maximum Output Powers**

Combination	PCC Band	PCC BW [MHz]	PCC				SCC 1				SCC 2				SCC 3				Power									
			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_4A-4A-71A	LTE B71	5	13347	695.5	QPSK	1	12	68911	649.5	LTE B4	20	2175	2132.5	LTE B4	10	2350	2150	-	-	-	-	-	-	-	-	24.16	24.01	
CA_4B-4B-71A	LTE B71	5	13347	695.5	QPSK	1	12	68911	649.5	LTE B48	20	55990	3625	LTE B48	20	56640	3650	-	-	-	-	-	-	-	-	24.00	24.01	
CA_4B-71A	LTE B71	5	13347	695.5	QPSK	1	12	68911	649.5	LTE B48	20	55990	3625	LTE B48	20	56168	3644.8	-	-	-	-	-	-	-	-	23.99	24.01	
CA_2A-2A-4A-71A	LTE B71	5	13347	695.5	QPSK	1	12	68911	649.5	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B4	20	2175	2132.5	-	-	-	-	-	24.02	24.01
CA_2A-2A-6A-71A	LTE B71	5	13347	695.5	QPSK	1	12	68911	649.5	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B66	20	66786	2145	-	-	-	-	24.04	24.01	
CA_2A-6A-6A-71A	LTE B71	5	13347	695.5	QPSK	1	12	68911	649.5	LTE B2	20	900	1960	LTE B66	20	66786	2145	LTE B66	20	67236	2190	-	-	-	-	24.16	24.01	
CA_2A-6B-71A	LTE B71	5	13347	695.5	QPSK	1	12	68911	649.5	LTE B2	20	900	1960	LTE B66	20	66786	2145	LTE B66	20	66964	2164.8	-	-	-	-	24.34	24.01	

I.2.2 LTE Band 12 as PCC

**Table I-4
Maximum Output Powers**

Combination	PCC Band	PCC BW [MHz]	PCC				SCC 1				SCC 2				SCC 3				SCC 4				Power						
			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_2A-12A (1)	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B2	20	900	1960	-	-	-	-	-	-	-	-	-	-	-	-	-	24.24	24.27	
CA_4A-12A (1)	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B4	20	2175	2132.5	-	-	-	-	-	-	-	-	-	-	-	-	-	24.33	24.27	
CA_4A-12A (2)	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B4	20	2175	2132.5	-	-	-	-	-	-	-	-	-	-	-	-	-	24.26	24.27	
CA_12A-25A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B25	20	8365	1962.5	-	-	-	-	-	-	-	-	-	-	-	-	-	24.28	24.27	
CA_12A-66A (1)	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B66	20	66786	2145	-	-	-	-	-	-	-	-	-	-	-	-	-	24.37	24.27	
CA_12A-66A (2)	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B66	20	66786	2145	-	-	-	-	-	-	-	-	-	-	-	-	-	24.27	24.27	
CA_2A-2A-4A-12A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B4	20	2175	2132.5	-	-	-	-	-	-	24.45	24.27
CA_2A-4A-12A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B2	20	900	1960	LTE B4	20	2175	2132.5	LTE B4	10	2350	2150	-	-	-	-	-	-	24.53	24.27
CA_2A-4A-12B	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B12	10	5107	738.7	LTE B2	20	900	1960	LTE B4	20	2175	2132.5	-	-	-	-	-	-	24.44	24.27
CA_2A-12A-6C	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B2	20	900	1960	LTE B66	20	66786	2145	LTE B66	20	66964	2164.8	-	-	-	-	-	-	24.34	24.27
CA_4A-4A-12B	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B12	10	5107	738.7	LTE B4	20	2175	2132.5	LTE B4	10	2350	2150	-	-	-	-	-	-	24.33	24.27
CA_2A-2A-12A-30A-66A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B30	10	9820	2355	LTE B66	20	66786	2145	-	-	24.48	24.27
CA_2A-2A-12A-66A-66A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B66	20	66786	2145	LTE B66	20	67236	2190	-	-	24.51	24.27
CA_2A-2A-12B-66A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B12	10	5107	738.7	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B66	20	66786	2145	-	-	24.33	24.27
CA_2A-12A-30A-66A-66A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B2	20	900	1960	LTE B30	10	9820	2355	LTE B66	20	66786	2145	LTE B66	20	67236	2190	-	-	24.49	24.27
CA_2A-12B-66A-66A	LTE B12	5	23035	701.5	QPSK	1	0	5035	731.5	LTE B12	10	5107	738.7	LTE B2	20	900	1960	LTE B66	20	66786	2145	LTE B66	20	67236	2190	-	-	24.50	24.27

I.2.3 LTE Band 13 as PCC

**Table I-5
Maximum Output Powers**

Combination	PCC Band	PCC BW [MHz]	PCC				SCC 1				SCC 2				SCC 3				SCC 4				Power						
			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_2A-4A-13A	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B4	20	2175	2132.5	-	-	-	-	-	-	-	-	-	24.96	23.87	
CA_4A-4A-13A	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B4	20	2175	2132.5	LTE B4	10	2350	2150	-	-	-	-	-	-	-	-	-	24.95	23.87	
CA_13A-4B	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B48	10	55990	3625	LTE B48	10	56999	3634.9	-	-	-	-	-	-	-	-	-	-	24.99	23.87
CA_2A-13A-4A-66A	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B48	20	55990	3625	LTE B66	20	66786	2145	-	-	-	-	-	-	24.98	23.87
CA_2A-13A-6B	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B66	15	66786	2145	LTE B66	15	66974	2164.5	-	-	-	-	-	-	24.99	23.87
CA_2A-13A-6C	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B66	20	66786	2145	LTE B66	20	66984	2164.8	-	-	-	-	-	-	24.01	23.87
CA_13A-6A-6B-6C	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B48	20	55990	3625	LTE B48	15	66786	2145	LTE B66	15	66974	2164.5	-	-	-	-	-	-	24.94	23.87
CA_13A-6A-6C	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B48	20	55990	3625	LTE B66	20	66786	2145	LTE B66	20	66984	2164.8	-	-	-	-	-	-	24.02	23.87
CA_2A-2A-13A-66A-66A	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B66	20	66786	2145	LTE B66	20	67236	2190	-	-	23.96	23.87
CA_2A-13A-6C-66A	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B48	20	55990	3625	LTE B66	20	66786	2145	LTE B66	20	66786	2145	-	-	23.94	23.87
CA_2A-13A-4B-6C	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B2	20	900	1960	LTE B48	20	55990	3625	LTE B48	20	56188	3644.8	LTE B48	20	56188	3644.8	-	-	23.94	23.87
CA_13A-4B-6C	LTE B13	10	25240	782	QPSK	1	0	5230	751	LTE B48	20	55990	3625	LTE B48	20	56188	3644.8	LTE B48	20	56188	3644.8	LTE B48	20	56188	3644.8	-	-	23.95	23.87

I.2.4 LTE Band 14 as PCC

**Table I-6
Maximum Output Powers**

Combination	PCC Band	PCC BW [MHz]	PCC				SCC 1				SCC 2				SCC 3				SCC 4				Power						
			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_2A-2A-14A-30A-66A	LTE B14	10	23330	793	QPSK	1	25	5330	763	LTE B2	20	900	1960	LTE B2	20	700	1940	LTE B30	10	9820	2355	LTE B66	20	66786	2145	-	-	24.99	23.77
CA_2A-2A-14A-66A-66A	LTE B14	10	23330	793	QPSK	1	25	5330	763	LTE B2	20	900	1960	LTE B2	20	700													

I.2.8 LTE Band 41 as PCC

Table I-10
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 41A-41A (1)	LTE B41	20	41490	2680	QPSK	1	50	41490	2680	LTE B41	20	39750	2506	-	-	-	-	23.95	24.17
CA 41A-41C	LTE B41	20	41490	2680	QPSK	1	50	41490	2680	LTE B41	20	39948	2525.8	LTE B41	20	39750	2506	24.30	24.17
CA 41C-41A	LTE B41	20	41490	2680	QPSK	1	50	41490	2680	LTE B41	20	41292	2660.2	LTE B41	20	39750	2506	24.23	24.17
CA 41D	LTE B41	20	41490	2680	QPSK	1	50	41490	2680	LTE B41	20	41292	2660.2	LTE B41	20	41094	2640.4	24.18	24.17

I.2.9 LTE Band 48 as PCC

Table I-11
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 48A-48A	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55640	3600	-	-	-	-	-	-	-	-	-	-	-	-	-	22.00	22.08
CA 48B	LTE B48	15	55765	3602.5	QPSK	1	74	55765	3602.5	LTE B48	5	55668	3611.8	-	-	-	-	-	-	-	-	-	-	-	-	-	22.16	22.05
CA 48A-48C	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55640	3600	LTE B48	20	56442	3670.2	-	-	-	-	-	-	-	-	-	22.15	22.08
CA 48C-48A	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55638	3579.8	LTE B48	20	55640	3600	-	-	-	-	-	-	-	-	-	22.13	22.08
CA 48A-48D	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55640	3600	LTE B48	20	56442	3670.2	LTE B48	20	56244	3650.4	-	-	-	-	22.14	22.08	
CA 48D-48A	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55638	3579.8	LTE B48	20	55736	3599.6	LTE B48	20	56244	3650.4	-	-	-	-	22.15	22.08	
CA 48C-48C	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55638	3579.8	LTE B48	20	55640	3600	LTE B48	20	56442	3670.2	-	-	-	-	22.13	22.08	
CA 48A-48E	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55640	3600	LTE B48	20	56442	3670.2	LTE B48	20	56244	3650.4	LTE B48	20	56244	3650.4	22.10	22.08	
CA 48E-48A	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55338	3579.8	LTE B48	20	55736	3599.6	LTE B48	20	55244	3619.4	LTE B48	20	56244	3650.4	22.15	22.08	
CA 48C-48D	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55338	3579.8	LTE B48	20	56442	3670.2	LTE B48	20	56244	3650.4	-	-	-	-	22.03	22.08	
CA 48D-48C	LTE B48	20	55340	3560	QPSK	1	0	55340	3560	LTE B48	20	55338	3579.8	LTE B48	20	55736	3599.6	LTE B48	20	56442	3670.2	LTE B48	20	56442	3670.2	22.01	22.08	

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-12
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	23.70	23.66	23.5
25	5	26665	1912.5	QPSK	1	24	23.82	23.88	23.5
30	5	27710	2310	QPSK	1	24	22.44	22.55	22.5
41	20	41490	2680	QPSK	1	50	24.16	24.17	24.0
48	20	55340	3560	QPSK	1	0	21.88	22.08	22.0

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I.4 Additional Downlink Carrier Aggregation with Uplink Carrier Aggregation Enabled

This device supports uplink carrier aggregation (ULCA) with additional Carrier Aggregation configurations active in the downlink. Power measurements were performed with 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 CA_66B, CA_66C, CA_41C, or CA_48C ULCA active.

I.4.1 Additional DL Carrier Aggregation RF Conducted Powers with Uplink Carrier Aggregation Enabled

Table I-22
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 (UL) Ch.	SCC (UL) Freq. [MHz]	Mod.	SCC UL# RB	SCC UL RB Offset	SCC (DL) Channel	SCC (DL) Freq. [MHz]	SCC Band	SCC BW [MHz]	SCC (DL) Channel	SCC (DL) Freq. [MHz]	ULCA Tx Power with add'l CA config. active (dBm)	ULCA Tx Power (dBm)
CA_41D	LTE B41	20	41490	2680	QPSK	1	0	41490	2680	LTE B41	20	41292	2660.2	QPSK	1	99	41292	2660.2	LTE B41	20	41094	2640.4	24.10	24.09

I.4.2 Additional 4x4 MIMO DL Carrier Aggregation RF Conducted Powers with Uplink Carrier Aggregation Enabled

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-23
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) Ch.	PCC (DL) Freq. [MHz]	DL Ant. Config.	SCC Band	SCC BW [MHz]	SCC (UL) Ch.	SCC (UL) Freq. [MHz]	Mod.	SCC UL# RB	SCC UL RB Offset	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.	Tx Power with add'l CA config. active (dBm)	ULCA Tx Power (dBm)
CA_41D	LTE B41	20	41490	2680	QPSK	1	0	41490	2680	4x4	LTE B41	20	41292	2660.2	QPSK	1	99	41292	2660.2	4x4	LTE B41	20	41094	2640.4	4x4	24.14	24.09

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