

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
		CC1	CC2	CC3	CC4		
CC#01	CA_2A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#02	CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#03	CA_2A-2A-4A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#04	CA_2A-2A-4A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#05	CA_2A-2A-4A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#06	CA_2A-2A-4A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#07	CA_2A-2A-4A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#08	CA_2A-2A-4A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#09	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#10	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#11	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#12	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#13	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#14	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#15	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#16	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#17	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#18	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#19	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#20	CA_2A-2A-4A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes

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

Index	BCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset
		CC1	CC2	CC3	CC4		
CC#M01	CA_12C1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M02	CA_12A1-12A	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M03	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M04	CA_12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M05	CA_12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M06	CA_12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M07	CA_12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M08	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M09	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M10	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M11	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M12	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M13	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M14	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M15	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M16	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M17	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M18	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M19	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M20	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M21	CA_12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M22	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M23	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M24	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M25	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M26	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M27	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M28	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M29	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes
CC#M30	CA_12A1-12A1	5, 10, 15, 20	5, 10, 15, 20			None	Yes

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

FCC ID: PY7-58692W	SAR EVALUATION REPORT	Approved by: Technical Manager
DUT Type: Portable Handset		APPENDIX I: Page 1 of 8

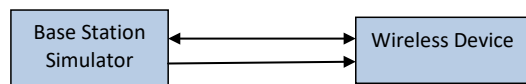
only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the 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.

This device supports LAA with downlink carrier aggregation only. It uses carrier aggregation in the downlink to combine LTE in the unlicensed spectrum (i.e. LTE Band 46) with LTE in the licensed band (served as PCC). All uplink communications and acknowledgements on the PCC remain identical to specifications when downlink carrier aggregation is inactive.

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 Section 9.2 and appendix H. 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**

FCC ID: PY7-58692W	SAR EVALUATION REPORT	Approved by: Technical Manager
DUT Type: Portable Handset		APPENDIX I: Page 2 of 8

1.2.4 LTE Band 66 as PCC

**Table I-6
Maximum Output Powers**

Combination	PCC Band	PCC BW [MHz]	PCC [UL] Ch.	PCC [UL] Freq. [MHz]	Mod.	PCC [UL] RB Offset		PCC [DL] Channel	PCC [DL] Freq. [MHz]	SCC 1		SCC 2		SCC 3		SCC 4		SCC 5		LTE Tx Power with DL CA Enabled [dBm]	LTE Single Carrier Tx Power [dBm]		
						PCC UL RB	PCC UL RB Offset			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]
CA 1A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 12A-66A (1)	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B12	5	6055	217.5	-	-	-	-	-	-	-	-	18.20	18.50
CA 13A-66A (1)	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B13	5	6055	217.5	-	-	-	-	-	-	-	-	18.20	18.50
CA 14A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 4A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 5A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 6A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 7A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 8A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 9A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 10A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 11A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 12A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 13A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 14A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 15A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 16A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 17A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 18A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 19A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50
CA 20A-66A	LTE B66	20	13027	1720	16QAM	1	0	66036	2120	LTE B66	20	66036	2120	-	-	-	-	-	-	-	-	18.20	18.50

1.2.5 LTE Band 41 as PCC

**Table I-7
Maximum Output Powers**

Combination	PCC Band	PCC BW [MHz]	PCC [UL] Ch.	PCC [UL] Freq. [MHz]	Mod.	PCC [UL] RB Offset		PCC [DL] Channel	PCC [DL] Freq. [MHz]	SCC 1		SCC 2		SCC 3		SCC 4		LTE Tx Power with DL CA Enabled [dBm]	LTE Single Carrier Tx Power [dBm]				
						PCC UL RB	PCC UL RB Offset			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]
CA 41A-46A	LTE B41	20	38750	2506	16QAM	1	0	38750	2506	LTE B41	20	38946	2525.6	-	-	-	-	-	-	-	19.25	19.16	
CA 41C (1)	LTE B41	20	38750	2506	16QAM	1	0	38750	2506	LTE B41	20	38946	2525.6	-	-	-	-	-	-	-	-	19.25	19.16
CA 41A-46C	LTE B41	20	38750	2506	16QAM	1	0	38750	2506	LTE B46	20	50605	5537.5	LTE B46	20	50467	5517.7	-	-	-	-	19.20	19.16
CA 41D	LTE B41	20	38750	2506	16QAM	1	0	38750	2506	LTE B41	20	38946	2525.6	LTE B41	20	42146	2644.6	-	-	-	-	19.25	19.16
CA 41A-46D	LTE B41	20	38750	2506	16QAM	1	0	38750	2506	LTE B46	20	50605	5537.5	LTE B46	20	50467	5517.7	LTE B46	20	50603	5537.5	19.22	19.16
CA 41A-46E	LTE B41	20	38750	2506	16QAM	1	0	38750	2506	LTE B46	20	50605	5537.5	LTE B46	20	50467	5517.7	LTE B46	20	53061	5577.1	19.23	19.16

1.3 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.

FCC ID: PY7-58692W	SAR EVALUATION REPORT	Approved by:
DUT Type: Portable Handset		Technical Manager
		APPENDIX I: Page 4 of 8

I.3.6 LTE Band 41 as PCC

Table I-13
Maximum Output Powers

Combination	PCC										SCC 1				SCC 2				SCC 3				SCC 4				Power					
	PCC Band	PCC BW [MHz]	PCC [UL] Ch.	PCC [DL] 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 [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.	LTE Tx Power with DL CA Enabled [dBm]	LTE Single Carrier Tx Power [dBm]
CA I41A1-46A	LTE B41	20	39750	2506	16QAM	1	0	39750	2506	4x4	LTE B46	20	50665	5537.5	2x2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.25	19.16
CA I41C1-1	LTE B41	20	39750	2506	16QAM	1	0	39750	2506	4x4	LTE B41	20	39948	2525.8	4x4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.29	19.16
CA I41A1-46C	LTE B41	20	39750	2506	16QAM	1	0	39750	2506	4x4	LTE B46	20	50665	5537.5	2x2	LTE B46	20	50467	5517.7	2x2	-	-	-	-	-	-	-	-	-	-	19.28	19.16
CA I41C1	LTE B41	20	39750	2506	16QAM	1	0	39750	2506	4x4	LTE B41	20	39948	2525.8	4x4	LTE B41	20	40146	2545.6	4x4	-	-	-	-	-	-	-	-	-	-	19.34	19.16
CA I41A1-46D	LTE B41	20	39750	2506	16QAM	1	0	39750	2506	4x4	LTE B46	20	50665	5537.5	2x2	LTE B46	20	50467	5517.7	2x2	LTE B46	20	50861	5557.3	2x2	-	-	-	-	-	19.31	19.16
CA I41A1-46E	LTE B41	20	39750	2506	16QAM	1	0	39750	2506	4x4	LTE B46	20	50665	5537.5	2x2	LTE B46	20	50467	5517.7	2x2	LTE B46	20	50863	5557.3	2x2	LTE B46	20	51061	5577.1	2x2	19.27	19.16

FCC ID: PY7-58692W	SAR EVALUATION REPORT	Approved by: Technical Manager
DUT Type: Portable Handset		APPENDIX I: Page 8 of 8