

APPENDIX G POWER REDUCTION VERIFICATION

Per the May 2017 TCBC Workshop Notes, demonstration of proper functioning of the power reduction mechanisms is required to support the corresponding SAR configurations. The verification process was divided into two parts: (1) evaluation of output power levels for individual or multiple triggering mechanisms and (2) evaluation of the triggering distances for proximity-based sensors.

G.1 Power Verification Procedure

The power verification was performed according to the following procedure:

1. A base station simulator was used to establish a conducted RF connection and the output power was monitored. The power measurements were confirmed to be within expected tolerances for all states before and after a power reduction mechanism was triggered.
2. Step 1 was repeated for all relevant modes and frequency bands for the mechanism being investigated.
3. Steps 1 and 2 were repeated for all individual power reduction mechanisms and combinations thereof. For the combination cases, one mechanism was switched to a 'triggered' state at a time; powers were confirmed to be within tolerances after each additional mechanism was activated.

G.2 Distance Verification Procedure

The distance verification procedure was performed according to the following procedure:

1. A base station simulator was used to establish an RF connection and to monitor the power levels. The device being tested was placed below the relevant section of the phantom with the relevant side or edge of the device facing toward the phantom.
2. The device was moved toward and away from the phantom to determine the distance at which the mechanism triggers and the output power is reduced, per KDB Publication 616217 D04v01r02 and FCC Guidance. Each applicable test position was evaluated. The distances were confirmed to be the same or larger (more conservative) than the minimum distances provided by the manufacturer.
3. Steps 1 and 2 were repeated for low, mid, and high bands, as appropriate (see note below Table G-2 for more details).
4. Steps 1 through 3 were repeated for all distance-based power reduction mechanisms.

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G.3 Main Antenna Verification Summary

Table G-1
Power Measurement Verification for Main Antenna

Mechanism(s)		Mode/Band	Conducted Power (dBm)		
1st	2nd		Un-triggered (Max)	Mechanism #1 (Reduced)	Mechanism #2 (Reduced)
Hotspot On		GPRS 1900	25.6	22.59	
Grip		GPRS 1900	25.59	22.58	
Hotspot On	Grip	GPRS 1900	25.6	22.6	22.61
Grip	Hotspot On	GPRS 1900	25.61	22.6	22.59
Hotspot On		UMTS 1750	24.35	21.37	
Grip		UMTS 1750	24.32	21.31	
Hotspot On	Grip	UMTS 1750	24.3	21.38	21.4
Grip	Hotspot On	UMTS 1750	24.28	21.32	21.33
Hotspot On		UMTS 1900	24.62	21.66	
Grip		UMTS 1900	24.6	21.64	
Hotspot On	Grip	UMTS 1900	24.62	21.65	21.66
Grip	Hotspot On	UMTS 1900	24.6	21.65	21.67
Hotspot On		PCS EVDO	24.13	21.02	
Grip		PCS EVDO	24.1	21	
Hotspot On	Grip	PCS EVDO	24.09	21.03	20.96
Grip	Hotspot On	PCS EVDO	24.07	20.99	21.01
Hotspot On		LTE FDD Band 66	24.45	21.26	
Grip		LTE FDD Band 66	24.48	21.27	
Hotspot On	Grip	LTE FDD Band 66	24.43	21.23	21.3
Grip	Hotspot On	LTE FDD Band 66	24.42	21.22	21.2
Hotspot On		LTE FDD Band 4	24.69	21.48	
Grip		LTE FDD Band 4	24.66	21.45	
Hotspot On	Grip	LTE FDD Band 4	24.62	21.49	21.5
Grip	Hotspot On	LTE FDD Band 4	24.63	21.55	21.47
Hotspot On		LTE FDD Band 25	24.59	21.52	
Grip		LTE FDD Band 25	24.6	21.53	
Hotspot On	Grip	LTE FDD Band 25	24.56	21.54	21.56
Grip	Hotspot On	LTE FDD Band 25	24.59	21.53	21.52
Hotspot On		LTE FDD Band 2	24.53	21.5	
Grip		LTE FDD Band 2	24.54	21.51	
Hotspot On	Grip	LTE FDD Band 2	24.57	21.5	21.52
Grip	Hotspot On	LTE FDD Band 2	24.55	21.52	21.44
Hotspot On		LTE FDD Band 7	22.32	20.1	
Hotspot On		LTE TDD Band 41 (PC2)	27.31	24.16	

Table G-2
Distance Measurement Verification for Main Antenna

Mechanism(s)	Test Condition	Band	Distance Measurements (mm)		Minimum Distance per Manufacturer (mm)
			Moving Toward	Moving Away	
Grip	Phablet - Back Side	Mid	16	18	10
Grip	Phablet - Bottom Edge	Mid	7	9	3

*Note: Mid band refers to: CDMA BC1, GSM1900, UMTS B2/4, LTE B2/4/25/66

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G.4 WIFI Verification Summary

Table G-3
Power Measurement Verification WIFI

Mechanism(s)	Mode/Band	Conducted Power (dBm)	
1st		Un-triggered (Max)	Mechanism #1 (Reduced)
Held-to-Ear	802.11b	20.99	11.92
Held-to-Ear	802.11g	18.98	11.93
Held-to-Ear	802.11n (2.4GHz)	18.85	11.77
Held-to-Ear	802.11a	17.76	10.97
Held-to-Ear	802.11n (5GHz, 20MHz BW)	17.00	11.15
Held-to-Ear	802.11ac (20MHz BW)	17.06	11.15
Held-to-Ear	802.11n (5GHz, 40MHz BW)	15.05	11.03
Held-to-Ear	802.11ac (40MHz BW)	15.13	11.15
Held-to-Ear	802.11ac (80MHz BW)	13.70	10.29

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APPENDIX H: DOWNLINK LTE CA RF CONDUCTED POWERS

1.1 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 1 – Example of Exclusion Table for SISO Configurations

Index	ZCC	Supported Channel Bandwidth (MHz)		Restriction	Completely Covered by Measurement Superset
		CC1	CC2		
CCC RM1	CA [2C]	5, 10, 15, 20	5, 10, 15, 20	CCC RM1	No
CCC RM2	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM2	No
CCC RM3	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM3	No
CCC RM4	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM4	No
CCC RM5	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM5	No
CCC RM6	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM6	No
CCC RM7	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM7	No
CCC RM8	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM8	No
CCC RM9	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM9	No
CCC RM10	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM10	No
CCC RM11	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM11	No
CCC RM12	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM12	No
CCC RM13	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM13	No
CCC RM14	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM14	No
CCC RM15	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM15	No
CCC RM16	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM16	No
CCC RM17	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM17	No
CCC RM18	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM18	No
CCC RM19	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM19	No
CCC RM20	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM20	No
CCC RM21	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM21	No
CCC RM22	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM22	No
CCC RM23	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM23	No
CCC RM24	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM24	No
CCC RM25	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM25	No
CCC RM26	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM26	No
CCC RM27	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM27	No
CCC RM28	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM28	No
CCC RM29	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM29	No
CCC RM30	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM30	No
CCC RM31	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM31	No
CCC RM32	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM32	No
CCC RM33	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM33	No
CCC RM34	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM34	No
CCC RM35	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM35	No
CCC RM36	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM36	No
CCC RM37	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM37	No
CCC RM38	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM38	No
CCC RM39	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM39	No
CCC RM40	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM40	No
CCC RM41	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM41	No
CCC RM42	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM42	No
CCC RM43	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM43	No
CCC RM44	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM44	No
CCC RM45	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM45	No
CCC RM46	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM46	No
CCC RM47	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM47	No
CCC RM48	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM48	No
CCC RM49	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM49	No
CCC RM50	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM50	No
CCC RM51	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM51	No
CCC RM52	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM52	No
CCC RM53	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM53	No
CCC RM54	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM54	No
CCC RM55	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM55	No
CCC RM56	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM56	No
CCC RM57	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM57	No
CCC RM58	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM58	No
CCC RM59	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM59	No
CCC RM60	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM60	No
CCC RM61	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM61	No
CCC RM62	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM62	No
CCC RM63	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM63	No
CCC RM64	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM64	No
CCC RM65	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM65	No
CCC RM66	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM66	No
CCC RM67	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM67	No
CCC RM68	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM68	No
CCC RM69	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM69	No
CCC RM70	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM70	No
CCC RM71	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM71	No
CCC RM72	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM72	No
CCC RM73	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM73	No
CCC RM74	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM74	No
CCC RM75	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM75	No
CCC RM76	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM76	No
CCC RM77	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM77	No
CCC RM78	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM78	No
CCC RM79	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM79	No
CCC RM80	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM80	No
CCC RM81	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM81	No
CCC RM82	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM82	No
CCC RM83	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM83	No
CCC RM84	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM84	No
CCC RM85	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM85	No
CCC RM86	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM86	No
CCC RM87	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM87	No
CCC RM88	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM88	No
CCC RM89	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM89	No
CCC RM90	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM90	No
CCC RM91	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM91	No
CCC RM92	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM92	No
CCC RM93	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM93	No
CCC RM94	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM94	No
CCC RM95	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM95	No
CCC RM96	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM96	No
CCC RM97	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM97	No
CCC RM98	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM98	No
CCC RM99	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM99	No
CCC RM100	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	CCC RM100	No

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

Table 2: Example Channel Bandwidth Combinations											Table 3: Example Channel Bandwidth Combinations										
Index	ZCC	Supported Channel Bandwidth (MHz)			Restriction	Completely Covered by Measurement Superset	Index	ZCC	Supported Channel Bandwidth (MHz)			Restriction	Completely Covered by Measurement Superset	Index	ZCC	Supported Channel Bandwidth (MHz)				Restriction	Completely Covered by Measurement Superset
		CC1	CC2	CC3					CC1	CC2	CC3					CC4					
CCC RM1	CA [2C]	5, 10, 15, 20	5, 10, 15, 20		CCC RM1	CA [2A]-2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	No	CCC RM1	CA [2A]-8A-66A	5, 10, 15, 20	5, 10	5, 10	5, 10, 15, 20	5, 10, 15, 20	No			
CCC RM2	CA [2A]-3A	5, 10, 15, 20	5, 10, 15, 20		CCC RM2	CA [2A]-2A-4A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	No	CCC RM2	CA [2A]-10A-66A	5, 10, 15, 20	5, 10	5, 10	5, 10, 15, 20	5, 10, 15, 20	No			
CCC RM3	CA [2A]-2A	5, 10, 15, 20	5, 10, 15, 20	No	CCC RM3	CA [2A]-2A-1A	5, 10, 15, 20	5, 10, 15, 20	5, 10	No	CCC RM3	CA [2A]-5A-66A	5, 10, 15, 20	5, 10	5, 10, 15	5, 10, 15	No				
CCC RM4	CA [2A]-4A (2)	5, 10, 15, 20	5, 10, 15, 20	CCC RM4	CA [2A]-2A-1A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	10	No	CCC RM4	CA 2A-5A-66A	5, 10, 15, 20	5, 10	5, 10, 15	5, 10, 15	No				
CCC RM5	CA [2A]-6A (2)	5, 10, 15, 20	5, 10, 15, 20	CCC RM5	CA [2A]-3A-1A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10	No	CCC RM5	CA [2A]-6A-66A	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10, 15, 20	No				
CCC RM6	CA [2A]-5A	5, 10, 15, 20	5, 10	CCC RM6	CA [2A]-4A-6A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10	No	CCC RM6	CA 2A-5A-66C	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10, 15, 20	No				
CCC RM7	CA [2A]-12A (1)	5, 10, 15, 20	3, 5, 10	CCC RM7	CA 2C-66A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10	No											
CCC RM8	CA [2A]-12A	5, 10, 15, 20	10	CCC RM8	CA [2C]-66A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10	No											
CCC RM9	CA [2A]-17A	5, 10, 15, 20	5, 10	No	CCC RM9	CA [2A]-2A-66A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	No											
CCC RM10	CA [2A]-28A (2)	5, 10, 15, 20	5, 10	B79 SCC Only	CCC RM10	CA 2A-2A-66A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	No											
CCC RM11	CA [2A]-38A	5, 10, 15, 20	5, 10	CCC RM11	CA [2A]-2A-7A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	No											
CCC RM12	CA [2A]-66A (2)	5, 10, 15, 20	5, 10, 15, 20	CCC RM12	CA [2A]-4A-29A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10	B79 SCC Only											
CCC RM13	CA 2A-66A (2)	5, 10, 15, 20	5, 10, 15, 20	CCC RM13	CA [2A]-4A-7A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	No											
CCC RM14	CA [2A]-66A (2)	5, 10, 15, 20	5, 10, 15, 20	CCC RM14	CA [2A]-6A-6A	5, 10, 15, 20	5, 10, 15, 20	5, 10, 15, 20	5, 10	CCC RM14											
CCC RM15	CA [2A]-7A	5, 10, 15, 20	5, 10, 15, 20	CCC RM15	CA [2A]-5A-66A	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10	CCC RM15											
CCC RM16	CA 5A-66A	5, 10, 15, 20	5, 10, 15, 20	CCC RM16	CA [2A]-5A-66A	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10	CCC RM16											
CCC RM17	CA [2A]-66A (4)	5, 10, 15, 20	5, 10, 15, 20	CCC RM17	CA 2A-2A-66A	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10	CCC RM17											
CCC RM18	CA [3A]-66A	5, 10, 15, 20	5, 10, 15, 20	CCC RM18	CA [2A]-1A-66A	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10	CCC RM18											
CCC RM19	CA 30A-66A	5, 10	5, 10, 15, 20	CCC RM19	CA 2A-13A-66A	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10	CCC RM19											
CCC RM20	CA [2A]-66A	5, 10, 15	5, 10, 15	CCC RM20	CA 2A-30A-66A	5, 10, 15, 20	5, 10	5, 10, 15, 20	5, 10	CCC RM20											
CCC RM21	CA [66C]	5, 10, 15, 20	5, 10, 15, 20	CCC RM21	CA [2A]-66B	5, 10, 15, 20	5, 10, 15	5, 10, 15	5, 10, 15	CCC RM21											
CCC RM22	CA 66A-66A	5, 10, 15, 20	5, 10, 15, 20	CCC RM22	CA 2A-66B	5, 10, 15, 20	5, 10, 15	5, 10, 15	5, 10, 15	CCC RM22											
CCC RM23	CA 66A-66A	5, 10, 15, 20	5, 10, 15, 20	No	CCC RM23	CA [2A]-66B	5, 10, 15, 20	5, 10, 15	5, 10, 15	CCC RM23											

1.2 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 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 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. 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.

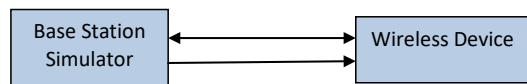


Figure 1
DL CA Power Measurement Setup

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1.3 Downlink Carrier Aggregation RF Conducted Powers

1.3.1 LTE Band 71 as PCC

Table 1
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 2A-71A	LTE B71	15	133297	680.5	QPSK	1	0	68761	634.5	LTE B2	20	900	1960	25.12	25.14
CA 4A-71A	LTE B71	15	133297	680.5	QPSK	1	0	68761	634.5	LTE B4	20	2175	2132.5	25.12	25.14
CA 66A-71A	LTE B71	15	133297	680.5	QPSK	1	0	68761	634.5	LTE B66	20	66786	2145	25.15	25.14

1.3.2 LTE Band 12 as PCC

Table 2
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 2A-12A (1)	LTE B12	5	23095	707.5	QPSK	1	12	5095	737.5	LTE B2	20	900	1960	24.78	24.84
CA 4A-12A (1)	LTE B12	5	23095	707.5	QPSK	1	12	5095	737.5	LTE B4	20	2175	2132.5	24.67	24.84
CA 4A-12A (2)	LTE B12	5	23095	707.5	QPSK	1	12	5095	737.5	LTE B4	20	2175	2132.5	24.67	24.84
CA 12A-66A (1)	LTE B12	5	23095	707.5	QPSK	1	12	5095	737.5	LTE B66	20	66786	2145	24.68	24.84
CA 12A-66A (2)	LTE B12	5	23095	707.5	QPSK	1	12	5095	737.5	LTE B66	20	66786	2145	24.68	24.84
CA 7A-12A	LTE B12	5	23095	707.5	QPSK	1	12	5095	737.5	LTE B7	20	3100	2655	24.67	24.84

1.3.3 LTE Band 13 as PCC

Table 3
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 2A-13A	LTE B13	10	23230	782	QPSK	1	25	5230	751	LTE B2	20	900	1960	24.51	24.57
CA 4A-13A	LTE B13	10	23230	782	QPSK	1	25	5230	751	LTE B4	20	2175	2132.5	24.53	24.57
CA 13A-66A	LTE B13	5	23230	782	QPSK	1	24	5230	751	LTE B66	20	66786	2145	24.61	24.71

1.3.4 LTE Band 26 as PCC

Table 4
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 25A-26A	LTE B26	10	26740	819	QPSK	1	25	8740	864	LTE B25	20	8365	1962.5	24.82	24.99
CA 26A-41A	LTE B26	10	26740	819	QPSK	1	25	8740	864	LTE B41	20	40620	2593	24.93	24.99

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1.3.5 LTE Band 66 as PCC

Table 5
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx.Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 66A-66A	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B66	20	67236	2190	24.57	24.74
CA 66B	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B66	10	66687	2135.1	24.62	24.74
CA 66C	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B66	20	66642	2130.6	24.64	24.74
CA 2A-66A	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B2	20	900	1960	24.65	24.74
CA 5A-66A	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B5	10	2525	881.5	24.63	24.74
CA 12A-66A (1)	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B12	10	5095	737.5	24.69	24.74
CA 12A-66A (2)	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B12	10	5095	737.5	24.64	24.74
CA 13A-66A	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B13	10	5230	751	24.62	24.74
CA 66A-71A	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B71	20	68761	634.5	24.65	24.74
CA 7A-66A	LTE B66	10	132322	1745	QPSK	1	0	66786	2145	LTE B7	20	3100	2655	24.76	24.74

1.3.6 LTE Band 25 as PCC

Table 6
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx.Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 25A-25A (1)	LTE B25	15	26115	1857.5	QPSK	1	36	8115	1937.5	LTE B25	20	8590	1985	24.64	24.65
CA 25A-26A	LTE B25	15	26115	1857.5	QPSK	1	36	8115	1937.5	LTE B26	15	8865	876.5	24.64	24.65
CA 25A-41A	LTE B25	15	26115	1857.5	QPSK	1	36	8115	1937.5	LTE B41	20	40620	2593	24.69	24.65

1.3.7 LTE Band 7 as PCC

Table 7
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx.Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 2A-7A	LTE B7	20	21100	2535	QPSK	1	0	3100	2655	LTE B2	20	900	1960	22.36	22.43
CA 4A-7A (1)	LTE B7	20	21100	2535	QPSK	1	0	3100	2655	LTE B4	20	2175	2132.5	22.39	22.43
CA 5A-7A	LTE B7	20	21100	2535	QPSK	1	0	3100	2655	LTE B5	10	2525	881.5	22.37	22.43
CA 7A-7A (1)	LTE B7	20	21100	2535	QPSK	1	0	3100	2655	LTE B7	20	2850	2630	22.51	22.43
CA 7A-12A	LTE B7	20	21100	2535	QPSK	1	0	3100	2655	LTE B12	10	5095	737.5	22.48	22.43
CA 7A-66A	LTE B7	20	21100	2535	QPSK	1	0	3100	2655	LTE B66	20	66786	2145	22.51	22.43

1.3.8 LTE Band 41 as PCC

Table 8
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx.Power with DL CA Enabled (dBm)	LTE Single Carrier Tx Power (dBm)
CA 41C (1)	LTE B41	20	40185	2549.5	QPSK	1	0	40185	2549.5	LTE B41	20	40383	2569.3	24.53	24.50
CA 41A-41A	LTE B41	20	40185	2549.5	QPSK	1	0	40185	2549.5	LTE B41	20	41490	2680	24.49	24.50

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1.3.9 LTE Band 41 PC2 as PCC

Table 9
Maximum Output Powers

Combination	PCC									SCC 1				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]	LTE Tx.Power with DL CA Enabled (dbm)	LTE Single Carrier Tx Power (dbm)
CA 41C (1)	LTE B41 PC2	20	40185	2549.5	QPSK	1	0	40185	2549.5	LTE B41 PC2	20	40383	2569.3	27.73	27.66
CA 41A-41A	LTE B41 PC2	20	40185	2549.5	QPSK	1	0	40185	2549.5	LTE B41 PC2	20	41540	2680	27.61	27.66

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