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. For licensed modes, the device state index as displayed on the device UI was recorded before and after the 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. For licensed modes, the device state index on the device UI was monitored to determine the triggering state.

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-3 for more details).

4. Steps 1 through 3 were repeated for all distance-based power reduction mechanisms.

G.3 Main Antenna Verification Summary

Table G-1
Power Measurement Verification for Main Antenna – Legacy Bands

Mechanism(s)			Mode/Band	Device State Index (DSI)			
1st	2nd	3rd		Un-triggered (Max)	Mechanism #1 (Reduced)	Mechanism #2 (Reduced)	Mechanism #3 (Reduced)
Hotspot On			PCS CDMA	0	2		
Grip			PCS CDMA	0	5		
Hotspot On	Grip		PCS CDMA	0	2	2	
Grip	Hotspot On		PCS CDMA	0	5	2	
Hotspot On			UMTS 1750	0	2		
Grip			UMTS 1750	0	5		
Hotspot On	Grip		UMTS 1750	0	2	2	
Grip	Hotspot On		UMTS 1750	0	5	2	
Hotspot On			UMTS 1900	0	2		
Grip			UMTS 1900	0	5		
Hotspot On	Grip		UMTS 1900	0	2	2	
Grip	Hotspot On		UMTS 1900	0	5	2	
Hotspot On			LTE Band 66	0	2		
Grip			LTE Band 66	0	5		
Hotspot On	Grip		LTE Band 66	0	2	2	
Grip	Hotspot On		LTE Band 66	0	5	2	
Hotspot On			LTE Band 4	0	2		
Grip			LTE Band 4	0	5		
Hotspot On	Grip		LTE Band 4	0	2	2	
Grip	Hotspot On		LTE Band 4	0	5	2	
Hotspot On			LTE Band 25	0	2		
Grip			LTE Band 25	0	5		
Hotspot On	Grip		LTE Band 25	0	2	2	
Grip	Hotspot On		LTE Band 25	0	5	2	
Hotspot On			LTE Band 2	0	2		
Grip			LTE Band 2	0	5		
Hotspot On	Grip		LTE Band 2	0	2	2	
Grip	Hotspot On		LTE Band 2	0	5	2	
Hotspot On			LTE Band 30	0	2		
Grip			LTE Band 30	0	5		
Held-to-Ear			LTE Band 30	0	1		
Hotspot On	Grip		LTE Band 30	0	2	2	
Grip	Hotspot On		LTE Band 30	0	5	2	
Hotspot On	Held-to-Ear		LTE Band 30	0	2	1	
Held-to-Ear	Hotspot On		LTE Band 30	0	1	1	
Grip	Held-to-Ear		LTE Band 30	0	5	1	
Held-to-Ear	Grip		LTE Band 30	0	1	1	
Hotspot On	Grip	Held-to-Ear	LTE Band 30	0	2	2	1
Hotspot On	Held-to-Ear	Grip	LTE Band 30	0	2	1	1
Grip	Held-to-Ear	Hotspot On	LTE Band 30	0	5	1	1
Grip	Hotspot On	Held-to-Ear	LTE Band 30	0	5	2	1
Held-to-Ear	Grip	Hotspot On	LTE Band 30	0	1	1	1
Held-to-Ear	Hotspot On	Grip	LTE Band 30	0	1	1	1
Hotspot On			LTE Band 7	0	2		
Grip			LTE Band 7	0	5		
Held-to-Ear			LTE Band 7	0	1		
Hotspot On	Grip		LTE Band 7	0	2	2	
Grip	Hotspot On		LTE Band 7	0	5	2	
Hotspot On	Held-to-Ear		LTE Band 7	0	2	1	
Held-to-Ear	Hotspot On		LTE Band 7	0	1	1	
Grip	Held-to-Ear		LTE Band 7	0	5	1	
Held-to-Ear	Grip		LTE Band 7	0	1	1	
Hotspot On	Grip	Held-to-Ear	LTE Band 7	0	2	2	1
Hotspot On	Held-to-Ear	Grip	LTE Band 7	0	2	1	1
Grip	Held-to-Ear	Hotspot On	LTE Band 7	0	5	1	1
Grip	Hotspot On	Held-to-Ear	LTE Band 7	0	5	2	1
Held-to-Ear	Grip	Hotspot On	LTE Band 7	0	1	1	1
Held-to-Ear	Hotspot On	Grip	LTE Band 7	0	1	1	1
Hotspot On			LTE Band 41 PC3	0	2		
Grip			LTE Band 41 PC3	0	5		
Held-to-Ear			LTE Band 41 PC3	0	1		
Hotspot On	Grip		LTE Band 41 PC3	0	2	2	
Grip	Hotspot On		LTE Band 41 PC3	0	5	2	
Hotspot On	Held-to-Ear		LTE Band 41 PC3	0	2	1	
Held-to-Ear	Hotspot On		LTE Band 41 PC3	0	1	1	
Grip	Held-to-Ear		LTE Band 41 PC3	0	5	1	
Held-to-Ear	Grip		LTE Band 41 PC3	0	1	1	
Hotspot On	Grip	Held-to-Ear	LTE Band 41 PC3	0	2	2	1
Hotspot On	Held-to-Ear	Grip	LTE Band 41 PC3	0	2	1	1
Grip	Held-to-Ear	Hotspot On	LTE Band 41 PC3	0	5	1	1
Grip	Hotspot On	Held-to-Ear	LTE Band 41 PC3	0	5	2	1
Held-to-Ear	Grip	Hotspot On	LTE Band 41 PC3	0	1	1	1
Held-to-Ear	Hotspot On	Grip	LTE Band 41 PC3	0	1	1	1
Hotspot On			LTE Band 41 PC2	0	2		
Grip			LTE Band 41 PC2	0	5		
Held-to-Ear			LTE Band 41 PC2	0	1		
Hotspot On	Grip		LTE Band 41 PC2	0	2	2	
Grip	Hotspot On		LTE Band 41 PC2	0	5	2	
Hotspot On	Held-to-Ear		LTE Band 41 PC2	0	2	1	
Held-to-Ear	Hotspot On		LTE Band 41 PC2	0	1	1	
Grip	Held-to-Ear		LTE Band 41 PC2	0	5	1	
Held-to-Ear	Grip		LTE Band 41 PC2	0	1	1	
Hotspot On	Grip	Held-to-Ear	LTE Band 41 PC2	0	2	2	1
Hotspot On	Held-to-Ear	Grip	LTE Band 41 PC2	0	2	1	1
Grip	Held-to-Ear	Hotspot On	LTE Band 41 PC2	0	5	1	1
Grip	Hotspot On	Held-to-Ear	LTE Band 41 PC2	0	5	2	1
Held-to-Ear	Grip	Hotspot On	LTE Band 41 PC2	0	1	1	1
Held-to-Ear	Hotspot On	Grip	LTE Band 41 PC2	0	1	1	1
Hotspot On			LTE Band 48	0	2		
Held-to-Ear			LTE Band 48	0	1		
Hotspot On	Held-to-Ear		LTE Band 48	0	2	1	
Held-to-Ear	Hotspot On		LTE Band 48	0	1	1	

*Note: This device uses different Device State Indices (DSI) to configure different time averaged power levels based on certain exposure scenarios. For this device, DSI = 5 represents the case when the grip sensor is active, DSI = 1 represents the case where the device is held to ear, and DSI = 2 represents the case when hotspot mode is active. DSI = 0 is configured at max power when the device cannot detect the use condition.

Table G-2
Power Measurement Verification for Main Antenna – NR FR1 Bands

Mechanism(s)		Mode/Band	Device State Index (DSI)		
1st	2nd		Un-triggered (Max)	Mechanism #1 (Reduced)	Mechanism #2 (Reduced)
Hotspot On		NR FDD Band n66	0	2	
Grip		NR FDD Band n66	0	5	
Hotspot On	Grip	NR FDD Band n66	0	2	2
Grip	Hotspot On	NR FDD Band n66	0	5	2
Hotspot On		NR FDD Band n25	0	2	
Grip		NR FDD Band n25	0	5	
Hotspot On	Grip	NR FDD Band n25	0	2	2
Grip	Hotspot On	NR FDD Band n25	0	5	2
Hotspot On		NR FDD Band n2	0	2	
Grip		NR FDD Band n2	0	5	
Hotspot On	Grip	NR FDD Band n2	0	2	2
Grip	Hotspot On	NR FDD Band n2	0	5	2
Held-to-Ear		NR TDD Band n41	0	1	
Held-to-Ear		NR TDD Band n77	0	1	

*Note: This device uses different Device State Indices (DSI) to configure different time averaged power levels based on certain exposure scenarios. For this device, DSI = 5 represents the case when the grip sensor is active, DSI = 1 represents the case where the device is held to ear, and DSI = 2 represents the case when hotspot mode is active. DSI = 0 is configured at max power when the device cannot detect the use condition.

Table G-3
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	12	15	8
Grip	Phablet - Back Side	High	13	15	11
Grip	Phablet - Left Edge	High	7	10	7

*Note: Mid band refers to: CDMA BC1, UMTS B2/4, LTE B2/4/25/66, NR Band n25/66; High band refers to: LTE B7/30/41

G.4 WIFI Verification Summary

Table G-4
Power Measurement Verification WIFI

Mechanism(s)	Mode/Band	Conducted Power (dBm)	
1st		Un-triggered (Max)	Mechanism #1 (Reduced)
Held-to-Ear	802.11b	20.94	14.74
Held-to-Ear	802.11g	19.21	14.02
Held-to-Ear	802.11n (2.4GHz)	18.30	14.64
Held-to-Ear	802.11a	16.13	10.08
Held-to-Ear	802.11n (5GHz, 20MHz BW)	18.00	10.97
Held-to-Ear	802.11ac (20MHz BW)	15.41	10.13
Held-to-Ear	802.11n (5GHz, 40MHz BW)	17.04	11.00
Held-to-Ear	802.11ac (40MHz BW)	15.76	10.94
Held-to-Ear	802.11ac (80MHz BW)	13.00	9.57

Table G-5
Power Measurement Verification – Bluetooth

Mechanism(s)	Mode/Band	Conducted Power (dBm)	
1st		Un-triggered (Max)	Mechanism #1 (Reduced)
Held-to-Ear	2.4 GHz Bluetooth	14.94	12.42