Appendix H. – Power reduction verification

Per the May 2017 TCBC Workshop notes, demonstration of proper functioning of the power reduction mechanism is required to support the corresponding SAR Configurations.

The verification process was divided into two parts:

1) Evaluation of output power levels for individual triggering mechanism

2) Evaluation of the triggering distances for proximity-based sensors.

1. Power Reduction Verification for Main Ant#1

The Power verification was performed according to the following procedure:

1. A base station simulator was used to establish a conducted RF connection and output power was monitored. The Power measurements were conformed 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. Step 1 and 2 were repeated for all individual power reduction mechanism and combinations thereof. For the combination cases, one mechanism was switched to a “triggered” state at a time; powers were conformed to be within tolerance after each additional mechanism was activated.

Main Antenna Verification Summary

Mechanism(s)	Mode/Band	Power reduction Mechanism(dBm)		
		Un-triggered (Max Power)	Triggered (Reduced Power)	Triggered (Reduced Power)
Grip	LTE Band 41	23.08		19.98
Hotspot On	LTE Band 41	23.08	20.02	
Hotspot On, Then Grip	LTE Band 41	23.08	20.02	19.98
Grip, then Hotspot On	LTE Band 41	23.08	19.98	19.98

1.1. Distance Verification Procedure

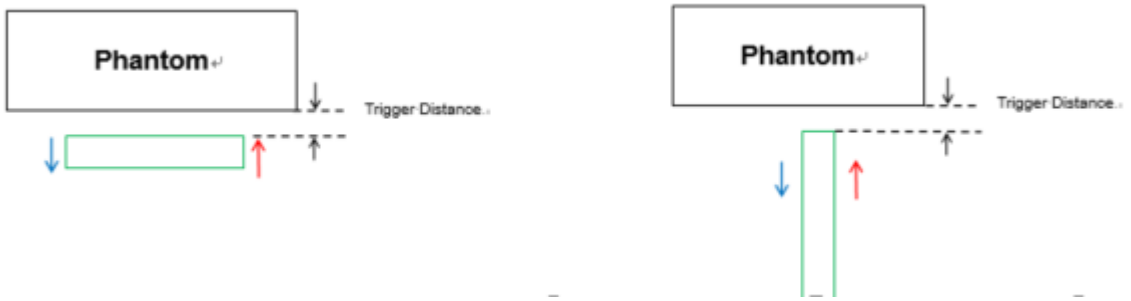
Procedures for determining proximity sensor triggering distances

(KDB 616217D04v01r02§6.2)

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. Each applicable test position was evaluated. The distance was conformed to be the same or larger (more conservative) than the minimum distances provided by the manufacturer.
3. Step 1 and 2 were repeated for the relevant modes, as appropriate
4. Steps1 through 3 were repeated for all distance-based power reduction mechanisms.

For detailed measurement conducted power results, please refer to the Section .11



Proximity Sensor Trigger Distance Assessment KDB 616217 D04§6.2

LEGEND

→ Direction of DUT travel for determination of power reduction triggering point

→ Direction of DUT travel for determination of full power resumption triggering point

Main Ant#1

Tissue simulating liquid	Triggering Distance							
	Rear		Front		Left		Bottom	
	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]
2600 MHz Tissue	16	17	3	4	4	5	8	8

Distance Measurement verification for Proximity sensor

Rear side (Main Ant#1) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	21[mm]	20[mm]	19[mm]	18[mm]	17[mm]	16[mm]	15[mm]	14[mm]	13[mm]	12[mm]
LTE Band 41	23.03	22.92	23.01	23.03	22.94	20.1	19.97	20.04	20.03	20.02

Rear side (Main Ant#1) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	13[mm]	14[mm]	15[mm]	16[mm]	17[mm]	18[mm]	19[mm]	20[mm]	21[mm]	22[mm]
LTE Band 41	20.03	19.98	20.09	20.03	20.02	22.97	22.91	22.94	22.95	23.01

Based on the most conservative measured triggering distance of 16mm, additional Phablet SAR measurements were required at 15mm from rear side for the above modes.

Front side (Main Ant#1) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	9[mm]	8[mm]	7[mm]	6[mm]	5[mm]	4[mm]	3[mm]	2[mm]	1[mm]	0[mm]
LTE Band 41	23.07	23.04	22.94	22.91	22.95	23.02	20.03	19.98	20.08	19.9

Front side (Main Ant#1) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	0mm	1[mm]	2[mm]	3[mm]	4[mm]	5[mm]	6[mm]	7[mm]	8[mm]	9[mm]
LTE Band 41	19.94	19.97	19.95	20.03	19.95	22.91	22.96	22.95	23.03	23.05

Based on the most conservative measured triggering distance of 3mm, additional Phablet SAR measurements were required at 2mm from Front side for the above modes.

Left side (Main Ant#1) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	9[mm]	8[mm]	7[mm]	6[mm]	5[mm]	4[mm]	3[mm]	2[mm]	1[mm]	0[mm]
LTE Band 41	23.03	22.91	22.96	22.997	23.03	20.04	20.02	19.96	20.03	19.93

Left side (Main Ant#1) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	1[mm]	2[mm]	3[mm]	4[mm]	5[mm]	6[mm]	7[mm]	8[mm]	9[mm]	10[mm]
LTE Band 41	19.56	20.01	19.97	20.05	20.02	23.06	22.98	22.99	23.01	23.11

Based on the most conservative measured triggering distance of 4mm, additional Phablet SAR measurements were required at 3mm from Left side for the above modes.

Bottom side (Main Ant#1) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	13[mm]	12[mm]	11[mm]	10[mm]	9[mm]	8[mm]	7[mm]	6[mm]	5[mm]	4[mm]
LTE Band 41	22.99	23.09	23.07	22.96	22.98	20.01	20.06	20.04	19.97	20.03

Bottom side (Main Ant#1) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	4[mm]	5[mm]	6[mm]	7[mm]	8[mm]	9[mm]	10[mm]	11[mm]	12[mm]	13[mm]
LTE Band 41	19.97	20.01	19.96	20.04	20.08	23.03	22.97	22.91	22.93	22.99

Based on the most conservative measured triggering distance of 8mm, additional Phablet SAR measurements were required at 7mm from Bottom side for the above modes.

1.2 Proximity Sensor Coverage for SAR measurements

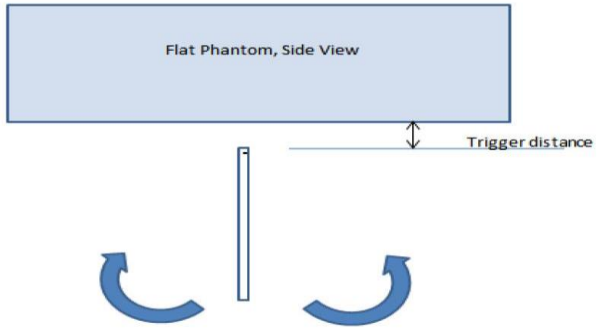
(KDB 616217 D04v01r02§6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

1.3 Proximity Sensor Tilt Angle Assessment

(KDB 616217 D04v01r02 §6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Left side parallel to the base of the flat phantom for each band. The EUT was rotated about Bottom side for angles up to ±45°. If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up±45°.



Proximity sensor tilt angle assessment (For Main Ant #1) KDB 616217 §6.4

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Bottom side for Main Ant#1)

Tissue	Minimum distance At which power reduction was maintained over-45°	Power reduction status										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
2600 MHz Tissue	8mm	On	On	On	On	On	On	On	On	On	On	On

1.4 Resulting test positions for Phablet SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance [mm]	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Phablet SAR [mm]
WWAN (LTE Band 41)	Rear	16	N/A	N/A	15
	Front	3	N/A	N/A	2
	Left	4	N/A	N/A	3
	Bottom	8	N/A	N/A	7

Note:FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device when being used in phablet use conditions

*There is no proximity sensor on the Right side of the device

**The power reduction stayed ‘on’ for the tilt angle assessment of +/-45°.

2. Power reduction Verification for RCV-ON

This device uses a power reduction mechanism for SAR compliance for operations during voice held to ear scenarios.

When a user makes or receives a voice call for Main Ant#1 the audio of the call is sent through the Receiver at the top of the device will trigger the Power reduction for Main Ant#1
(i.e. reducing output power for Head SAR compliance)

Detailed descriptions of the power reduction mechanism are included in the Main operational description document

Main Ant#1

Condition For Power reduction	Wireless Technologies	Power reduction Mechanism(dBm)	
		Un-Triggered (Max Power)	Triggered (Reduced Power)
RCV-on	WCDMA Band 5	24.38	21.48

3. Power reduction Verification for WLAN Ant

This device uses a power reduction mechanism for SAR compliance for WLAN operations during voice or VoIP held to ear scenarios.

When a user makes or receives a WLAN voice or WLAN VOIP call for WLAN Ant the audio of the call is sent through the Receiver at the top of the device will trigger the Power reduction for WLAN Ant (i.e. reducing output power for Head SAR compliance)

Detailed descriptions of the power reduction mechanism are included in the Main operational description document

Power Measurement Verification for WLAN Ant

Condition For Power reduction	Wireless Technologies	Conducted Power[dBm]	
		Un-Triggered (Max Power)	Triggered (Reduced Power)
RCV-on	2.4GHz 802.11b	17.31	12.17
RCV-on	2.4GHz 802.11g	13.89	11.63
RCV-on	2.4GHz 802.11n	14.40	11.65
RCV-on	5GHz 802.11a	15.61	10.73
RCV-on	5GHz 802.11n 20MHz	14.89	10.58
RCV-on	5GHz 802.11n 40MHz	14.09	10.78
RCV-on	5GHz 802.11ac 20MHz	14.93	10.81
RCV-on	5GHz 802.11ac 40MHz	13.81	10.32
RCV-on	5GHz 802.11ac 80MHz	11.06	10.46