

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, 2

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.

Power Reduction Verification for Main Ant. 1, 2

Mechanism(s)	Mode/Band	Power reduction Mechanism		
		Un-triggered (Max Power)	Triggered (Reduced Power)	Triggered (Reduced Power)
Grip	GSM Band 850	33.26		29.20
Grip	GSM Band 1900	30.22		27.28
Grip	UMTS Band 2	24.20		21.26
Grip	UMTS Band 4	24.37		21.42
Grip	LTE Band 2	24.07		22.44
Grip	LTE Band 4	23.96		22.21
Grip	LTE Band 7	23.23		21.88
Grip	LTE Band 25	24.08		22.29
Grip	LTE Band 30	22.95		21.96
Grip	LTE Band 38	23.93		20.46
Grip	LTE Band 41	23.92		19.30
Grip	LTE Band 41 (HPUE)	25.17		21.44
Grip	LTE Band 66	24.25		22.35
Grip	NR Band n2	23.73		21.01
Grip	NR Band n25	23.72		20.99
Grip	NR Band n30	22.88		21.37
Grip	NR Band n41	23.02		17.02
Grip	NR Band n41 (HPUE)	25.47		17.01
Grip	NR Band n66	23.51		21.56
Grip	NR Band n70	24.73		22.27
Hotspot On	GSM Band 850	33.10	29.18	
Hotspot On	GSM Band 1900	30.36	27.36	
Hotspot On	UMTS Band 2	24.14	21.17	
Hotspot On	UMTS Band 4	24.30	21.34	
Hotspot On	LTE Band 2	24.03	22.29	
Hotspot On	LTE Band 4	23.92	22.29	
Hotspot On	LTE Band 7	23.12	21.86	
Hotspot On	LTE Band 25	24.00	22.45	
Hotspot On	LTE Band 30	23.01	21.87	
Hotspot On	LTE Band 38	23.94	20.46	
Hotspot On	LTE Band 41	23.84	19.20	
Hotspot On	LTE Band 41 (HPUE)	25.19	21.40	
Hotspot On	LTE Band 66	24.29	22.41	
Hotspot On	NR Band n2	23.69	21.17	
Hotspot On	NR Band n25	23.83	21.08	
Hotspot On	NR Band n30	22.80	21.37	
Hotspot On	NR Band n41	23.15	17.05	
Hotspot On	NR Band n41 (HPUE)	25.55	17.03	
Hotspot On	NR Band n66	23.59	21.47	
Hotspot On	NR Band n70	24.72	22.26	
Hotspot On, Then Grip	GSM Band 850	33.20	29.13	29.19
Hotspot On, Then Grip	GSM Band 1900	30.38	27.41	27.36
Hotspot On, Then Grip	UMTS Band 2	24.24	21.17	21.20
Hotspot On, Then Grip	UMTS Band 4	24.28	21.40	21.33
Hotspot On, Then Grip	LTE Band 2	24.08	22.28	22.41
Hotspot On, Then Grip	LTE Band 4	23.92	22.31	22.31
Hotspot On, Then Grip	LTE Band 7	23.10	21.87	21.95
Hotspot On, Then Grip	LTE Band 25	24.08	22.35	22.40
Hotspot On, Then Grip	LTE Band 30	22.91	21.87	21.88
Hotspot On, Then Grip	LTE Band 38	23.98	20.46	20.47
Hotspot On, Then Grip	LTE Band 41	23.90	19.30	19.29
Hotspot On, Then Grip	LTE Band 41 (HPUE)	25.15	21.43	21.47
Hotspot On, Then Grip	LTE Band 66	24.09	22.45	22.40
Hotspot On, Then Grip	NR Band n2	23.73	21.07	21.08
Hotspot On, Then Grip	NR Band n25	23.70	21.00	21.00
Hotspot On, Then Grip	NR Band n30	22.91	21.25	21.35
Hotspot On, Then Grip	NR Band n41	23.12	17.04	17.02
Hotspot On, Then Grip	NR Band n41 (HPUE)	25.65	17.03	17.02

Hotspot On, Then Grip	NR Band n66	23.68	21.47	21.54
Hotspot On, Then Grip	NR Band n70	24.77	22.16	22.15
Grip Then Hotspot on	UMTS Band 2	33.1	29.23	29.23
Grip Then Hotspot on	UMTS Band 4	30.29	27.43	27.40
Grip Then Hotspot on	LTE Band 2	24.29	21.20	21.24
Grip Then Hotspot on	LTE Band 4	24.20	21.47	21.32
Grip Then Hotspot on	LTE Band 7	24.02	22.37	22.31
Grip Then Hotspot on	LTE Band 25	23.96	22.31	22.26
Grip Then Hotspot on	LTE Band 30	23.09	21.83	21.91
Grip Then Hotspot on	LTE Band 38	23.99	22.41	22.30
Grip Then Hotspot on	LTE Band 41	22.99	21.83	21.96
Grip Then Hotspot on	LTE Band 41 (HPUE)	24.01	20.38	20.48
Grip Then Hotspot on	LTE Band 66	25.29	21.34	21.43
Grip Then Hotspot on	NR Band n2	22.24	20.65	20.80
Grip Then Hotspot on	NR Band n25	24.15	22.38	22.41
Grip Then Hotspot on	NR Band n30	23.78	21.17	21.08
Grip Then Hotspot on	NR Band n41	23.83	17.10	17.01
Grip Then Hotspot on	NR Band n41 (HPUE)	25.32	17.09	17.08
Grip Then Hotspot on	NR Band n66	25.49	20.83	20.88
Grip Then Hotspot on	NR Band n70	23.04	22.75	22.84

when Hotspot Mode (RSI=3), Grip sensor (RSI=2) and Ear-jack mode(RSI=1) are triggered at the same time, RSI =3(Hotspot) takes higher priority. The Priority for power reduction was given in the order of hotspot(RSI=3), ear-jack.(RSI=1), and grip sensor On (RSI=2).

1.1. Distance Verification Procedure

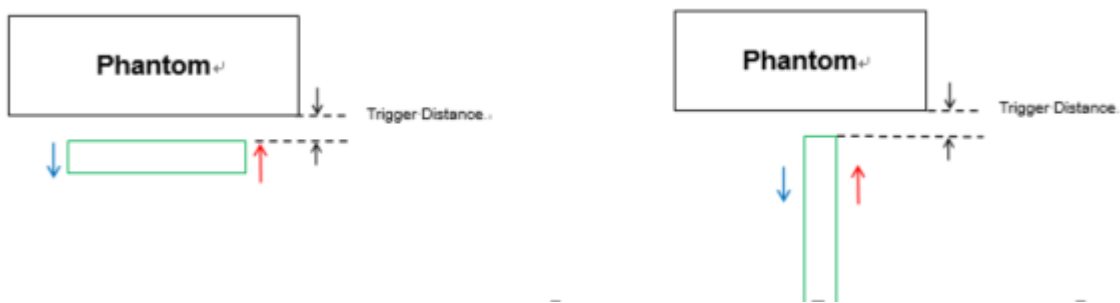
Procedures for determining proximity sensor triggering distances

(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. Steps 1 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, 2

Tissue simulating liquid	Triggering Distance					
	Rear		Front		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]
750 MHz Tissue	17	18	5	6	13	14
835 MHz Tissue	17	18	5	6	13	14
1 640 MHz Tissue	17	18	5	6	13	14
1 800 MHz Tissue	17	18	5	6	13	14
1 900 MHz Tissue	17	18	5	6	13	14
2 300 MHz Tissue	17	18	5	6	13	14
2 600 MHz Tissue	17	18	5	6	13	14

Distance Measurement verification for Proximity sensor

Rear side (Main Ant. 1, 2) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	22[mm]	21[mm]	20[mm]	19[mm]	18[mm]	17[mm]	16[mm]	15[mm]	14[mm]	13[mm]
NR Band n41	23.10	23.00	23.14	23.03	23.00	17.08	17.12	17.04	17.06	17.16
NR Band n41 (HPUE)	25.59	25.42	25.50	25.42	25.49	17.16	17.05	17.10	17.11	17.12

Rear side (Main Ant. 1, 2) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	14[mm]	15[mm]	16[mm]	17[mm]	18[mm]	19[mm]	20[mm]	21[mm]	22[mm]	23[mm]
NR Band n41	17.19	17.20	17.01	17.08	17.12	23.17	23.07	23.15	23.05	23.04
NR Band n41 (HPUE)	17.06	17.05	17.14	17.07	17.02	25.57	25.49	25.30	25.40	25.54

Based on the most conservative measured triggering distance of 17mm, additional Phablet SAR measurements were required at 16mm from rear side for the above modes.

Front side (Main Ant. 1, 2) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	10[mm]	9[mm]	8[mm]	7[mm]	6[mm]	5[mm]	4[mm]	3[mm]	2[mm]	1[mm]
GSM Band 850	33.13	33.13	33.10	33.08	33.14	29.14	29.12	29.06	29.09	29.06
GSM Band 1900	30.13	30.18	30.26	30.30	30.29	27.40	27.31	27.25	27.52	27.42
UMTS Band 2	24.23	24.16	24.21	24.23	24.16	21.18	21.10	21.18	21.14	21.10
UMTS Band 4	24.13	24.27	24.28	24.18	24.22	21.43	21.36	21.39	21.30	21.29
LTE Band 2	23.98	23.87	23.81	23.97	23.95	22.35	22.32	22.45	22.40	22.36
LTE Band 4	23.93	23.90	23.81	23.82	23.94	22.12	22.29	22.33	22.21	22.16
LTE Band 7	23.16	23.21	23.15	23.17	23.08	21.86	21.82	21.83	21.68	21.67
LTE Band 25	23.96	23.91	24.03	23.91	23.89	22.32	22.34	22.32	22.25	22.22
LTE Band 30	22.86	22.93	22.98	22.94	22.83	21.81	21.80	21.80	21.97	21.90
LTE Band 38	23.94	24.05	24.00	24.01	23.90	20.23	20.34	20.41	20.35	20.29
LTE Band 41	23.89	23.84	23.81	23.73	23.90	19.26	19.16	19.28	19.28	19.22
LTE Band 41 (HPUE)	25.12	25.13	25.23	25.16	25.10	21.21	21.26	21.32	21.35	21.33
LTE Band 66	24.26	24.17	24.12	24.05	24.17	22.42	22.23	22.29	22.41	22.31
NR Band n2	23.75	23.57	23.58	23.62	23.57	21.16	20.98	21.14	21.08	21.05
NR Band n25	23.78	23.75	23.77	23.64	23.61	21.01	20.91	20.90	21.00	20.99
NR Band n30	22.76	22.81	22.74	22.76	22.78	21.30	21.36	21.25	21.32	21.28
NR Band n41	23.09	22.91	23.07	22.98	22.91	17.17	17.19	16.95	17.24	17.16
NR Band n41 (HPUE)	25.55	25.54	25.41	25.53	25.46	17.23	17.05	17.18	17.25	17.18
NR Band n66	23.56	23.58	23.54	23.61	23.53	21.42	21.47	21.43	21.33	21.32
NR Band n70	24.61	24.54	24.69	24.57	24.53	22.21	22.18	22.19	22.27	22.22

Front side (Main Ant. 1, 2) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	2[mm]	3[mm]	4[mm]	5[mm]	6[mm]	7[mm]	8[mm]	9[mm]	10[mm]	11[mm]
GSM Band 850	29.23	29.21	29.16	29.22	29.19	33.04	33.06	33.16	33.14	33.08
GSM Band 1900	27.35	27.31	27.38	27.37	27.25	30.33	30.13	30.20	30.25	30.31
UMTS Band 2	21.19	21.16	21.17	21.23	21.22	24.11	24.21	24.16	24.18	24.28
UMTS Band 4	21.56	21.49	21.39	21.30	21.34	24.29	24.27	24.19	24.27	24.17
LTE Band 2	22.33	22.30	22.27	22.26	22.31	23.99	24.00	24.03	23.83	24.01
LTE Band 4	22.36	22.30	22.28	22.30	22.15	23.88	23.91	23.98	23.87	23.83
LTE Band 7	21.96	21.93	21.90	21.77	21.90	23.06	23.21	23.12	23.22	23.16
LTE Band 25	22.40	22.31	22.38	22.45	22.28	23.95	23.97	23.95	23.94	23.87
LTE Band 30	21.86	21.77	21.87	21.91	21.77	22.90	22.94	22.86	22.82	22.84
LTE Band 38	20.45	20.38	20.27	20.31	20.43	23.92	24.06	23.95	24.07	23.91
LTE Band 41	19.24	19.20	19.13	19.14	19.13	23.84	23.88	23.79	23.82	23.79
LTE Band 41 (HPUE)	21.29	21.28	21.29	21.34	21.23	25.11	25.11	25.21	25.13	25.15
LTE Band 66	22.42	22.32	22.32	22.43	22.33	24.10	24.15	24.15	24.04	24.13
NR Band n2	21.20	21.10	21.02	21.14	21.02	23.56	23.55	23.68	23.73	23.56
NR Band n25	21.09	21.08	20.94	20.99	20.93	23.81	23.71	23.75	23.73	23.64
NR Band n30	21.28	21.20	21.38	21.32	21.32	22.79	22.78	22.82	22.72	22.78
NR Band n41	17.29	17.2	16.96	17.07	17.04	23.15	23.01	23.13	22.99	23.03
NR Band n41 (HPUE)	17.07	16.97	17.18	17.02	16.95	25.53	25.54	25.53	25.52	25.53
NR Band n66	21.44	21.37	21.48	21.58	21.33	23.44	23.57	23.51	23.48	23.63
NR Band n70	22.18	22.13	22.10	22.22	22.05	24.66	24.64	24.56	24.73	24.56

Based on the most conservative measured triggering distance of 5mm, additional Phablet SAR measurements were required at 4mm from front side for the above modes.

Bottom side (Main Ant. 2) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	18[mm]	17[mm]	16[mm]	15[mm]	14[mm]	13[mm]	12[mm]	11[mm]	10[mm]	9[mm]
NR Band n41	23.03	23.07	23.11	23.09	23.03	17.07	17.08	17.17	17.15	17.00
NR Band n41 (HPUE)	25.59	25.41	25.61	25.62	25.50	16.89	16.98	16.97	17.12	17.03

Bottom side (Main Ant. 2) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	10[mm]	11[mm]	12mm]	13[mm]	14[mm]	15[mm]	16[mm]	17[mm]	18[mm]	19[mm]
NR Band n41	17.12	17.04	16.91	16.95	17.02	23.07	23.09	23.04	23.04	23.09
NR Band n41 (HPUE)	17.03	17.06	16.96	16.95	17.13	25.58	25.58	25.56	25.41	25.55

Based on the most conservative measured triggering distance of 13mm, additional Phablet SAR measurements were required at 12mm from bottom side for the above modes.

1.2 Proximity Sensor Coverage for SAR measurements

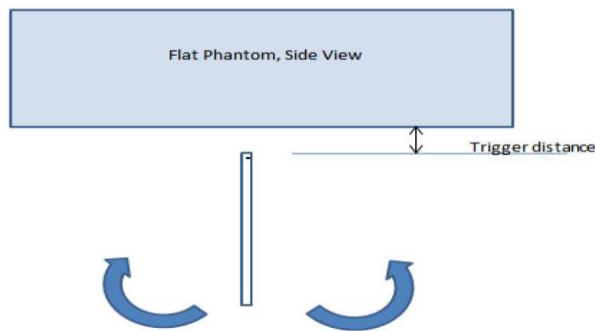
(KDB 616217 D04v01r02§6.3)

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 $\pm 45^\circ$. 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 to $\pm 45^\circ$.



Proximity sensor tilt angle assessment (Bottom For Main Ant #2) KDB 616217 §6.4

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Bottom side for Main Ant.#1,2)

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°	
2 600 MHz Tissue	13mm	On	On	On	On	On	On	On	On	On	On	On	On

2. Power Reduction Verification for Sub Ant. 3

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, the audio of the call is sent through the Receiver at the top of the device will trigger the Power reduction for Sub Ant. 3 (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 Reduction Verification for Sub Ant. 3

Mechanism(s)	Mode/Band	Power reduction Mechanism	
		Un-Triggered (Max Power)	Triggered (Reduced Power)
RCV-on	NR Band n48	23.15	13.54