

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.

1. Power Reduction Verification for Main Ant

This device utilizes a power reduction mechanism for some wireless modes and bands for SAR compliance under hotspot conditions and under some conditions when the device is being used in close proximity to the user's hand for Main Ant

The Grip sensor power reduction applied to this product has a higher priority than the proximity sensor, so these two conditions do not work simultaneously. and In both cases, powers were reduced to the same Power level.

All Hotspot SAR evaluations for this device were performed at the maximum allowed output Power when Hotspot is activated. FCC KDB Publication 616217D04v01r02 section 6 was used as a guideline for selection SAR test distances for this device when being used in phablet use conditions. For detailed measurement conducted power results, please refer to the Section .11

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.

1.1. Power Verification Procedure for Main Ant

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 Bands

Mechanism(s)	Mode/Band	Conducted Power (dBm)		
		Un-triggered (Max Power)	Triggered (Reduced Power)	Triggered (Reduced Power)
Grip	GSM1900 Voice	30.50	27.28	
Grip	GPRS1900 1Tx	30.51	27.22	
Grip	GPRS1900 2Tx	28.33	24.83	
Grip	GPRS1900 3Tx	26.01	22.97	
Grip	GPRS1900 4Tx	24.16	21.34	
Grip	WCDMA 2	21.72	18.29	
Grip	WCDMA 4	22.63	19.14	
Grip	LTE Band 2	22.53	18.91	
Grip	LTE Band 4	22.67	19.17	
Grip	LTE Band 25	22.45	18.87	
Grip	LTE Band 41 (Powerclass 3)	22.67	21.63	
Grip	LTE Band41 (Powerclass 2)	24.46	21.58	
Grip	LTE Band 66	22.93	19.31	
Hotspot	GSM1900 Voice	30.50	27.22	
Hotspot	GPRS1900 1Tx	30.51	27.22	
Hotspot	GPRS1900 2Tx	28.33	24.79	
Hotspot	GPRS1900 3Tx	26.01	22.96	
Hotspot	GPRS1900 4Tx	24.16	21.29	
Hotspot	WCDMA 2	21.72	18.25	
Hotspot	WCDMA 4	22.63	19.08	
Hotspot	LTE Band 2	22.53	18.92	
Hotspot	LTE Band 4	22.67	19.14	
Hotspot	LTE Band 25	22.45	18.83	
Hotspot	LTE Band 41 (Powerclass 3)	22.67	21.56	
Hotspot	LTE Band41 (Powerclass 2)	24.46	21.55	
Hotspot	LTE Band 66	22.93	19.24	
Hotspot On, Then Grip	GSM1900 Voice	30.50	27.22	27.28
Hotspot On, Then Grip	GPRS1900 1Tx	30.51	27.22	27.22

Hotspot On, Then Grip	GPRS1900 2Tx	28.33	24.79	24.83
Hotspot On, Then Grip	GPRS1900 3Tx	26.01	22.96	22.97
Hotspot On, Then Grip	GPRS1900 4Tx	24.16	21.29	21.34
Hotspot On, Then Grip	WCDMA 2	21.72	18.25	18.29
Hotspot On, Then Grip	WCDMA 4	22.63	19.08	19.14
Hotspot On, Then Grip	LTE Band 2	22.53	18.92	18.91
Hotspot On, Then Grip	LTE Band 4	22.67	19.14	19.17
Hotspot On, Then Grip	LTE Band 25	22.45	18.83	18.87
Hotspot On, Then Grip	LTE Band 41 (Powerclass 3)	22.67	21.56	21.63
Hotspot On, Then Grip	LTE Band41 (Powerclass 2)	24.46	21.55	21.58
Hotspot On, Then Grip	LTE Band 66	22.93	19.24	19.31
Grip, then Hotspot On	GSM1900 Voice	30.50	27.28	27.22
Grip, then Hotspot On	GPRS1900 1Tx	30.51	27.22	27.22
Grip, then Hotspot On	GPRS1900 2Tx	28.33	24.83	24.79
Grip, then Hotspot On	GPRS1900 3Tx	26.01	22.97	22.96
Grip, then Hotspot On	GPRS1900 4Tx	24.16	21.34	21.29
Grip, then Hotspot On	WCDMA 2	21.72	18.29	18.25
Grip, then Hotspot On	WCDMA 4	22.63	19.14	19.08
Grip, then Hotspot On	LTE Band 2	22.53	18.91	18.92
Grip, then Hotspot On	LTE Band 4	22.67	19.17	19.14
Grip, then Hotspot On	LTE Band 25	22.45	18.87	18.83
Grip, then Hotspot On	LTE Band 41 (Powerclass 3)	22.67	21.63	21.56
Grip, then Hotspot On	LTE Band41 (Powerclass 2)	24.46	21.58	21.55
Grip, then Hotspot On	LTE Band 66	22.93	19.31	19.24

1.2. Procedures for determining proximity sensor triggering distances

(KDB 616217 D04v01r02 §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 were 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 .9



Proximity Sensor Trigger Distance Assessment KDB 616217 D04 §6.2 (Rear /Front/Bottom)

LEGEND

- Direction of DUT travel for determination of power reduction triggering point
- Direction of DUT travel for determination of full power resumption triggering point

Tissue simulating liquid	Trigger distance - Rear (mm)		Trigger distance - Front(mm)		Trigger distance - Bottom(mm)	
	Moving toward phantom	Moving Away from phantom	Moving toward phantom	Moving Away from phantom	Moving toward phantom	Moving Away from phantom
1750Mhz	9	12	7	10	13	15
1900Mhz	9	12	7	10	13	15
2600MHz	9	12	7	10	13	15

Distance Measurement verification for Proximity sensor

Rear side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	14	13	12	11	10	9	8	7	6	5
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
GSM1900 Voice	30.58	30.57	30.4	30.53	30.52	27.34	27.32	27.33	27.19	27.36
GPRS1900 1Tx	30.60	30.51	30.51	30.46	30.46	27.25	27.21	27.26	27.15	27.15
GPRS1900 2Tx	28.36	28.28	28.42	28.42	28.24	24.76	24.79	24.8	24.85	24.93
GPRS1900 3Tx	26.06	25.97	26.11	26.11	26.09	22.98	22.98	23.06	23.06	23.01
GPRS1900 4Tx	24.09	24.17	24.23	24.1	24.07	21.43	21.35	21.33	21.36	21.31
WCDMA 2	21.74	21.68	21.80	21.73	21.75	18.34	18.39	18.35	18.35	18.28
WCDMA 4	22.70	22.60	22.66	22.69	22.66	19.07	19.07	19.21	19.14	19.18
LTE Band 2	22.59	22.54	22.58	22.57	22.52	18.93	18.88	18.92	18.91	18.92
LTE Band 4	22.6	22.62	22.67	22.65	22.59	19.21	19.16	19.15	19.08	19.26
LTE Band 25	22.39	22.52	22.43	22.53	22.46	18.81	18.77	18.82	18.86	18.85
LTE Band 41 (Powerclass 3)	22.77	22.74	22.63	22.69	22.71	21.67	21.69	21.72	21.56	21.58
LTE Band41 (Powerclass 2)	24.39	24.52	24.55	24.45	24.47	21.48	21.49	21.57	21.63	21.65
LTE Band 66	22.95	22.97	23.01	22.85	22.86	19.21	19.36	19.41	19.36	19.26

Rear side – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	8	9	10	11	12	13	14	15	16	17
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
GSM1900 Voice	27.19	27.29	27.21	27.21	27.25	30.47	30.41	30.53	30.54	30.56
GPRS1900 1Tx	27.12	27.25	27.25	27.17	27.31	30.58	30.44	30.59	30.42	30.53
GPRS1900 2Tx	24.82	24.9	24.82	24.80	24.79	28.26	28.39	28.34	28.43	28.23
GPRS1900 3Tx	23.06	23.07	22.96	23.02	23.07	26.01	26.09	26.04	25.91	25.91
GPRS1900 4Tx	21.33	21.44	21.36	21.41	21.33	24.12	24.22	24.06	24.08	24.08
WCDMA 2	18.24	18.33	18.33	18.31	18.19	21.7	21.64	21.67	21.69	21.81
WCDMA 4	19.22	19.12	19.19	19.09	19.11	22.58	22.67	22.60	22.59	22.71
LTE Band 2	19.02	18.93	18.89	18.93	18.98	22.63	22.63	22.51	22.52	22.55
LTE Band 4	19.15	19.23	19.25	19.23	19.21	22.71	22.58	22.71	22.66	22.75
LTE Band 25	18.94	18.85	18.81	18.91	18.93	22.51	22.41	22.45	22.55	22.42
LTE Band 41 (Powerclass 3)	21.55	21.73	21.54	21.61	21.54	22.62	22.68	22.66	22.58	22.75
LTE Band41 (Powerclass 2)	21.52	21.65	21.63	21.55	21.56	24.51	24.36	24.47	24.52	24.43
LTE Band 66	19.29	19.34	19.28	19.26	19.28	22.85	22.87	22.95	22.98	22.99

Based on the most conservative measured triggering distance of 9mm, additional Phablet SAR measurements were required at 8mm from rear side for the above modes

Front side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	12	11	10	9	8	7	6	5	4	3
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
GSM1900 Voice	30.54	30.58	30.49	30.52	30.5	27.31	27.27	27.27	27.34	27.38
GPRS1900 1Tx	30.48	30.53	30.44	30.48	30.49	27.15	27.13	27.18	27.15	27.31
GPRS1900 2Tx	28.38	28.29	28.35	28.28	28.33	24.74	24.76	24.93	24.91	24.75
GPRS1900 3Tx	26.09	25.93	26.02	25.92	26.01	22.94	22.91	22.93	22.93	23.02
GPRS1900 4Tx	24.19	24.22	24.15	24.25	24.26	21.37	21.41	21.28	21.25	21.24
WCDMA 2	21.67	21.70	21.64	21.62	21.63	18.22	18.22	18.25	18.29	18.34
WCDMA 4	22.63	22.58	22.63	22.6	22.66	19.08	19.18	19.07	19.15	19.12
LTE Band 2	22.49	22.47	22.58	22.63	22.56	18.86	18.89	18.90	18.91	18.97
LTE Band 4	22.75	22.65	22.65	22.63	22.66	19.07	19.16	19.13	19.08	19.23
LTE Band 25	22.49	22.46	22.47	22.41	22.54	18.88	18.96	18.93	18.92	18.93
LTE Band 41 (Powerclass 3)	22.69	22.61	22.69	22.77	22.71	21.64	21.66	21.66	21.57	21.69
LTE Band41 (Powerclass 2)	24.47	24.41	24.49	24.36	24.46	21.56	21.55	21.65	21.54	21.49
LTE Band 66	22.98	22.95	22.89	22.99	22.99	19.33	19.39	19.29	19.28	19.32

Front side – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	6	7	8	9	10	11	12	13	14	15
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
GSM1900 Voice	27.37	27.26	27.25	27.22	27.22	30.58	30.53	30.54	30.55	30.56
GPRS1900 1Tx	27.28	27.12	27.22	27.26	27.12	30.46	30.46	30.55	30.52	30.51
GPRS1900 2Tx	24.78	24.89	24.81	24.78	24.9	28.39	28.23	28.23	28.36	28.23
GPRS1900 3Tx	23.02	23.07	23.07	22.88	22.87	25.96	26.07	25.92	26.06	25.95
GPRS1900 4Tx	21.40	21.29	21.35	21.31	21.27	24.19	24.11	24.17	24.06	24.18
WCDMA 2	18.37	18.31	18.22	18.23	18.22	21.65	21.81	21.63	21.81	21.77
WCDMA 4	19.12	19.11	19.17	19.08	19.07	22.57	22.68	22.62	22.54	22.68
LTE Band 2	18.9	18.81	18.93	18.85	18.99	22.43	22.61	22.52	22.47	22.58
LTE Band 4	19.24	19.19	19.26	19.16	19.19	22.61	22.67	22.66	22.57	22.74

LTE Band 25	18.81	18.88	18.82	18.78	18.84	22.54	22.49	22.38	22.40	22.37
LTE Band 41 (Powerclass 3)	21.58	21.56	21.61	21.7	21.63	22.58	22.58	22.63	22.77	22.63
LTE Band41 (Powerclass 2)	21.56	21.55	21.67	21.61	21.67	24.48	24.48	24.51	24.46	24.53
LTE Band 66	19.35	19.25	19.27	19.41	19.25	23.01	22.87	23.01	22.83	22.88

Based on the most conservative measured triggering distance of 7mm, additional Phablet SAR measurements were required at 6mm from Front side for the above modes

Bottom side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	18	17	16	15	14	13	12	11	10	9
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
GSM1900 Voice	30.46	30.41	30.41	30.55	30.56	27.23	27.21	27.24	27.34	27.31
GPRS1900 1Tx	30.56	30.46	30.56	30.61	30.59	27.22	27.30	27.14	27.21	27.24
GPRS1900 2Tx	28.31	28.41	28.29	28.26	28.37	24.91	24.76	24.86	24.73	24.93
GPRS1900 3Tx	26.08	25.93	26.09	25.96	25.96	22.96	22.96	22.91	22.99	23.07
GPRS1900 4Tx	24.11	24.22	24.11	24.17	24.11	21.39	21.44	21.40	21.31	21.21
WCDMA 2	21.61	21.60	21.61	21.77	21.83	18.30	18.37	18.21	18.33	18.33
WCDMA 4	22.53	22.52	22.60	22.62	22.70	19.12	19.11	19.03	19.15	19.10
LTE Band 2	22.52	22.61	22.59	22.57	22.45	18.89	18.90	18.82	18.89	19.15
LTE Band 4	22.71	22.69	22.68	22.59	22.61	19.12	19.19	19.11	19.21	19.16
LTE Band 25	22.47	22.46	22.48	22.49	22.41	18.85	18.86	18.82	18.89	18.86
LTE Band 41 (Powerclass 3)	22.67	22.76	22.57	22.57	22.68	21.66	21.63	21.71	21.56	21.64
LTE Band41 (Powerclass 2)	24.40	24.55	24.38	24.36	24.55	21.63	21.58	21.61	21.60	21.57
LTE Band 66	22.94	22.94	22.95	22.92	22.96	19.37	19.26	19.25	19.21	19.33

Bottom – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	11	12	13	14	15	16	17	18	19	20
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
GSM1900 Voice	27.34	27.21	27.19	27.18	27.31	30.56	30.49	30.44	30.56	30.60
GPRS1900 1Tx	27.29	27.12	27.27	27.28	27.21	30.56	30.52	30.42	30.56	30.51
GPRS1900 2Tx	24.89	24.87	24.76	24.77	24.77	28.38	28.33	28.23	28.32	28.25
GPRS1900 3Tx	22.88	23.01	22.96	22.92	23.06	26.01	25.91	25.99	25.93	25.92
GPRS1900 4Tx	21.39	21.33	21.39	21.32	21.38	24.11	24.06	24.23	24.21	24.19
WCDMA 2	18.31	18.39	18.29	18.33	18.31	21.64	21.63	21.66	21.79	21.72
WCDMA 4	19.14	19.12	19.04	19.18	19.13	22.57	22.58	22.66	22.61	22.72
LTE Band 2	18.90	18.84	18.94	18.84	18.91	22.48	22.55	22.54	22.59	22.55
LTE Band 4	19.09	19.18	19.09	19.19	19.08	22.57	22.65	22.71	22.68	22.71
LTE Band 25	18.85	18.97	18.97	18.95	18.97	22.43	22.52	22.44	22.48	22.55
LTE Band 41 (Powerclass 3)	21.63	21.61	21.66	21.61	21.57	22.58	22.71	22.66	22.68	22.67
LTE Band41 (Powerclass 2)	21.68	21.53	21.54	21.48	21.63	24.51	24.52	24.56	24.39	24.42
LTE Band 66	19.41	19.31	19.32	19.30	19.21	22.95	23.01	22.99	22.85	22.98

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

1.3 Proximity Sensor Coverage for SAR measurements

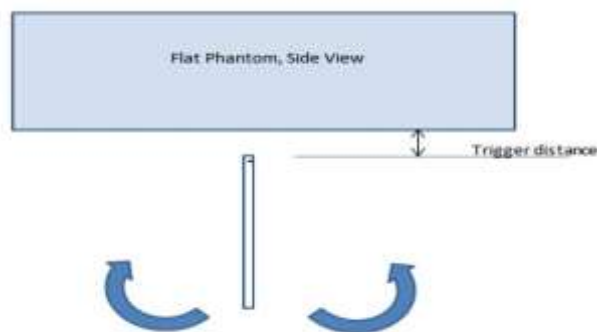
(KDB 616217 D04v01r02 §6.3)

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

1.4 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 Bottom 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 side) KDB 616217 §6.4

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Bottom side)

Band (MHz)	Minimum distance at which power reduction was maintained over-45°	Power reduction status										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
1750Mhz Muscle	13 mm	On	On	On	On	On	On	On	On	On	On	On
1900Mhz Muscle	13 mm	On	On	On	On	On	On	On	On	On	On	On
2600MHz Muscle	13 mm	On	On	On	On	On	On	On	On	On	On	On

1.5 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 (GSM1900/ WCDMA B2/B4 LTE B2,4,25,41(PC2),41(PC3),66)	Rear	9	N/A	N/A	8
	Front	7	N/A	N/A	6
	Bottom	13	N/A	N/A	12

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

2. 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)	
		Ant1	Ant2	Ant1	Ant2
RCV-on (Voice call)	2.4GHz 802.11b (Exclude 12/13ch)	18.46	19.00	16.07	15.67
RCV-on (Voice call)	5GHz 802.11a	17.00	17.15	14.23	14.11
RCV-on (Voice call)	5GHz 802.11n 20MHz	17.10	17.07	14.19	13.97
RCV-on (Voice call)	5GHz 802.11n 40MHz (Exclude 38,62,102ch)	16.46	16.67	14.51	14.39
RCV-on (Voice call)	5GHz 802.11ac 20MHz	17.08	17.16	14.35	13.81
RCV-on (Voice call)	5GHz 802.11ac 40MHz (exclude 38,62,102ch)	16.09	16.45	14.56	14.09
RCV-on (Voice call)	5GHz 802.11ac 80Hz (exclude UNII-1/UNII-2A ,106ch)	15.19	15.18	13.99	13.64
RCV-on (Voice call)	5GHz 802.11ax_20MHz (SU)	16.91	16.78	14.18	14.13
RCV-on (Voice call)	5GHz 802.11ax_40MHz (SU) (exclude 38,62,102ch)	16.50	16.62	14.34	14.02
RCV-on (Voice call)	5GHz 802.11ax_80MHz (SU) (exclude UNII-1/UNII-2A ,106ch)	14.94	14.13	14.73	14.24