

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.

A Base station simulator was used to establish a conducted RF connection and output power was monitored. The power measurements were confirmed to be within expected tolerance for all DSI. before and after a power reduction mechanism was triggered. 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

1. Power Reduction Verification Result for Main Ant

This device utilizes a power reduction mechanism for some wireless modes under DSI(Device State Index). In WWAN mode, the device operation is controlled by Smart Transmit.

For this device DSI = 0 is configured when the device cannot detect the use conditions, and DSI = 1 is configured when receiver mode on.

Band	Antenna	Free Space/ Body worn / Hotspot / Phablet	Head
		Device State Index (DSI)	
Low Band	A	0	1
Mid Band	A	0	1
Mid Band	F	0	1
High Band	A	0	1
High Band	C	0	1
Ultra High Band	G	0	1

Note:

Low Band refers to GSM850, UMTS B5, LTE B5/12/13/17/26 and NR n5.

Mid Band refers to GSM1900, UMTS B2/4, LTE B2/4/66 and NR n66.

High Band refers to LTE B41 and NR n41.

Ultra High Band refers to NR n77.

NR SRS Antennas were not evaluated due to Base station simulator restriction.

2. Power Reduction Verification for WLAN/BT ANT

Mechanism(s)	Mode/Band	Power reduction Mechanism		
		Un-triggered	Triggered	Triggered
		(Max Power)	(Reduced Power)	(Reduced Power)
Grip	2.4GHz 802.11b	18.26		15.44
Grip	2.4GHz 802.11g	16.53		15.18
Grip	2.4GHz 802.11n	16.53		15.31
Grip	2.4GHz 802.11ac20	16.55		15.31
Grip	802.11a	16.28		11.50
Grip	802.11n20	16.05		11.53
Grip	802.11ac20	16.12		11.49
Grip	802.11n40	15.63		11.54
Grip	802.11ac40	15.51		11.50
Grip	802.11ac80	14.43		11.44
RCV On	2.4GHz 802.11b	18.22	12.55	
RCV On	2.4GHz 802.11g	16.57	12.27	
RCV On	2.4GHz 802.11n	16.48	12.34	
RCV On	2.4GHz 802.11ac20	16.49	12.32	
RCV On	802.11a	16.31	11.55	
RCV On	802.11n20	16.11	11.43	
RCV On	802.11ac20	16.16	11.57	
RCV On	802.11n40	15.73	11.54	
RCV On	802.11ac40	15.43	11.44	
RCV On	802.11ac80	14.45	11.48	
RCV On, Then Grip	2.4GHz 802.11b	18.19	12.38	12.42
RCV On, Then Grip	2.4GHz 802.11g	16.43	12.25	12.37
RCV On, Then Grip	2.4GHz 802.11n	16.45	12.31	12.35
RCV On, Then Grip	2.4GHz 802.11ac20	16.46	12.36	12.30
RCV On, Then Grip	802.11a	16.33	11.47	11.51
RCV On, Then Grip	802.11n20	16.08	11.44	11.57
RCV On, Then Grip	802.11ac20	16.11	11.45	11.56
RCV On Then Grip	802.11n40	15.67	11.51	11.45
RCV On, Then Grip	802.11ac40	15.55	11.47	11.44
RCV On, Then Grip	802.11ac80	14.50	11.50	11.51
Grip Then RCV On	2.4GHz 802.11b	18.20	15.39	12.46
Grip Then RCV On	2.4GHz 802.11g	16.53	15.23	12.33
Grip Then RCV On	2.4GHz 802.11n	16.43	15.25	12.31
Grip Then RCV On	2.4GHz 802.11ac20	16.51	15.32	12.35
Grip Then RCV On	802.11a	16.25	11.50	11.42
Grip Then RCV On	802.11n20	16.11	11.56	11.44
Grip Then RCV On	802.11ac20	16.02	11.46	11.47
Grip Then RCV On	802.11n40	15.67	11.52	11.44
Grip Then RCV On	802.11ac40	15.51	11.46	11.46
Grip Then RCV On	802.11ac80	14.45	11.54	11.54

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)

And when Grip sensor on and RCV-ON mode are triggered at the same time, RCV-ON takes higher priority.

3. 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

WIFI ANT.

Tissue simulating liquid	Triggering Distance			
	Rear		Top	
	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]
2 450MHz Tissue	8	9	10	11
5 250 MHz Tissue	8	9	10	11
5 600 MHz Tissue	8	9	10	11
5 750 MHz Tissue	8	9	10	11

Distance Measurement verification for Proximity sensor

Rear side (WIFI Ant.) – 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]
802.11b	18.20	18.27	18.15	18.15	18.19	15.19	15.30	15.22	15.20	15.29
802.11g	16.45	16.48	16.49	16.46	16.47	15.31	15.37	15.40	15.34	15.35
802.11n	16.46	16.47	16.50	16.49	16.55	15.42	15.40	15.29	15.41	15.37
802.11ac20	16.46	16.44	16.51	16.55	16.53	15.25	15.15	15.42	15.14	15.21
802.11a	16.36	16.34	16.36	16.24	16.24	11.36	11.40	11.13	11.38	11.46
802.11n20	16.14	16.15	16.05	16.06	16.15	11.45	11.14	11.26	11.18	11.20
802.11ac20	16.02	16.04	16.03	16.16	16.10	11.18	11.28	11.22	11.23	11.15
802.11n40	15.70	15.74	15.62	15.74	15.75	11.46	11.41	11.45	11.25	11.13
802.11ac40	15.49	15.42	15.52	15.44	15.57	11.15	11.42	11.13	11.36	11.19
802.11ac80	14.43	14.46	14.55	14.54	14.46	11.26	11.28	11.24	11.22	11.18

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

Mode	Distance to DUT Output power (dBm)									
	5[mm]	6[mm]	7[mm]	8[mm]	9[mm]	10[mm]	11[mm]	12[mm]	13[mm]	14[mm]
802.11b	15.44	15.29	15.18	15.38	15.47	18.24	18.22	18.21	18.21	18.24
802.11g	15.37	15.13	15.19	15.26	15.13	16.52	16.44	16.44	16.56	16.46
802.11n	15.46	15.38	15.23	15.37	15.23	16.45	16.47	16.52	16.45	16.51
802.11ac20	15.28	15.31	15.14	15.28	15.33	16.53	16.45	16.49	16.46	16.44
802.11a	11.14	11.21	11.14	11.38	11.40	16.23	16.25	16.26	16.23	16.25
802.11n20	11.45	11.32	11.16	11.27	11.36	16.13	16.15	16.11	16.16	16.14
802.11ac20	11.18	11.46	11.40	11.39	11.25	16.14	16.08	16.14	16.15	16.03
802.11n40	11.47	11.39	11.47	11.19	11.36	15.63	15.68	15.70	15.71	15.74
802.11ac40	11.39	11.33	11.37	11.38	11.35	15.45	15.46	15.50	15.53	15.54
802.11ac80	11.33	11.18	11.29	11.17	11.24	14.49	14.56	14.53	14.44	14.46

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

Top side (WIFI Ant.) – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	15[mm]	14[mm]	13[mm]	12[mm]	11[mm]	10[mm]	9[mm]	8[mm]	7[mm]	6[mm]
802.11b	18.16	18.24	18.22	18.16	18.18	15.36	15.37	15.46	15.21	15.27
802.11g	16.54	16.54	16.45	16.52	16.44	15.22	15.13	15.42	15.46	15.39
802.11n	16.54	16.43	16.54	16.43	16.44	15.40	15.46	15.28	15.17	15.29
802.11ac20	16.49	16.56	16.48	16.54	16.52	15.30	15.26	15.33	15.14	15.26
802.11a	16.29	16.25	16.30	16.31	16.33	11.19	11.30	11.20	11.17	11.35
802.11n20	16.11	16.15	16.13	16.11	16.03	11.13	11.41	11.22	11.34	11.31
802.11ac20	16.08	16.10	16.08	16.08	16.03	11.13	11.40	11.36	11.32	11.21
802.11n40	15.76	15.62	15.63	15.74	15.73	11.26	11.45	11.46	11.41	11.29
802.11ac40	15.52	15.57	15.50	15.46	15.45	11.25	11.13	11.47	11.31	11.28
802.11ac80	14.45	14.47	14.43	14.47	14.53	11.35	11.22	11.47	11.43	11.36

Top side (WIFI Ant.) – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	7[mm]	8[mm]	9[mm]	10[mm]	11[mm]	12[mm]	13[mm]	14[mm]	15[mm]	16[mm]
802.11b	15.43	15.22	15.27	15.37	15.35	18.13	18.15	18.19	18.21	18.24
802.11g	15.40	15.42	15.22	15.17	15.46	16.55	16.44	16.56	16.51	16.53
802.11n	15.28	15.20	15.29	15.46	15.29	16.52	16.42	16.48	16.45	16.42
802.11ac20	15.44	15.46	15.15	15.25	15.15	16.45	16.43	16.46	16.50	16.45
802.11a	11.24	11.17	11.44	11.27	11.20	16.28	16.31	16.29	16.24	16.23
802.11n20	11.41	11.41	11.23	11.20	11.21	16.03	16.07	16.07	16.16	16.17
802.11ac20	11.18	11.40	11.41	11.34	11.34	16.09	16.06	16.14	16.15	16.07
802.11n40	11.31	11.23	11.38	11.13	11.30	15.72	15.74	15.63	15.63	15.73
802.11ac40	11.36	11.41	11.36	11.35	11.25	15.54	15.43	15.44	15.54	15.44
802.11ac80	11.28	11.39	11.29	11.38	11.41	14.46	14.46	14.50	14.50	14.52

Based on the most conservative measured triggering distance of 10mm, additional Phablet SAR measurements were required at 9mm from Top side for the above modes.

3.1 Proximity Sensor Coverage for SAR measurements

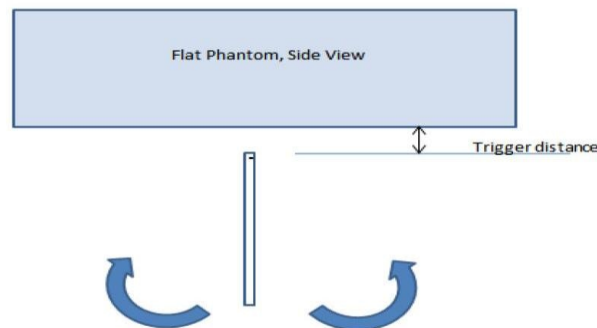
(KDB 616217 D04v01r02 § 6.3)

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

3.2 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 $\pm 45^\circ$.



Proximity sensor tilt angle assessment (Top For WIFI Ant.) KDB 616217 § 6.4

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Top side for WIFI Ant.)

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°
2 450 MHz Tissue	10mm	On	On	On	On	On	On	On	On	On	On	On
5 250 MHz Tissue	10mm	On	On	On	On	On	On	On	On	On	On	On
5 600 MHz Tissue	10mm	On	On	On	On	On	On	On	On	On	On	On
5 750 MHz Tissue	10mm	On	On	On	On	On	On	On	On	On	On	On