

APPENDIX F: 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.

F.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.
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.

F.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.
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. Triggering states within ± 5 mm of the triggering distance, moving towards and away from the phantom, are tabulated below. The influence of table tilt angles to proximity sensor triggering was also evaluated at the smallest sensor triggering distance by rotating the device the edge next to the phantom in 10 degree increments between ± 45 degrees.
3. Steps 1 through 3 were repeated for all distance-based power reduction mechanisms.

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F.3 WIFI Verification Summary

Table F-1
Power Measurement Verification WIFI – Antenna WIFI 0

Mechanism(s)	Mode/Band	Conducted Powers	
1st		Un-triggered (Max)	Mechanism #1 (Grip Sensor Active)
Grip	802.11b	14.95	11.56
Grip	802.11g	16.03	11.51
Grip	802.11n (2.4GHz)	16.00	11.31
Grip	802.11ax (2.4GHz)	14.94	11.69
Grip	802.11a	15.47	6.58
Grip	802.11n (5GHz, 20MHz BW)	15.22	6.36
Grip	802.11n (5GHz, 40MHz BW)	15.11	6.25
Grip	802.11ac (20MHz BW)	15.01	6.00
Grip	802.11ac (40MHz BW)	13.10	6.37
Grip	802.11ac (80MHz BW)	11.14	6.54
Grip	802.11ac (160MHz BW)	9.55	6.61
Grip	802.11ax (20MHz BW)	9.10	6.49
Grip	802.11ax (40MHz BW)	9.50	6.74
Grip	802.11ax (80MHz BW)	9.28	6.58
Grip	802.11ax (160MHz BW)	9.19	6.65

*Note: MIMO WIFI modes were not evaluated due to equipment limitations.

Table F-2
Power Measurement Verification WIFI – Antenna WIFI 1

Mechanism(s)	Mode/Band	Conducted Powers	
1st		Un-triggered (Max)	Mechanism #1 (Grip Sensor Active)
Grip	802.11b	14.81	11.75
Grip	802.11g	17.73	11.98
Grip	802.11n (2.4GHz)	16.10	11.90
Grip	802.11ax (2.4GHz)	14.75	11.86
Grip	802.11a	16.23	7.70
Grip	802.11n (5GHz, 20MHz BW)	15.98	7.42
Grip	802.11n (5GHz, 40MHz BW)	15.51	6.94
Grip	802.11ac (20MHz BW)	16.09	7.45
Grip	802.11ac (40MHz BW)	14.06	7.59
Grip	802.11ac (80MHz BW)	12.46	7.41
Grip	802.11ac (160MHz BW)	11.50	7.13
Grip	802.11ax (20MHz BW)	10.46	7.72
Grip	802.11ax (40MHz BW)	10.54	7.75
Grip	802.11ax (80MHz BW)	10.44	7.66
Grip	802.11ax (160MHz BW)	8.33	7.62

*Note: MIMO WIFI modes were not evaluated due to equipment limitations.

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F.4 Distance Verification Summary

Table F-3
Distance Measurement Verification for Grip #1

Test Position	Activation	Distance[Open] (mm)	Moving towards	Moving away
Back	O	23	23	34
Top	O	25	25	31
Left	O	16	16	23

Table F-4
Distance Measurement Verification for Grip Sensor #2

Test Position	Activation	Distance[Open] (mm)	Moving Towards	Moving Away
Back	O	20	23	34
Top	O	20	25	33
Right	O	20	16	23

Table F-5
Back Side, Moving Toward Phantom

KDB 616217 Section 6.2 Measured Power Moving Toward Phantom [dBm]															
Distance [mm]	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
Grip #1				Max	Max	Max	Max	Max	Red	Red	Red	Red	Red	Red	
Grip #2				Max	Max	Max	Max	Max	Red	Red	Red	Red	Red	Red	

Table F-6
Back Side, Moving Away From Phantom

KDB 616217 Section 6.2 Measured Power Moving Away From Phantom [dBm]																		
Distance [mm]	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Grip #1										Red	Red	Red	Red	Red	Max	Max	Max	Max
Grip #2										Red	Red	Red	Red	Red	Max	Max	Max	Max

Table F-7
Top Edge, Moving Toward Phantom

KDB 616217 Section 6.2 Measured Power Moving Toward Phantom [dBm]												
Distance [mm]	31	30	29	28	27	26	25	24	23	22	21	20
Grip #1		Max	Max	Max	Max	Max	Red	Red	Red	Red	Red	Red
Grip #2		Max	Max	Max	Max	Max	Red	Red	Red	Red	Red	Red

Table F-8
Top Edge, Moving Away From Phantom

KDB 616217 Section 6.2 Measured Power Moving Away From Phantom [dBm]													
Distance [mm]	26	27	28	29	30	31	32	33	34	35	36	37	38
Grip #1	Red	Red	Red	Red	Red	Max	Max	Max	Max	Max	Max		
Grip #2			Red	Red	Red	Red	Red	Max	Max	Max	Max	Max	Max

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Table F-9
Left Edge, Moving Toward Phantom

KDB 616217 Section 6.2 Measured Power Moving Toward Phantom [dBm]											
Distance [mm]	21	20	19	18	17	16	15	14	13	12	11
Grip #1	Max	Max	Max	Max	Max	Red	Red	Red	Red	Red	Red

Table F-10
Left Edge, Moving Away From Phantom

KDB 616217 Section 6.2 Measured Power Moving Away From Phantom [dBm]											
Distance [mm]	17	18	19	20	21	22	23	24	25	26	27
Grip #1	Red	Red	Red	Red	Red	Red	Max	Max	Max	Max	Max

Table F-11
Right Edge, Moving Toward Phantom

KDB 616217 Section 6.2 Measured Power Moving Toward Phantom [dBm]											
Distance [mm]	21	20	19	18	17	16	15	14	13	12	11
Grip #2	Max	Max	Max	Max	Max	Red	Red	Red	Red	Red	Red

Table F-12
Right Edge, Moving Away From Phantom

KDB 616217 Section 6.2 Measured Power Moving Away From Phantom [dBm]											
Distance [mm]	17	18	19	20	21	22	23	24	25	26	27
Grip #2	Red	Red	Red	Red	Red	Red	Max	Max	Max	Max	Max

Table F-13
Triggering States by Tilt Angle for each Sensor per KDB 616217 Section 6.4 – Top Edge

KDB 616217 Section 6.4 Measured Tilt Angle											
Tilt Angle	-45	-35	-25	-15	-5	0	5	15	25	35	45
Grip #1	25	25	25	25	25	25	25	25	25	25	25
Grip #2	26	26	26	26	26	26	26	26	26	26	26

Table F-14
Triggering States by Tilt Angle for each Sensor per KDB 616217 Section 6.4 – Left Edge

KDB 616217 Section 6.4 Measured Tilt Angle											
Tilt Angle	-45	-35	-25	-15	-5	0	5	15	25	35	45
Grip #1	16	16	16	16	16	16	16	16	16	16	16

Table F-15
Triggering States by Tilt Angle for each Sensor per KDB 616217 Section 6.4 – Right Edge

KDB 616217 Section 6.4 Measured Tilt Angle											
Tilt Angle	-45	-35	-25	-15	-5	0	5	15	25	35	45
Grip #2	16	16	16	16	16	16	16	16	16	16	16

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