Appendix I. – 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.

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 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.

For detailed measurement conducted power results, please refer to the Section .10

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Main Antenna Verification Summary

Mechanism(s)	Mode/Band	Conducted Power (dBm)	
		Un-triggered (Max Power)	Triggered (Reduced Power)
Grip	WCDMA B2	23.40	13.94
Grip	WCDMA B4	23.77	14.27
Grip	WCDMA B5	23.43	15.39
Grip	LTE Band 2	22.83	14.57
Grip	LTE Band 4	23.08	15.10
Grip	LTE Band 5	22.79	16.31
Grip	LTE Band 7	23.15	12.58
Grip	LTE Band 12	23.26	17.53
Grip	LTE Band 13	22.62	16.60
Grip	LTE Band 14	22.61	16.73
Grip	LTE Band 17	23.07	17.54
Grip	LTE Band 25	22.85	14.62
Grip	LTE Band 26	22.87	16.53
Grip	LTE Band 38	23.07	15.89
Grip	LTE Band 41	23.07	14.29
Grip	LTE Band 66	23.09	14.53
Grip	NR Band n2	23.06	10.71
Grip	NR Band n5	23.19	12.75
Grip	NR Band n66	23.49	10.81
Grip	NR Band n77	23.09	7.14
Grip	NR Band n77 DoD	23.28	7.33

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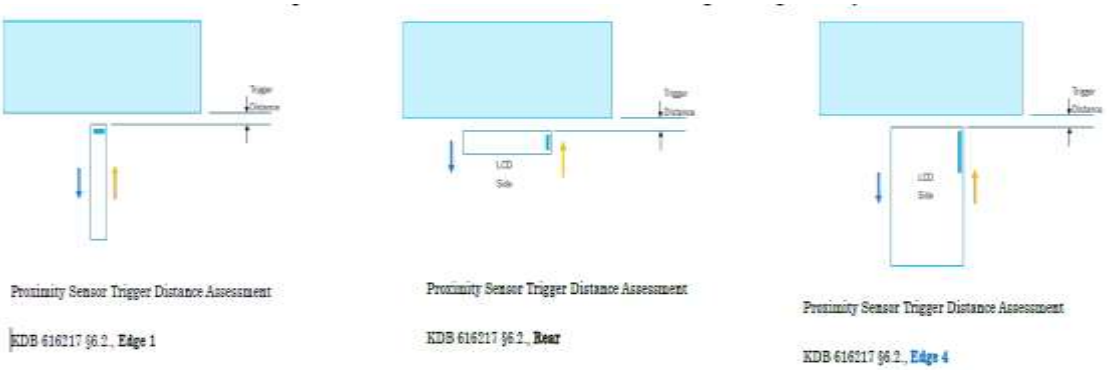
1. Power Reduction Verification for Main 1 Ant

This device utilizes a power reduction mechanism for some wireless modes under some conditions when the device is being used in close proximity to the user's hand for Main1 Ant

FCC KDB Publication 616217 D04v01r02 section 6 was used as a guideline for selection SAR test distances for this device when being used in Proximity use conditions.

1.1 Proximity sensor triggering Distance Verification.



Proximity Sensor Trigger Distance Assessment KDB 616217 D04 §6.2 (Rear/ Edge 1/ Edge 4)

LEGEND
Top Side = Edge 1 / Left Side = Edge 4
→ 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 – Edge 1		Trigger distance – Rear		Trigger distance – Edge 4	
	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]
750MHz Tissue	46	46	26	26	6	6
835MHz Tissue	46	46	26	26	6	6
1800MHz Tissue	46	46	26	26	6	6
1900MHz Tissue	46	46	26	26	6	6
2600MHz Tissue	46	46	26	26	6	6
3500MHz Tissue	46	46	26	26	6	6
3700MHz Tissue	46	46	26	26	6	6
3900MHz Tissue	46	46	26	26	6	6

Distance Measurement verification for Proximity sensor

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

Mode	Distance to DUT Output power (dBm)									
	31[mm]	30[mm]	29[mm]	28[mm]	27[mm]	26[mm]	25[mm]	24[mm]	23[mm]	22[mm]
WCDMA B2	23.32	23.42	23.47	23.46	23.41	13.94	13.98	13.87	13.93	13.89
WCDMA B4	23.86	23.86	23.75	23.67	23.69	14.25	14.33	14.27	14.32	14.31
WCDMA B5	23.40	23.34	23.40	23.33	23.37	15.49	15.38	15.45	15.35	15.43
LTE Band 2	22.76	22.87	22.86	22.89	22.78	14.66	14.66	14.56	14.65	14.54
LTE Band 4	23.07	23.00	23.11	23.01	23.06	15.15	15.08	15.18	15.17	15.18
LTE Band 5	22.82	22.70	22.84	22.69	22.80	16.25	16.28	16.35	16.30	16.21
LTE Band 7	23.13	23.07	23.20	23.05	23.13	12.58	12.51	12.57	12.60	12.62
LTE Band 12	23.28	23.25	23.32	23.23	23.16	17.60	17.54	17.43	17.56	17.53
LTE Band 13	22.52	22.69	22.71	22.65	22.60	16.67	16.51	16.59	16.60	16.65
LTE Band 14	22.52	22.66	22.58	22.59	22.60	16.67	16.77	16.66	16.70	16.73
LTE Band 17	23.16	23.08	23.13	23.07	23.04	17.53	17.57	17.52	17.64	17.47
LTE Band 25	22.95	22.77	22.82	22.75	22.91	14.56	14.63	14.57	14.68	14.58
LTE Band 26	22.77	22.96	22.90	22.94	22.79	16.45	16.51	16.62	16.57	16.57
LTE Band 38	23.06	23.04	23.03	23.08	23.05	15.84	15.82	15.80	15.98	15.90
LTE Band 41	23.06	23.03	23.09	23.10	23.12	14.37	14.32	14.23	14.29	14.36
LTE Band 66	23.08	23.06	23.11	23.15	23.14	14.56	14.45	14.44	14.54	14.60
NR Band n2	23.15	23.01	23.03	23.10	23.15	10.78	10.73	10.78	10.74	10.81
NR Band n5	23.15	23.18	23.21	23.18	23.20	12.70	12.85	12.79	12.71	12.79
NR Band n66	23.59	23.46	23.42	23.52	23.57	10.85	10.74	10.86	10.80	10.87
NR Band n77	23.17	23.18	23.00	23.02	23.02	7.14	7.20	7.22	7.06	7.19
NR Band n77 DoD	23.38	23.28	23.18	23.33	23.28	7.28	7.39	7.27	7.41	7.37

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

Mode	Distance to DUT Output power (dBm)									
	22[mm]	23[mm]	24[mm]	25[mm]	26[mm]	27[mm]	28[mm]	29[mm]	30[mm]	31[mm]
WCDMA B2	14.02	13.84	14.02	14.04	14.00	23.32	23.30	23.46	23.41	23.36
WCDMA B4	14.34	14.20	14.22	14.26	14.18	23.73	23.79	23.84	23.75	23.77
WCDMA B5	15.46	15.47	15.33	15.29	15.30	23.38	23.38	23.34	23.46	23.37
LTE Band 2	14.67	14.48	14.54	14.55	14.59	22.92	22.75	22.82	22.84	22.83
LTE Band 4	15.16	15.02	15.04	15.00	15.09	23.05	23.13	23.11	23.04	23.02
LTE Band 5	16.32	16.41	16.32	16.35	16.41	22.77	22.70	22.80	22.71	22.85
LTE Band 7	12.65	12.60	12.65	12.49	12.60	23.21	23.05	23.14	23.25	23.11
LTE Band 12	17.46	17.53	17.44	17.45	17.45	23.21	23.25	23.17	23.18	23.33
LTE Band 13	16.67	16.63	16.60	16.61	16.56	22.70	22.61	22.55	22.70	22.60
LTE Band 14	16.80	16.79	16.65	16.74	16.76	22.52	22.63	22.58	22.61	22.61
LTE Band 17	17.59	17.45	17.44	17.52	17.52	23.08	23.17	23.17	23.02	23.13
LTE Band 25	14.57	14.69	14.71	14.54	14.59	22.78	22.92	22.81	22.92	22.76
LTE Band 26	16.52	16.46	16.62	16.50	16.50	22.82	22.89	22.93	22.79	22.80
LTE Band 38	15.87	15.85	15.88	15.92	15.93	23.08	23.08	23.15	23.08	23.16
LTE Band 41	14.26	14.30	14.21	14.31	14.24	23.02	22.99	22.99	23.09	23.03
LTE Band 66	14.59	14.57	14.49	14.62	14.56	23.03	23.19	23.02	22.99	23.00
NR Band n2	10.62	10.75	10.77	10.62	10.67	23.01	23.03	23.07	23.07	23.12
NR Band n5	12.78	12.77	12.66	12.81	12.69	23.18	23.14	23.13	23.18	23.14
NR Band n66	10.81	10.74	10.79	10.76	10.88	23.58	23.48	23.45	23.39	23.45
NR Band n77	7.18	7.09	7.20	7.24	7.21	23.13	23.04	23.16	23.17	23.14
NR Band n77 DoD	7.25	7.35	7.34	7.30	7.39	23.21	23.19	23.24	23.31	23.34

Based on the most conservative measured triggering distance of 26mm, additional SAR measurements were required at 25mm from rear side for the above modes.

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Edge1 side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	51[mm]	50[mm]	49[mm]	48[mm]	47[mm]	46[mm]	45[mm]	44[mm]	43[mm]	42[mm]
WCDMA B2	23.30	23.41	23.42	23.48	23.42	13.90	13.98	13.89	14.00	14.00
WCDMA B4	23.79	23.85	23.83	23.86	23.67	14.22	14.37	14.28	14.29	14.21
WCDMA B5	23.44	23.38	23.43	23.39	23.35	15.41	15.35	15.46	15.30	15.43
LTE Band 2	22.84	22.78	22.76	22.84	22.78	14.61	14.55	14.59	14.56	14.56
LTE Band 4	23.08	23.03	22.98	23.17	23.11	15.06	15.20	15.06	15.09	15.05
LTE Band 5	22.78	22.83	22.73	22.81	22.69	16.27	16.34	16.24	16.25	16.27
LTE Band 7	23.05	23.23	23.22	23.10	23.19	12.48	12.49	12.65	12.54	12.50
LTE Band 12	23.28	23.20	23.31	23.21	23.19	17.48	17.49	17.48	17.51	17.59
LTE Band 13	22.61	22.66	22.63	22.53	22.71	16.67	16.70	16.53	16.53	16.61
LTE Band 14	22.54	22.53	22.70	22.57	22.71	16.75	16.75	16.76	16.71	16.68
LTE Band 17	23.15	23.04	23.06	22.98	23.16	17.62	17.54	17.60	17.62	17.55
LTE Band 25	22.85	22.95	22.76	22.87	22.94	14.59	14.66	14.71	14.67	14.62
LTE Band 26	22.90	22.91	22.81	22.87	22.81	16.53	16.58	16.58	16.63	16.49
LTE Band 38	22.99	23.17	23.15	23.02	22.98	15.80	15.85	15.84	15.84	15.93
LTE Band 41	23.03	22.98	23.09	22.98	22.99	14.29	14.36	14.37	14.35	14.39
LTE Band 66	23.00	23.16	23.17	23.16	23.07	14.60	14.48	14.48	14.58	14.50
NR Band n2	23.10	22.98	23.08	23.13	23.10	10.67	10.69	10.66	10.79	10.64
NR Band n5	23.11	23.25	23.25	23.20	23.23	12.84	12.69	12.70	12.69	12.80
NR Band n66	23.40	23.54	23.59	23.56	23.39	10.76	10.81	10.72	10.82	10.88
NR Band n77	23.08	23.13	23.09	23.07	23.02	7.04	7.14	7.12	7.20	7.22
NR Band n77 DoD	23.22	23.21	23.24	23.33	23.38	7.23	7.25	7.26	7.26	7.36

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Edge1 side – EUT Moving away (Release) from the Phantom

Mode	Distance to DUT Output power (dBm)									
	42[mm]	43[mm]	44[mm]	45[mm]	46[mm]	47[mm]	48[mm]	49[mm]	50[mm]	51[mm]
WCDMA B2	13.92	13.94	13.93	13.99	13.92	23.40	23.40	23.32	23.40	23.31
WCDMA B4	14.31	14.25	14.32	14.31	14.33	23.72	23.86	23.70	23.83	23.76
WCDMA B5	15.32	15.32	15.38	15.29	15.42	23.38	23.39	23.51	23.42	23.53
LTE Band 2	14.55	14.56	14.59	14.65	14.53	22.91	22.77	22.85	22.85	22.87
LTE Band 4	15.15	15.19	15.12	15.10	15.16	23.03	23.14	22.98	23.09	23.08
LTE Band 5	16.34	16.38	16.36	16.41	16.27	22.81	22.85	22.77	22.80	22.86
LTE Band 7	12.67	12.48	12.66	12.51	12.67	23.23	23.24	23.12	23.08	23.07
LTE Band 12	17.63	17.63	17.62	17.56	17.63	23.30	23.34	23.26	23.19	23.31
LTE Band 13	16.69	16.60	16.67	16.60	16.50	22.68	22.57	22.67	22.59	22.67
LTE Band 14	16.65	16.65	16.71	16.77	16.81	22.69	22.54	22.62	22.71	22.60
LTE Band 17	17.62	17.52	17.44	17.55	17.44	23.03	23.11	23.01	23.11	22.99
LTE Band 25	14.55	14.72	14.54	14.65	14.52	22.84	22.79	22.80	22.81	22.93
LTE Band 26	16.47	16.60	16.45	16.50	16.49	22.80	22.85	22.97	22.89	22.77
LTE Band 38	15.87	15.92	15.91	15.99	15.95	23.13	23.04	23.04	23.11	23.01
LTE Band 41	14.23	14.34	14.27	14.25	14.28	23.03	23.16	23.14	23.14	23.15
LTE Band 66	14.54	14.57	14.54	14.60	14.59	23.07	23.14	23.18	23.05	23.14
NR Band n2	10.73	10.64	10.72	10.78	10.64	23.16	22.96	23.09	23.11	22.97
NR Band n5	12.78	12.74	12.75	12.77	12.82	23.12	23.17	23.17	23.26	23.21
NR Band n66	10.76	10.91	10.91	10.79	10.85	23.47	23.47	23.42	23.57	23.44
NR Band n77	7.17	7.13	7.14	7.11	7.15	22.99	23.19	23.01	23.05	23.18
NR Band n77 DoD	7.43	7.37	7.36	7.25	7.37	23.28	23.22	23.19	23.37	23.21

Based on the most conservative measured triggering distance of 46mm, additional SAR measurements were required at 45mm from Edge 1 side for the above modes.

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Edge4 side – EUT Moving toward (trigger) to the Phantom

Mode	Distance to DUT Output power (dBm)									
	11[mm]	10[mm]	9[mm]	8[mm]	7[mm]	6[mm]	5[mm]	4[mm]	3[mm]	2[mm]
WCDMA B2	23.42	23.40	23.42	23.44	23.40	13.85	13.96	13.88	13.98	13.99
WCDMA B4	23.71	23.84	23.69	23.73	23.70	14.32	14.22	14.35	14.33	14.32
WCDMA B5	23.37	23.39	23.34	23.53	23.34	15.38	15.34	15.34	15.36	15.37
LTE Band 2	22.92	22.76	22.77	22.88	22.79	14.55	14.53	14.62	14.49	14.61
LTE Band 4	23.01	23.01	23.11	23.10	23.13	15.09	15.01	15.04	15.00	15.11
LTE Band 5	22.89	22.79	22.84	22.83	22.89	16.25	16.35	16.28	16.33	16.25
LTE Band 7	23.09	23.20	23.17	23.15	23.16	12.68	12.68	12.59	12.51	12.63
LTE Band 12	23.25	23.17	23.33	23.20	23.27	17.60	17.52	17.45	17.60	17.48
LTE Band 13	22.71	22.52	22.59	22.72	22.58	16.51	16.67	16.68	16.68	16.66
LTE Band 14	22.60	22.70	22.56	22.54	22.53	16.79	16.65	16.67	16.66	16.63
LTE Band 17	23.04	22.98	23.02	23.12	23.17	17.49	17.54	17.47	17.58	17.57
LTE Band 25	22.76	22.78	22.80	22.83	22.89	14.53	14.56	14.69	14.69	14.65
LTE Band 26	22.91	22.86	22.78	22.86	22.96	16.53	16.46	16.47	16.57	16.60
LTE Band 38	23.03	23.16	23.06	23.10	23.08	15.93	15.84	15.86	15.85	15.89
LTE Band 41	23.03	23.07	22.98	23.11	23.14	14.21	14.19	14.21	14.23	14.32
LTE Band 66	23.11	23.11	23.19	23.01	23.18	14.51	14.62	14.55	14.46	14.62
NR Band n2	23.12	23.05	23.00	23.10	22.97	10.67	10.80	10.80	10.61	10.79
NR Band n5	23.19	23.10	23.11	23.10	23.24	12.82	12.78	12.74	12.68	12.73
NR Band n66	23.54	23.47	23.50	23.59	23.52	10.76	10.81	10.88	10.91	10.79
NR Band n77	23.01	23.18	22.99	23.17	23.08	7.20	7.17	7.06	7.19	7.06
NR Band n77 DoD	23.25	23.25	23.19	23.18	23.22	7.26	7.23	7.29	7.37	7.25

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Edge4 side – 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]
WCDMA B2	14.00	13.96	13.85	13.96	13.91	23.42	23.43	23.35	23.36	23.38
WCDMA B4	14.28	14.22	14.21	14.35	14.31	23.81	23.78	23.69	23.73	23.82
WCDMA B5	15.30	15.29	15.30	15.32	15.45	23.39	23.49	23.48	23.50	23.46
LTE Band 2	14.48	14.58	14.60	14.65	14.64	22.90	22.78	22.77	22.74	22.85
LTE Band 4	15.07	15.02	15.03	15.20	15.03	23.06	23.13	23.07	23.18	23.14
LTE Band 5	16.31	16.36	16.35	16.33	16.22	22.80	22.79	22.72	22.77	22.88
LTE Band 7	12.68	12.51	12.68	12.53	12.68	23.11	23.12	23.12	23.12	23.16
LTE Band 12	17.46	17.63	17.57	17.55	17.59	23.27	23.31	23.20	23.33	23.31
LTE Band 13	16.61	16.56	16.51	16.59	16.55	22.62	22.68	22.55	22.56	22.63
LTE Band 14	16.63	16.70	16.65	16.73	16.81	22.70	22.60	22.54	22.64	22.66
LTE Band 17	17.56	17.50	17.60	17.62	17.57	23.07	23.17	23.00	23.15	23.17
LTE Band 25	14.71	14.71	14.52	14.57	14.65	22.83	22.76	22.91	22.91	22.93
LTE Band 26	16.47	16.62	16.61	16.45	16.53	22.94	22.85	22.92	22.79	22.81
LTE Band 38	15.82	15.95	15.86	15.84	15.82	22.97	22.97	23.03	23.15	23.05
LTE Band 41	14.30	14.31	14.22	14.36	14.35	23.05	23.09	23.10	23.03	23.15
LTE Band 66	14.61	14.51	14.43	14.44	14.62	23.10	23.04	23.05	23.17	23.09
NR Band n2	16.63	16.70	16.65	16.73	16.81	22.70	22.60	22.54	22.64	22.66
NR Band n5	17.56	17.50	17.60	17.62	17.57	23.07	23.17	23.00	23.15	23.17
NR Band n66	10.75	10.76	10.76	10.81	10.83	23.40	23.47	23.59	23.53	23.42
NR Band n77	7.23	7.20	7.13	7.20	7.12	23.17	23.01	23.16	23.01	23.00
NR Band n77 DoD	7.29	7.28	7.31	7.32	7.24	23.24	23.21	23.27	23.28	23.26

Based on the most conservative measured triggering distance of 6mm, additional SAR measurements were required at 5mm from Edge 4 side for the above modes.

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1.3 Proximity Sensor Coverage for SAR measurements

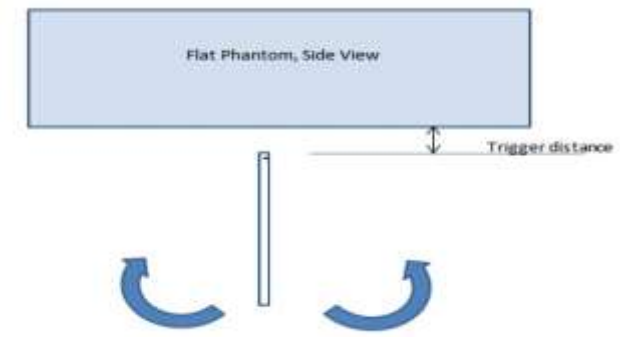
(KDB 616217 D04v01r02§6.3)

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 ±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

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Edge1 side)

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°
750MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On
835MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On
1800MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On
1900MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On
2600MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On
3500MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On
3700MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On
3900MHz Tissue	46 mm	On	On	On	On	On	On	On	On	On	On	On

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Edge4 side)

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°
750MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On
835MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On

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1800MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On
1900MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On
2600MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On
3500MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On
3700MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On
3900MHz Tissue	6 mm	On	On	On	On	On	On	On	On	On	On	On

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1.5 Resulting test positions for Tablet SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance [mm]	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Tablet SAR [mm]
WWAN (WCDMA B2/B4/B5 /LTEB2/B4/B5/B7/B12/ B13/B14/B17/B25/B26/ B38/B41/B66/NR n2/n5/n66/n77/n77 DoD)	Rear	26	N/A	N/A	25
	Edge 1	46	N/A	N/A	45
	Edge 2	N/A	N/A	N/A	N/A
	Edge 3	N/A	N/A	N/A	N/A
	Edge 4	6	N/A	N/A	5

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 Tablet use conditions.

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