

## 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.

Evaluation of the triggering distances for proximity-based sensors.

Due to the operating configurations and exposure conditions required by laptops, proximity sensors are used in this device to reduce the maximum output power in specific wireless and operating modes to ensure SAR compliance.

This device uses a capacitive proximity sensor that is same metallic component as the transmitting antenna to facilitate triggering in typical user interactivity with the device.

This document discloses the procedures and data obtained to determine triggering distances for each sensor. An assessment of the antenna and sensor coverage of this device was also not required since the proximity sensor is the same metallic component as the transmitting antenna

This device utilizes a power reduction mechanism for some wireless modes and bands for SAR compliance under some conditions when the device is being used in close proximity to the user's body. FCC KDB Publication 616217D04v01r02 section 6 was used as a guideline for selection SAR test distances for this device when being used in proximity sensor used conditions. For detailed measurement conducted power results, please refer to the Section .11

### 1. Power Reduction Verification for Main Ant 1

The laptop has two independent Main antennas, each with a proximity grip sensor that independently reduces the output power of the antenna.

For detailed measurement conducted power results, please refer to the Section .11

#### 1.1. Power Verification Procedure for Main Ant 1

Main Ant 1: WCDMA B5 /LTEB5/B12/B13/B14/B26/B30/B41

Mechanism(s)	Mode/Band	Conducted Power (dBm)	
		Un-triggered (Max Power)	Triggered (Reduced Power)
Grip	WCDMA B5	24.12	18.42
Grip	LTE Band 5	24.12	18.00
Grip	LTE Band 7	23.73	12.22
Grip	LTE Band 12	24.55	18.05
Grip	LTE Band 13	24.36	17.88
Grip	LTE Band 14	23.63	17.59
Grip	LTE Band 26	24.10	17.95
Grip	LTE Band 30	23.63	12.77
Grip	LTE Band 38	24.57	13.54
Grip	LTE Band 41(PC3)	23.93	12.44
Grip	LTE Band 41(PC2)	26.68	12.43
Grip	LTE Band 71	24.70	18.06

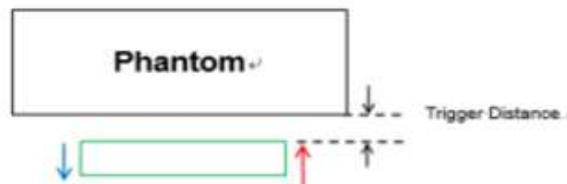
## 1.2. Procedures for determining proximity sensor triggering distances

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

(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



For detailed measurement conducted power results, please refer to the Section .9 [Proximity Sensor Trigger Distance Assessment KDB 616217 D04 §6.2 \(Rear\)](#)

### 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	
	Moving toward phantom	Moving from phantom
700MHz Muscle	15	17
800MHz Muscle	15	17
2300Mhz Muscle	15	17
2600Mhz Muscle	15	17

Distance Measurement verification for Proximity sensor

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

Mode	Distance to DUT Output power (dBm)									
	20	19	18	17	16	15	14	13	12	11
WCDMA B5	24.08	24.19	24.11	24.12	24.03	18.51	18.46	18.37	18.39	18.48
LTE Band 5	24.09	24.03	24.03	24.15	24.03	17.99	18.09	18.07	18	17.96
LTE Band 7	23.65	23.75	23.64	23.79	23.65	12.29	12.28	12.27	12.27	12.22
LTE Band 12	24.54	24.62	24.54	24.56	24.63	17.98	18.02	18.1	18.11	17.95
LTE Band 13	24.45	24.42	24.28	24.41	24.42	17.93	17.91	17.87	17.92	17.89
LTE Band 14	23.61	23.63	23.7	23.63	23.72	17.6	17.56	17.64	17.63	17.53
LTE Band 26	24.02	24	24.03	24.03	24.11	18.02	17.9	18.04	17.98	17.99
LTE Band 30	23.54	23.71	23.64	23.62	23.59	12.71	12.75	12.71	12.68	12.74
LTE Band 38	24.62	24.61	24.65	24.67	24.52	13.49	13.45	13.62	13.6	13.63
LTE Band 41(PC3)	23.83	23.95	23.9	23.83	23.91	12.11	12.16	12.23	12.04	12.1
LTE Band 41(PC2)	26.7	26.76	26.78	26.76	26.66	12.36	12.35	12.33	12.29	12.31
LTE Band 71	24.68	24.63	24.62	24.62	24.69	17.97	18.09	18.16	18.04	18.16

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

Mode	Distance to DUT Output power (dBm)									
	13	14	15	16	17	18	19	20	21	22
WCDMA B5	18.4	18.43	18.38	18.48	18.37	24.08	24.07	24.21	24.14	24.17
LTE Band 5	17.91	17.94	18.05	18.1	17.92	24.13	24.17	24.13	24.2	24.16
LTE Band 7	12.18	12.23	12.15	12.19	12.32	23.73	23.83	23.69	23.64	23.7
LTE Band 12	18.1	18.03	17.98	18.1	18.1	24.57	24.46	24.52	24.58	24.55
LTE Band 13	17.91	17.82	17.89	17.91	17.85	24.34	24.31	24.34	24.39	24.39
LTE Band 14	17.59	17.57	17.51	17.69	17.54	23.67	23.66	23.7	23.68	23.61
LTE Band 26	17.93	18	17.95	18.03	18.02	24.18	24.07	24.07	24.01	24.16
LTE Band 30	12.77	12.68	12.68	12.79	12.71	23.64	23.63	23.57	23.68	23.61
LTE Band 38	13.63	13.52	13.48	13.6	13.55	24.64	24.63	24.48	24.61	24.49
LTE Band 41(PC3)	12.03	12.19	12.14	12.05	12.05	23.88	23.86	23.92	24.01	23.94
LTE Band 41(PC2)	12.4	12.3	12.35	12.33	12.34	26.71	26.67	26.59	26.75	26.62
LTE Band 71	18.05	18	17.97	17.96	18.12	24.67	24.76	24.6	24.6	24.69

Based on the most conservative measured triggering distance of 15mm, additional SAR measurements were required at 14mm from rear 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)

Proximity sensor is applied to the rear side of the laptop, there is no need for Tilt Angle Assessment of Proximity sensor.

### 1.5 Resulting test positions for Body SAR measurements

Main Band Antenna Configuration	Wireless technologies	Position	§6.2 Triggering Distance	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Body SAR
Main Ant 1	WCDMA B5 /LTEB5/B7/B12/B13/ B14/B26/B30/B38/B40/B41/B71)	Rear	15	N/A	N/A	14

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 Laptop use conditions

## 2.1 Power Verification Procedure for Main Ant 2

Main Ant 2: WCDMA B4/B2 /LTEB2/B4/B25/B66

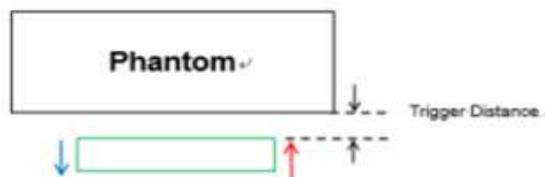
Mechanism(s)	Mode/Band	Conducted Power (dBm)	
		Un-triggered (Max Power)	Triggered (Reduced Power)
Grip	WCDMA B2	24.49	13.84
Grip	WCDMA B4	24.16	13.44
Grip	LTE Band 2	25.00	12.67
Grip	LTE Band 4	24.67	12.73
Grip	LTE Band 25	24.59	12.74
Grip	LTE Band 66	24.64	12.75

## 2.2 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
- For detailed measurement conducted power results, please refer to the Section .11



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

### 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	
	Moving toward phantom	Moving from phantom
1700MHz Muscle	14	15
1900MHz Muscle	14	15

Distance Measurement verification for Proximity sensor

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

Mode	Distance to DUT Output power (dBm)									
	19	18	17	16	15	14	13	12	11	10
WCDMA B2	24.44	24.46	24.55	24.42	24.45	13.81	13.83	13.8	13.9	13.91
WCDMA B4	24.24	24.25	24.08	24.11	24.22	13.37	13.38	13.52	13.34	13.34
LTE Band 2	25.03	25.03	24.9	24.97	24.95	12.76	12.71	12.67	12.67	12.57
LTE Band 4	24.58	24.61	24.57	24.71	24.71	12.73	12.8	12.81	12.82	12.65
LTE Band 25	24.65	24.65	24.58	24.52	24.5	12.76	12.76	12.67	12.83	12.82
LTE Band 66	23.92	23.99	23.97	23.91	24.03	12.76	12.78	12.66	12.85	12.85

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

Mode	Distance to DUT Output power (dBm)									
	11	12	13	14	15	16	17	18	19	20
WCDMA B2	13.84	13.79	13.86	13.74	13.81	24.41	24.48	24.42	24.53	24.49
WCDMA B4	13.43	13.39	13.4	13.49	13.5	24.21	24.26	24.23	24.12	24.26
LTE Band 2	12.73	12.66	12.68	12.73	12.59	25.03	25.01	25.08	25.07	25.02
LTE Band 4	12.69	12.67	12.73	12.77	12.68	24.75	24.66	24.64	24.72	24.72
LTE Band 25	12.66	12.83	12.84	12.71	12.71	24.54	24.58	24.64	24.66	24.69
LTE Band 66	12.72	12.69	12.79	12.84	12.77	23.97	23.92	23.86	23.88	23.86

Based on the most conservative measured triggering distance of 14mm, additional SAR measurements were required at 13mm from rear side for the above modes

**2.3 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.

**2.4 Proximity Sensor Tilt Angle Assessment**

(KDB 616217 D04v01r02 §6.4)

Proximity sensor is applied to the rear side of the laptop, there is no need for Tilt Angle Assessment of Proximity sensor.

## 2.5 Resulting test positions for Body SAR measurements

Main Band Antenna Configuration	Wireless technologies	Position	§6.2 Triggering Distance	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Body SAR
Main Ant 2	(WCDMA B2/B4 /LTEB2/B4/B25/B66	Rear	14	N/A	N/A	13

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 Laptop use conditions

### 3. Power reduction Verification for WLAN Antenna 1

The laptop has two independent WLAN antennas, each with a proximity grip sensor that independently reduces the output power of the antenna.

#### 3.1 Power verification for WLAN Ant 1

Mechanism(s)	Mode/Band	Conducted Power (dBm)	
		Un-triggered (Max Power)	Triggered (Reduced Power)
Grip	2.4GHz 802.11b(1ch-11ch)	18.25	13.16
Grip	2.4GHz 802.11g(1ch-11ch)	16.13	12.82
Grip	2.4GHz 802.11n(1ch-10ch)	15.96	12.70
Grip	5 GHz 802.11a [BW 20]	13.50	8.35
Grip	5 GHz 802.11n [BW 20]	13.04	8.03
Grip	5 GHz 802.11n [BW 40]	12.64	8.11
Grip	5 GHz 802.11ac [BW 20]	12.37	8.32
Grip	5 GHz 802.11ac [BW 40]	11.54	8.26
Grip	5 GHz 802.11ac [BW 80]	10.51	8.09

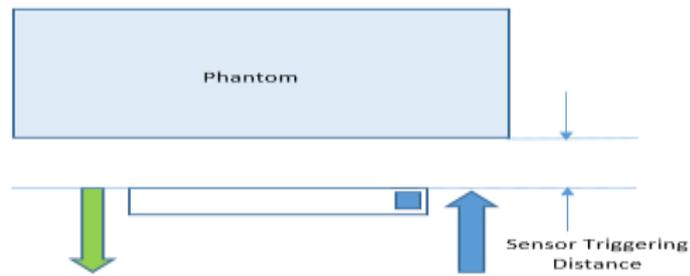
#### 3.2 Procedures for determining proximity sensor triggering distances

(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

For detailed measurement conducted power results, please refer to the Section .11



Proximity Sensor Trigger Distance Assessment  
KDB616217 §6.2 Rear Side

- Away from the Phantom direction of DUT travel for determination of triggering release point
- Toward the Phantom direction of DUT travel for determination of power reduction triggering point

Tissue simulating liquid	Trigger distance – Front (mm)	
	Moving toward phantom	Moving away phantom
2450 Muscle	5	7
5000 Muscle	5	7

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

Mode	Distance to DUT Output power (dBm)									
	10	9	8	7	6	5	4	3	2	1
2.4GHz 802.11b(1ch-11ch)	18.31	18.3	18.33	18.17	18.22	13.16	13.1	13.12	13.11	13.18
2.4GHz 802.11g(1ch-11ch)	16.07	16.04	16.18	16.13	16.1	12.9	12.72	12.88	12.91	12.81
2.4GHz 802.11n(1ch-10ch)	15.94	15.95	16.03	16	16.06	12.69	12.66	12.72	12.64	12.74
5 GHz 802.11a [BW 20]	13.47	13.42	13.51	13.56	13.4	8.29	8.35	8.26	8.43	8.41
5 GHz 802.11n [BW 20]	12.96	13.14	13.01	13	13	7.96	8.1	8	8.11	8.08
5 GHz 802.11n [BW 40]	12.67	12.58	12.63	12.57	12.64	8.2	8.04	8.14	8.2	8.17
5 GHz 802.11ac [BW 20]	12.47	12.35	12.31	12.4	12.43	8.27	8.28	8.24	8.39	8.22
5 GHz 802.11ac [BW 40]	11.49	11.64	11.53	11.59	11.56	8.16	8.16	8.25	8.33	8.16
5 GHz 802.11ac [BW 80]	10.5	10.57	10.44	10.5	10.49	8.03	8.08	8.09	8.06	8.11

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

Mode	Distance to DUT Output power (dBm)									
	3	4	5	6	7	8	9	10	11	12
2.4GHz 802.11b(1ch-11ch)	13.22	13.12	13.25	13.26	13.12	18.31	18.24	18.25	18.24	18.24
2.4GHz 802.11g(1ch-11ch)	12.88	12.87	12.87	12.83	12.81	16.04	16.09	16.18	16.05	16.21
2.4GHz 802.11n(1ch-10ch)	12.67	12.71	12.75	12.69	12.71	15.9	15.9	16.06	15.99	15.87
5 GHz 802.11a [BW 20]	8.31	8.38	8.45	8.36	8.4	13.51	13.56	13.43	13.52	13.55
5 GHz 802.11n [BW 20]	8.1	7.96	8.04	8	7.99	13.1	13.02	13.13	13.03	12.96
5 GHz 802.11n [BW 40]	8.06	8.01	8.03	8.19	8.15	12.66	12.61	12.65	12.55	12.56
5 GHz 802.11ac [BW 20]	8.29	8.27	8.28	8.34	8.37	12.28	12.27	12.31	12.29	12.41
5 GHz 802.11ac [BW 40]	8.2	8.35	8.34	8.24	8.32	11.47	11.51	11.64	11.45	11.51
5 GHz 802.11ac [BW 80]	8.11	8.13	8.12	8.1	8.06	10.58	10.43	10.49	10.56	10.42

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

**3.3 Procedures for determining antenna and proximity sensor coverage**

KDB 616217 D04 §6.3

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

**3.4 Procedures for determining tablet tilt angle influences to proximity sensor triggering**

KDB 616217 D04v01r02 §6.4

Proximity sensor is applied to the rear side of the laptop, there is no need for Tilt Angle Assessment of Proximity sensor.

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**3.5 Resulting test positions for Body SAR measurements**

Wireless Antenna Configuration	DUT Position	§ 6.2 Triggering distance	§ 6.3 Coverage	§ 6.4 Tilt Angle	Worst case Distance for Body SAR
WLAN Ant 1	Rear	5 mm	N/A	N/A	4 mm

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 Laptop use conditions

## 4. Power reduction Verification for WLAN Antenna 2

The laptop has two independent WLAN antennas, each with a proximity grip sensor that independently reduces the output power of the antenna.

### 4.1 Power verification for WLAN Ant 2

Mechanism(s)	Mode/Band	Conducted Power (dBm)	
		Un-triggered (Max Power)	Triggered (Reduced Power)
Grip	2.4GHz 802.11b(1ch-11ch)	18.01	13.00
Grip	2.4GHz 802.11g(1ch-11ch)	15.72	12.61
Grip	2.4GHz 802.11b(1ch-11ch)	15.54	12.40
Grip	5 GHz 802.11a [BW 20]	13.11	7.83
Grip	5 GHz 802.11n [BW 20]	12.88	7.60
Grip	5 GHz 802.11n [BW 40]	12.12	8.04
Grip	5 GHz 802.11ac [BW 20]	11.77	7.63
Grip	5 GHz 802.11ac [BW 40]	11.10	8.16
Grip	5 GHz 802.11ac [BW 80]	9.69	8.05

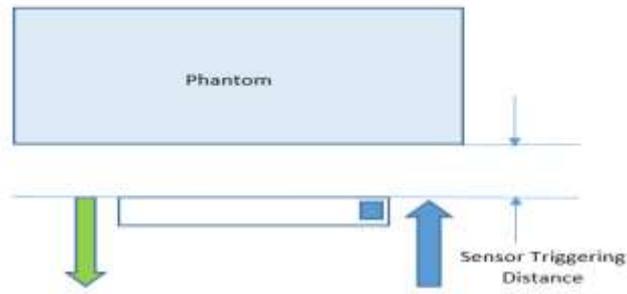
### 4.2 Procedures for determining proximity sensor triggering distances

(KDB 616217 D04v01r02 §6.2)

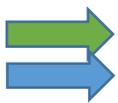
The distance verification procedure was performed according to the following procedure:

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

For detailed measurement conducted power results, please refer to the Section .11



Proximity Sensor Trigger Distance Assessment  
KDB616217 56.2 Rear Side



Away from the Phantom direction of DUT travel for determination of triggering release point

Toward the Phantom direction of DUT travel for determination of power reduction triggering point

Tissue simulating liquid	Trigger distance – Front (mm)	
	Moving toward phantom	Moving away phantom
2450 Muscle	5	7
5000 Muscle	5	7

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

Mode	Distance to DUT Output power (dBm)									
	10	9	8	7	6	5	4	3	2	1
2.4GHz 802.11b(1ch-11ch)	17.99	18.06	18.03	17.92	18.07	13.07	13.08	12.99	13.07	12.96
2.4GHz 802.11g(1ch-11ch)	15.64	15.66	15.63	15.63	15.65	12.53	12.69	12.51	12.55	12.68
2.4GHz 802.11b(1ch-11ch)	15.5	15.54	15.52	15.46	15.51	12.47	12.45	12.44	12.39	12.31
5 GHz 802.11a [BW 20]	13.07	13.09	13.03	13.2	13.16	7.74	7.74	7.93	7.92	7.84
5 GHz 802.11n [BW 20]	12.86	12.85	12.98	12.91	12.9	7.67	7.62	7.63	7.61	7.63
5 GHz 802.11n [BW 40]	12.05	12.19	12.03	12.15	12.22	8.03	7.99	7.97	7.94	8.08
5 GHz 802.11ac [BW 20]	11.81	11.8	11.71	11.7	11.68	7.54	7.53	7.57	7.55	7.64
5 GHz 802.11ac [BW 40]	11.12	11.14	11.09	11.16	11.06	8.11	8.18	8.17	8.18	8.08
5 GHz 802.11ac [BW 80]	9.67	9.63	9.65	9.73	9.68	8.09	8.12	8.15	7.95	8.04

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

Mode	Distance to DUT Output power (dBm)									
	3	4	5	6	7	8	9	10	11	12
2.4GHz 802.11b(1ch-11ch)	13.08	13.01	12.93	12.96	12.97	17.92	17.97	18.08	17.91	18
2.4GHz 802.11g(1ch-11ch)	12.71	12.65	12.64	12.56	12.65	15.8	15.7	15.76	15.73	15.62
2.4GHz 802.11b(1ch-11ch)	12.49	12.46	12.49	12.37	12.39	15.54	15.56	15.55	15.53	15.55
5 GHz 802.11a [BW 20]	7.77	7.87	7.78	7.78	7.76	13.06	13.11	13.18	13.19	13.01
5 GHz 802.11n [BW 20]	7.65	7.56	7.7	7.62	7.68	12.98	12.88	12.78	12.84	12.81
5 GHz 802.11n [BW 40]	8.13	7.96	7.97	7.96	8.08	12.18	12.21	12.2	12.14	12.19
5 GHz 802.11ac [BW 20]	7.71	7.72	7.73	7.57	7.72	11.82	11.67	11.68	11.69	11.67
5 GHz 802.11ac [BW 40]	8.18	8.17	8.22	8.24	8.26	11.04	11.07	11.13	11.07	11.17
5 GHz 802.11ac [BW 80]	8.04	8.13	8.05	8.02	7.98	9.78	9.76	9.67	9.61	9.73

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

### 4.3 Procedures for determining antenna and proximity sensor coverage

KDB 616217 D04 §6.3

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

### 4.4 Procedures for determining tablet tilt angle influences to proximity sensor triggering

KDB 616217 D04v01r02 §6.4

Proximity sensor is applied to the rear side of the laptop, there is no need for Tilt Angle Assessment of Proximity sensor.

### 4.5 Resulting test positions for Body SAR measurements

Wireless Antenna Configuration	DUT Position	§ 6.2 Triggering distance	§ 6.3 Coverage	§ 6.4 Tilt Angle	Worst case Distance for Body SAR
WLAN Ant 2	Rear	5 mm	N/A	N/A	4 mm

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 Laptop use conditions