FCC 47 CFR § 2.1093
IEEE Std 1528-2013

SAR EVALUATION REPORT

CLASS II PERMISSIVE CHANGE
FOR

DTS/UNII a/b/g/n/ac Tablet + BT/BLE and ANT+

MODEL NUMBER: SM-P610

FCC ID: A3LSMP610

REPORT NUMBER: 4789438507-S1V1

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Prepared for
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IAS ACCREDITED

Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	3/31/2020	Initial Issue	-

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.		
FCC ID	A3LSMP610		
Model Name	SM-P610		
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013		
SAR Limits (W/Kg)			
Exposure Category	Peak spatial-average(1g of tissue)		
General population / Uncontrolled exposure	1.6		
The Highest Reported SAR (W/kg)			
RF Exposure Conditions	**Equipment Class**		
	DTS	**U-NII**	**DSS(BT)**
Standalone	0.64	0.58	0.32
Simultaneous TX	1.04	0.98	0.80
Date Tested	3/30/2020		
Test Results	Pass		

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

This test report contains SAR measurements to support a Permissive Change application that only affect specific exposure conditions for the Wi-Fi 2.4GHz cellular operations. The tables in sections 1 and 1.1 below, and data used for the simultaneous analysis in section 13, for the operating bands and modes not detailed in this report have been taken directly from the test report submitted to support the original filing for device certification.

Approved & Released By:	Prepared By:
	
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory	JeongYeon Won Laboratory Technician UL Korea, Ltd. Suwon Laboratory

1.1. The Highest Reported SAR for RF exposure conditions for each bands

Equipment Class	Band	The Highest Reported SAR (W/kg)
		1g of tissue
		Standalone Exposure condition
DTS	2.4GHz WLAN	**0.635**
UNII	5GHz WLAN	**0.579**
DSS	Bluetooth	**0.320**

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 616217 D04 SAR for laptop and tablets v01r02
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02

In addition to the above, the following information was used:

- TCB workshop October, 2016; Page 7, RF Exposure Procedures (Bluetooth Duty Factor)
- TCB workshop April, 2019 Page 19, RF Exposure Procedures (Tissue Simulating Liquids (TSL))

Additional Guidance: KDB inquiry

- Additional SAR test of corner side – KDB guidance to identify that SAR test when sensor and antenna is located near corner side.

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

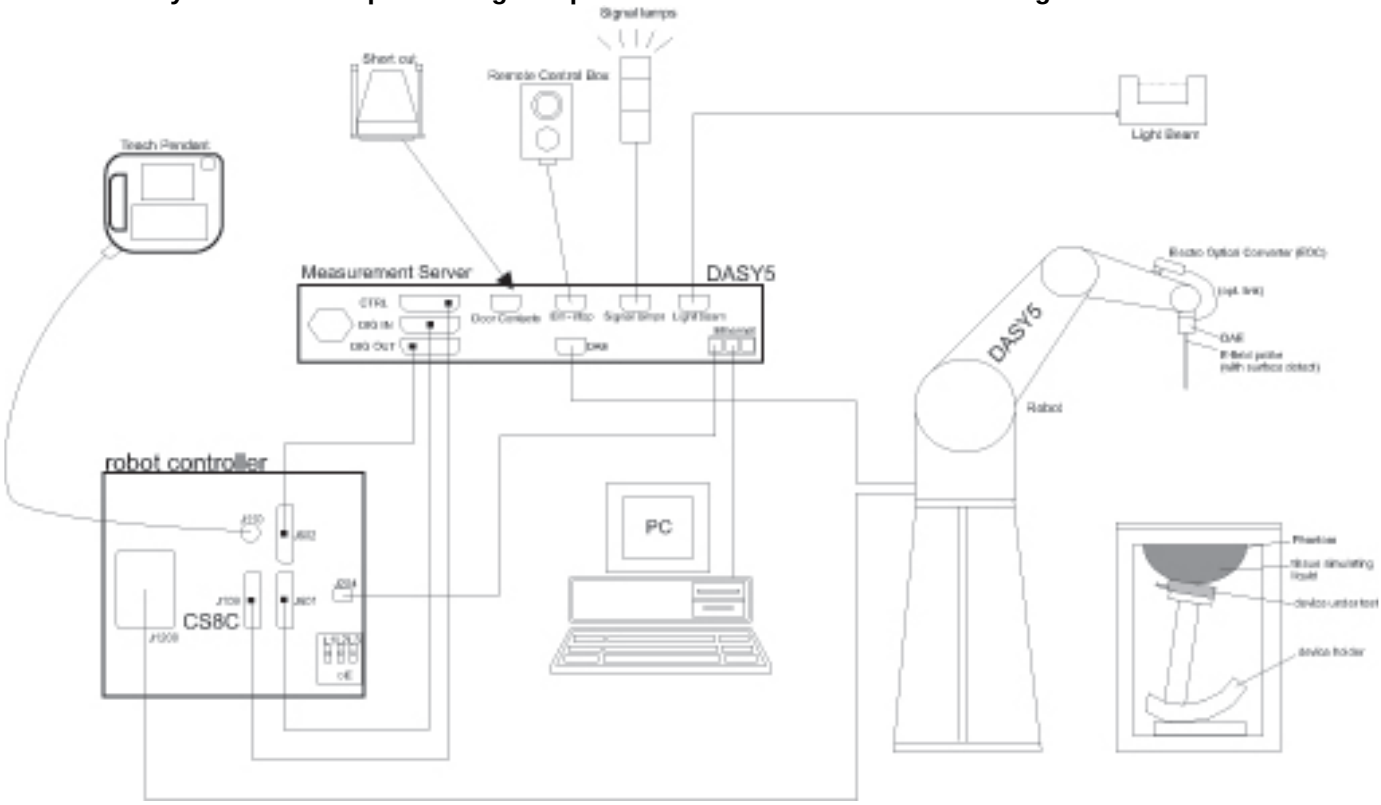
Suwon
SAR 4 Room

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/TL-637.pdf.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	E5071C	MY46522054	8-7-2020
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	6-18-2020
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3424	8-9-2020

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-6-2020
Power Sensor	Agilent	U2000A	MY54260010	8-9-2020
Power Sensor	Agilent	U2000A	MY54260007	8-9-2020
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-8-2020
Directional Coupler	Agilent	778D	MY52180432	8-7-2020
Low Pass Filter	FILTRON	L14012FL	1410003S	8-7-2020
Attenuator	Agilent	8491B/003	MY39269292	8-7-2020
Attenuator	Agilent	8491B/010	MY39269315	8-7-2020
Attenuator	Agilent	8491B/020	MY39269298	8-7-2020
E-Field Probe (SAR4)	SPEAG	EX3DV4	7545	9-23-2020
Data Acquisition Electronics (SAR4)	SPEAG	DAE4	1591	9-11-2020
System Validation Dipole	SPEAG	D2450V2	939	7-25-2021
Thermometer (SAR4),(SAR5)	Lutron	MHB-382SD	AJ.45903	5-17-2020

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

5.1 DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Refer to Appendix A.
Back Cover	☒ The Back Cover is not removable.
Battery Options	☒ The rechargeable battery is not user accessible.
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5 GHz : Ch.36 – Ch.48, Ch.149 – Ch.165))
Test Sample Information	**No.** **S/N** **Notes** 1 R52N10VDXDW Wi-Fi Conducted 2 R52N10VEH7P SAR

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	99.3% (802.11b) 96.5% (802.11g) 96.3% (802.11n 20MHz BW)
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80)	96.5% (802.11a) 97.9% (802.11n,ac 20MHz BW) 95.8% (802.11n,ac 40MHz BW) 92.8% (802.11ac 80MHz BW)
	Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No		
	Does this device support Band gap channel(s)? ☒ Yes ☐ No		
Bluetooth	2.4 GHz	Version 5.0 LE	76.7% (DH5)

Notes:

1. The Bluetooth protocol is considered source-based averaging. Bluetooth GFSK (DH5) was verified to have the highest duty cycle of 76.7% and was considered and used for SAR Testing.
2. Duty cycle for Wi-Fi is referenced from the DTS and UNII report.

6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1. at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

WLAN SISO mode

RF Air interface	Mode	Max. RF Output Power (dBm)		Reduced. RF Output Power (dBm) -Proximity sensor back-off-	
		Wi-Fi Ant.1	Wi-Fi Ant.2	Wi-Fi Ant.1	Wi-Fi Ant.2
WiFi 2.4 GHz (Ch.1)	802.11b	**17.0**	**18.0**	**13.0**	**12.0**
	802.11g	**16.0**	**15.0**	**13.0**	**12.0**
	802.11n HT20	**16.0**	**15.0**	**13.0**	**12.0**
WiFi 2.4 GHz (Ch.2~11)	802.11b	**19.0**	**18.0**	**13.0**	**12.0**
	802.11g	**16.0**	**15.0**	**13.0**	**12.0**
	802.11n HT20	**16.0**	**15.0**	**13.0**	**12.0**
WiFi 2.4 GHz (Ch.12)	802.11b	**16.0**	**18.0**	**13.0**	**12.0**
	802.11g	**11.0**	**15.0**	**11.0**	**12.0**
	802.11n HT20	**12.0**	**15.0**	**12.0**	**12.0**
WiFi 2.4 GHz (Ch.13)	802.11b	**13.0**	**15.0**	**13.0**	**12.0**
	802.11g	**8.0**	**11.0**	**8.0**	**11.0**
	802.11n HT20	**6.0**	**10.0**	**6.0**	**10.0**

Notes:

1. WLAN bands has support to power reduction during triggering proximity sensor. So the Proximity sensor were verified according to KDB 616217 D04. Please refer to section 6.6.

WLAN MIMO mode

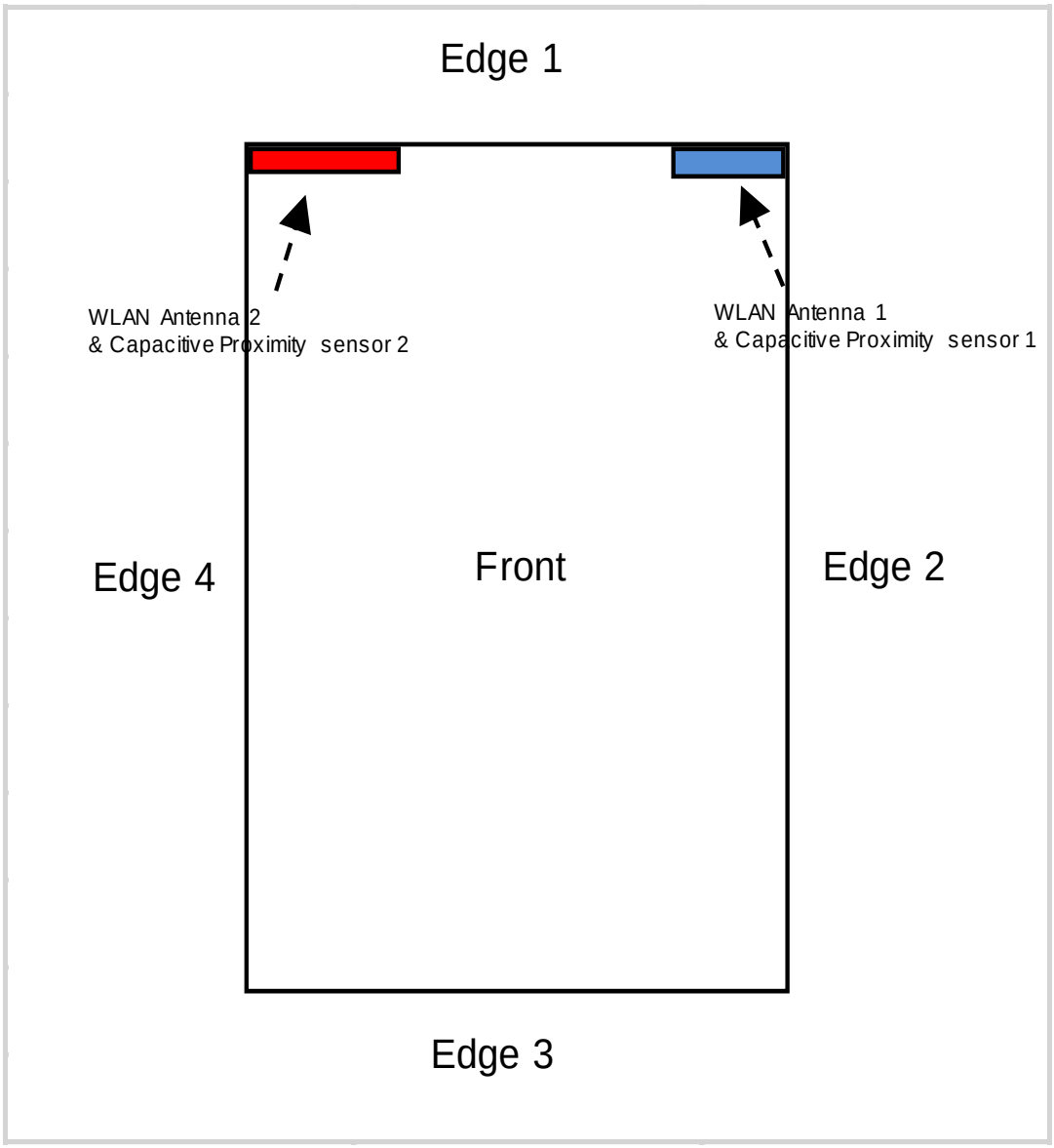
RF Air interface	Mode	Max RF Output power (dBm			Reduced RF Output power (dBm) -Proximity sensor back-off-		
		Wi-Fi Ant.1	Wi-Fi Ant.2	Wi-Fi MIMO (Ant 1 + Ant 2)	Wi-Fi Ant.1	Wi-Fi Ant.2	Wi-Fi MIMO (Ant 1 + Ant 2)
WiFi 2.4 GHz (Ch.1~11)	802.11g	**14.0**	**14.0**	**17.0**	**12.0**	**12.0**	**15.0**
	802.11n HT20	**14.0**	**14.0**	**17.0**	**12.0**	**12.0**	**15.0**
WiFi 2.4 GHz (Ch.12)	802.11g	**11.5**	**11.5**	**14.5**	**11.5**	**11.5**	**14.5**
	802.11n HT20	**11.0**	**11.0**	**14.0**	**11.0**	**11.0**	**14.0**
WiFi 2.4 GHz (Ch.13)	802.11g	**6.0**	**6.0**	**9.0**	**6.0**	**6.0**	**9.0**
	802.11n HT20	**4.0**	**4.0**	**7.0**	**4.0**	**4.0**	**7.0**

Notes:

1. WLAN bands has support to power reduction during triggering proximity sensor. So the Proximity sensor were verified according to KDB 616217 D04. Please refer to section 6.6.
2. Each antennas has the different target power for SISO and MIMO mode, but Each antennas of MIMO mode has same or lower for maximum output power than SISO mode.

6.4. Proximity sensor feature

The DUT has three proximity sensors to reduce the output power. The position of the sensors and antenna are as shown in the graphic.

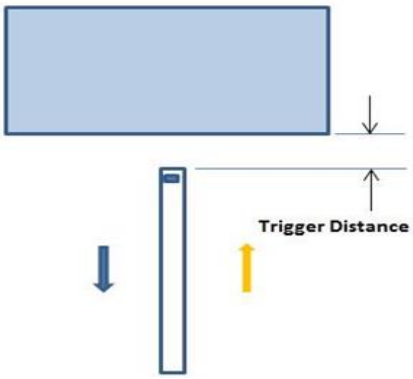


6.4.1 Proximity Sensor Triggering Distance (KDB 616217 §6.2)

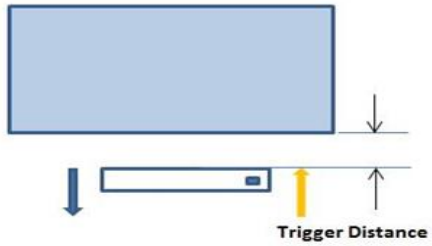
Rear, Edge 1, Edge 2, Edge 4, Corner A (Side of between Edge 1 and Edge 2), Corner B (Side of between Edge 1 and Edge 4) of the DUT was placed directly below the flat phantom. The DUT was moved toward the phantom in accordance with the steps outlined in KDB 616217 §6.2 to determine the trigger distance for enabling power reduction. The DUT was moved away from the phantom to determine the trigger distance for resuming full power.

The DUT featured a visual indicator on its display that showed the status of the proximity sensor (Triggered or not triggered). This was used to determine the status of the sensor during the proximity sensor assessment as monitoring the output power directly was not practical without affecting the measurement.

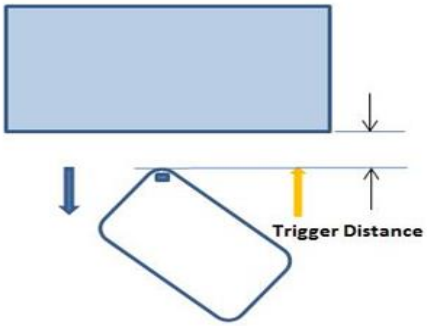
It was confirmed separately that the output power was altered according to the proximity sensor status indication. This was achieved by observing the proximity sensor status at the same time as monitoring the conducted power. Section 9 contains both the full and reduced conducted power measurements.



Proximity Sensor Trigger Distance Assessment
KDB 616217 §6.2, Edge 1, Edge 2, Edge 4



Proximity Sensor Trigger Distance Assessment
KDB 616217 §6.2, Rear



Proximity Sensor Trigger Distance Assessment
KDB 616217 §6.2, Corner A, Corner B

LEGEND

→ Direction of DUT travel for determination of power reduction triggering point

→ Direction of DUT travel for determination of full power resumption triggering point

Summary of Trigger Distances

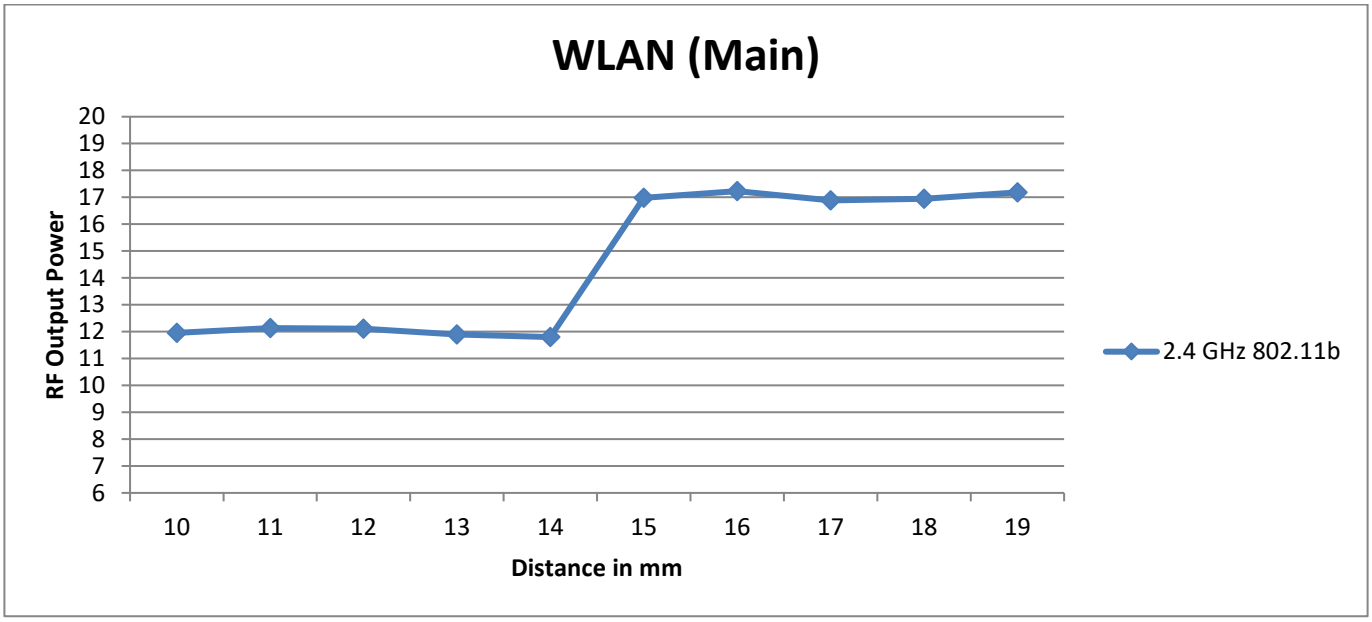
Antenna	Tissue simulating liquid	Trigger distance - Rear		Trigger distance – Edge 1		Trigger distance – Edge 2		Trigger distance – Edge 4		Trigger distance – Corner A		Trigger distance – Corner B	
		Moving toward phantom	Moving from phantom	Moving toward phantom	Moving from phantom	Moving toward phantom	Moving from phantom	Moving toward phantom	Moving from phantom	Moving toward phantom	Moving from phantom	Moving toward phantom	Moving from phantom
WLAN Ant.	2450 Head Ant 1	14 mm	14 mm	13 mm	13 mm	8 mm	8 mm	N/A	N/A	9 mm	9 mm	N/A	N/A
	2450 Head Ant 2	14 mm	14 mm	13 mm	13 mm	N/A	N/A	7 mm	7 mm	N/A	N/A	8 mm	8 mm

Proximity Sensor Triggering Distance Measurement Results

WLAN 2.4GHz

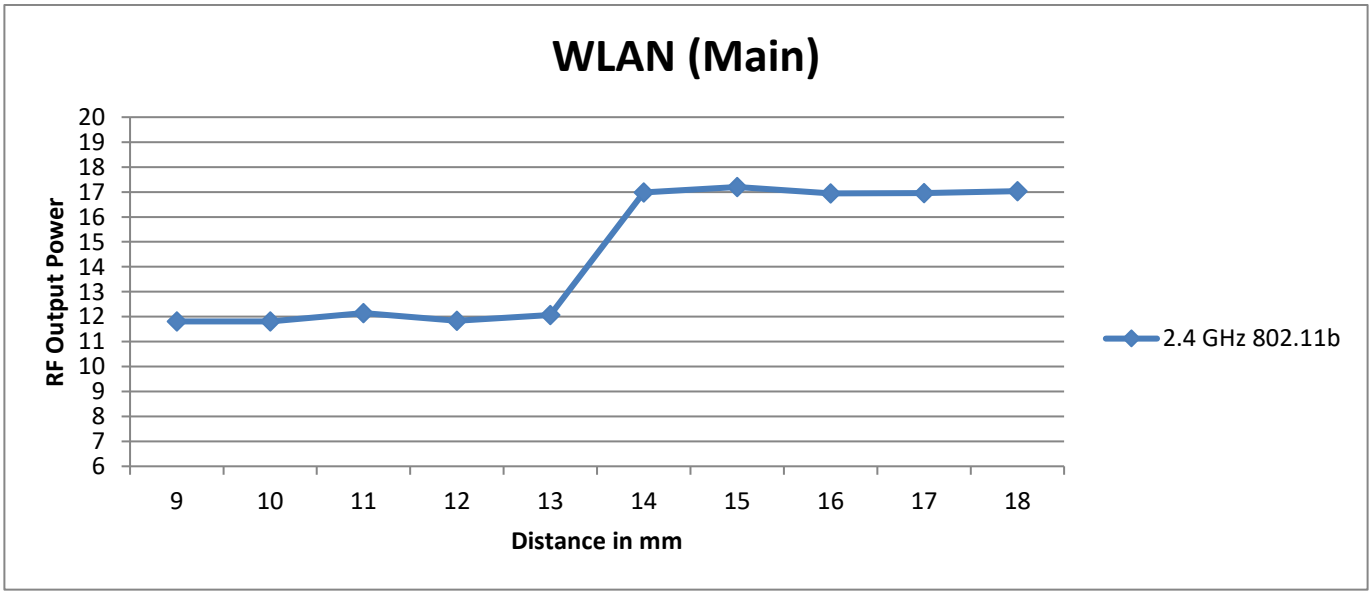
Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance	10	11	12	13	14	15	16	17	18	19
Ant 1	2.4 GHz 802.11b	12.0	12.1	12.1	11.9	11.8	17.0	17.2	16.9	17.0	17.2



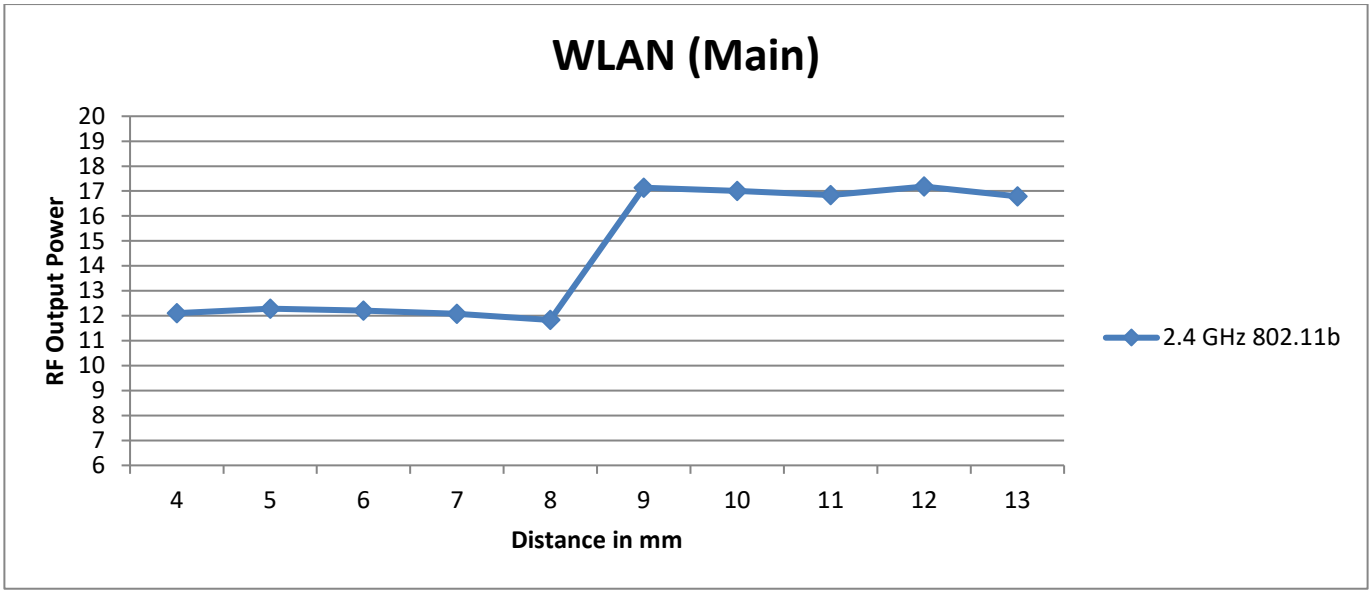
Edge 1, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance (mm)	9	10	11	12	13	14	15	16	17	18
Ant 1	2.4 GHz 802.11b	11.8	11.8	12.2	11.8	12.1	17.0	17.2	17.0	17.0	17.0



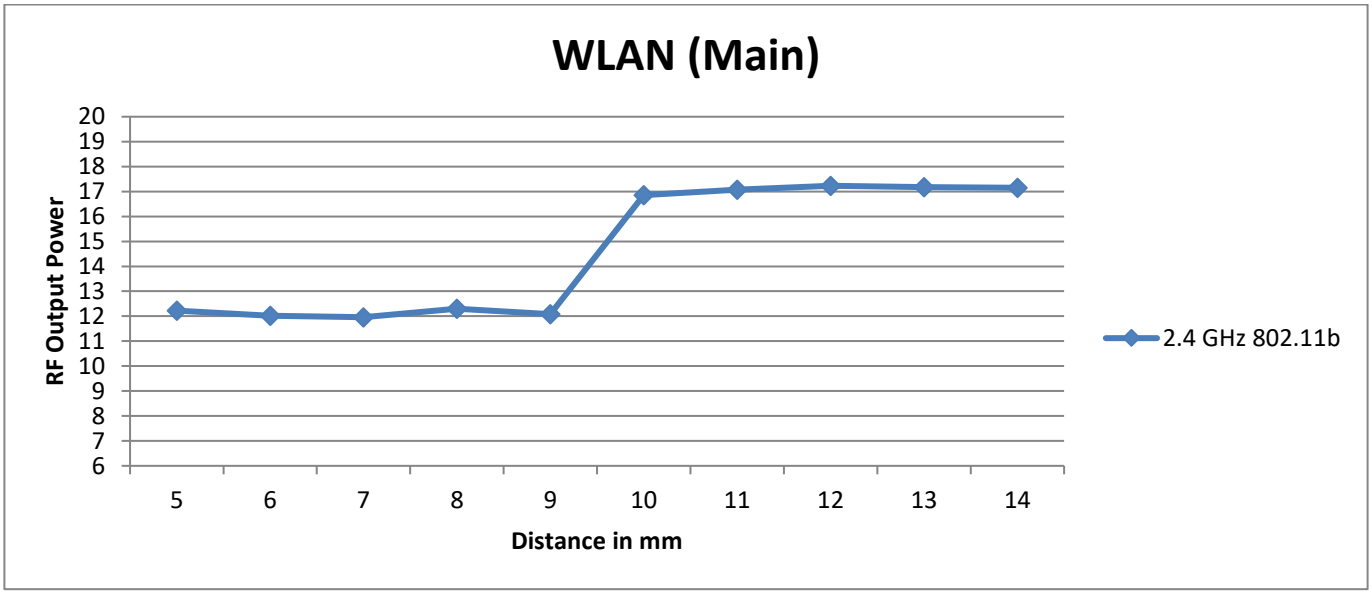
Edge 2, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance (mm)	4	5	6	7	8	9	10	11	12	13
Ant 1	2.4 GHz 802.11b	12.1	12.3	12.2	12.1	11.8	17.1	17.0	16.8	17.2	16.8



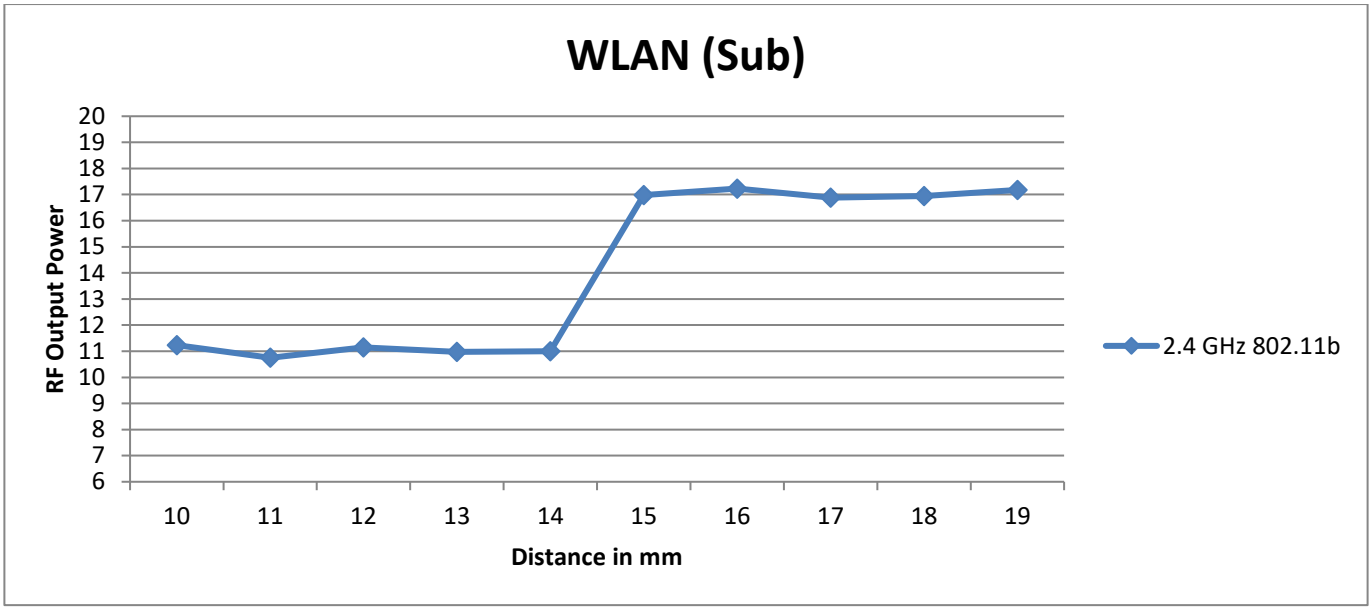
Corner A, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance (mm)	5	6	7	8	9	10	11	12	13	14
Ant 1	2.4 GHz 802.11b	12.2	12.0	12.0	12.3	12.1	16.9	17.1	17.2	17.2	17.2



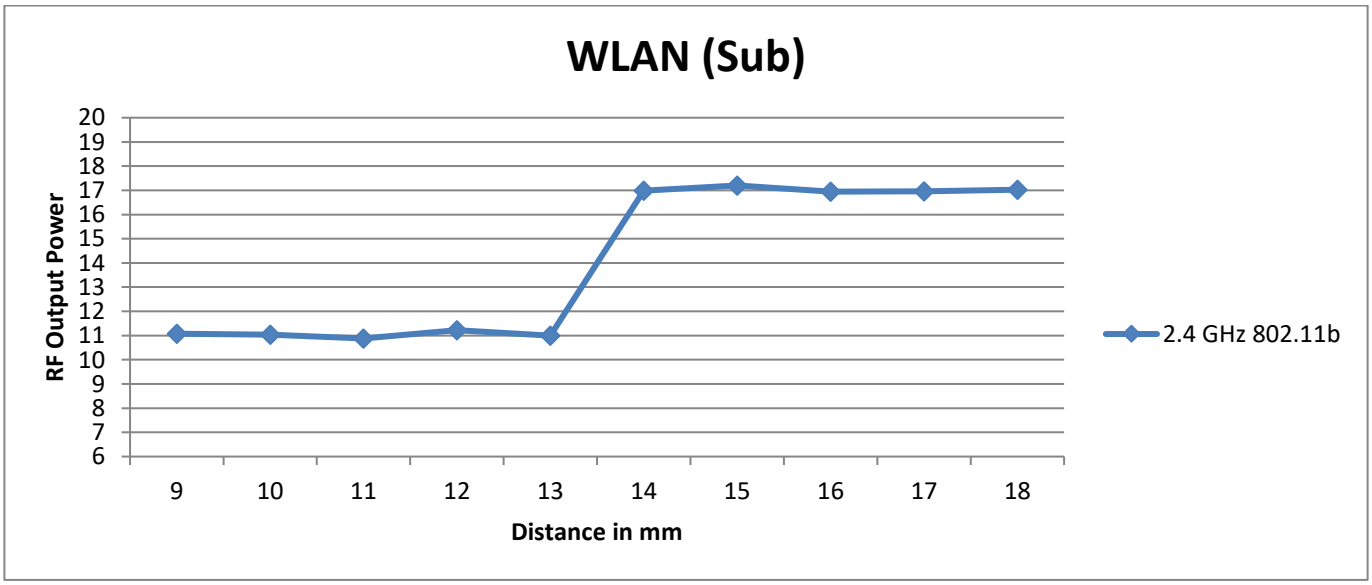
Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance	10	11	12	13	14	15	16	17	18	19
Ant 2	2.4 GHz 802.11b	11.2	10.8	11.2	11.0	11.0	17.0	17.2	16.9	17.0	17.2



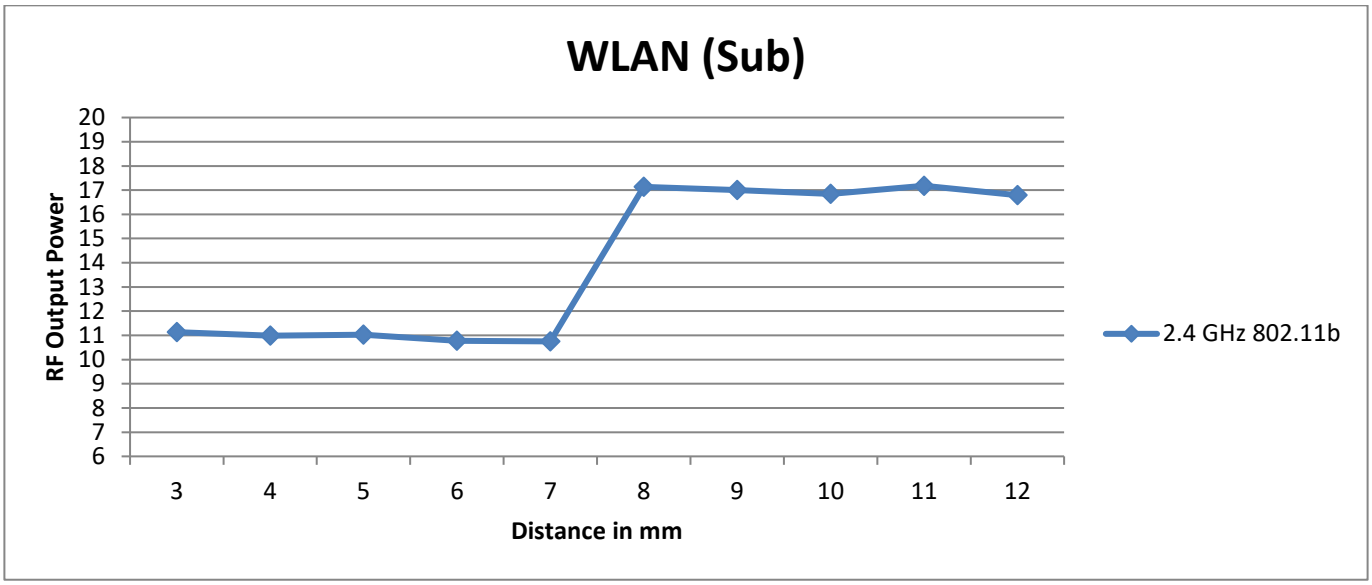
Edge 1, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance (mm)	9	10	11	12	13	14	15	16	17	18
Ant 2	2.4 GHz 802.11b	11.1	11.0	10.9	11.2	11.0	17.0	17.2	17.0	17.0	17.0



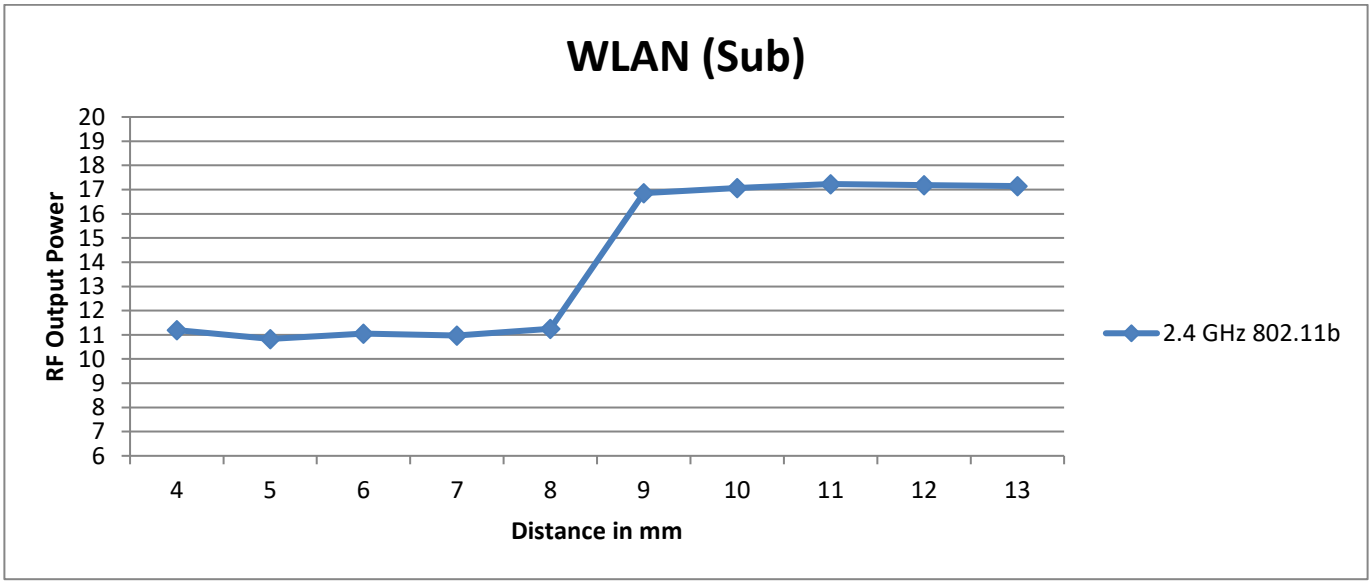
Edge 4, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance (mm)	3	4	5	6	7	8	9	10	11	12
Ant 2	2.4 GHz 802.11b	11.1	11.0	11.0	10.8	10.8	17.1	17.0	16.8	17.2	16.8



Corner B, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance (mm)	4	5	6	7	8	9	10	11	12	13
Ant 2	2.4 GHz 802.11b	11.2	10.8	11.1	11.0	11.3	16.9	17.1	17.2	17.2	17.2



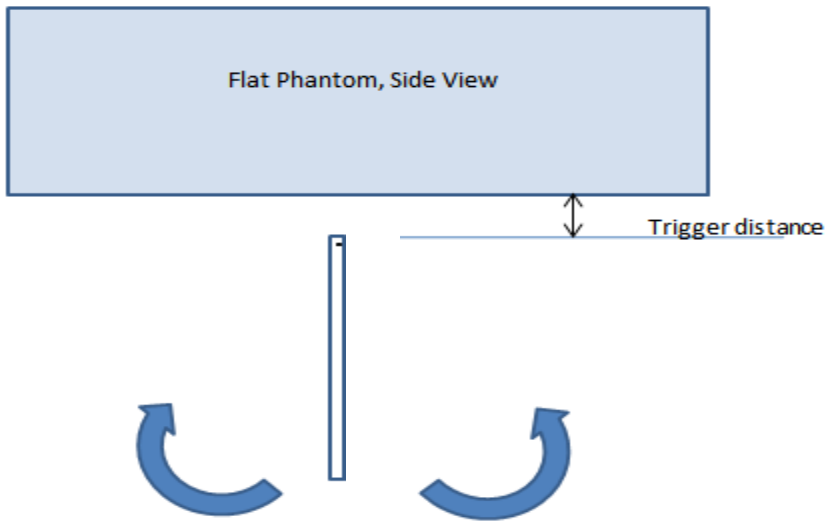
6.4.2 Proximity Sensor Coverage (KDB 616217 §6.3)

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

6.4.3 Proximity Sensor Tilt Angle Assessment (KDB 616217 §6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Edge 1, Edge 2, Edge 4 parallel to the base of the flat phantom for each band.

The EUT was rotated about Edge 1, Edge 2, Edge 4 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 to +/- 45°.



Proximity sensor tilt angle assessment (Edge 1, Edge 2, Edge 4) KDB 616217 §6.4

Summary of Tablet Tilt Angle Influence to Proximity Sensor Triggering (Edge 1)

Band (MHz)	Minimum trigger distance measured according to KDB 616217 §6.2	Minimum distance at which power reduction was maintained over +/-45°	Power reduction status										
			-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
2450	13 mm	13 mm	On	On	On	On	On	On	On	On	On	On	On

Summary of Tablet Tilt Angle Influence to Proximity Sensor Triggering (Edge 2)

Band (MHz)	Minimum trigger distance measured according to KDB 616217 §6.2	Minimum distance at which power reduction was maintained over +/-45°	Power reduction status										
			-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
2450	8 mm	8 mm	On	On	On	On	On	On	On	On	On	On	On

Summary of Tablet Tilt Angle Influence to Proximity Sensor Triggering (Edge 4)

Band (MHz)	Minimum trigger distance measured according to KDB 616217 §6.2	Minimum distance at which power reduction was maintained over +/-45°	Power reduction status										
			-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
2450	7 mm	7 mm	On	On	On	On	On	On	On	On	On	On	On

6.4.4 Resulting test positions for SAR measurements

Wireless technologies	Position	§6.6.1 Triggering Distance	§6.6.2 Coverage	§6.6.3 Tilt Angle	Worst case distance for SAR
WLAN	Rear	14 mm	N/A	N/A	13 mm
	Edge 1	13 mm	N/A	13 mm	12 mm
	Edge 2	8 mm	N/A	8 mm	7 mm
	Edge 4	7 mm	N/A	7 mm	6 mm
	Corner A	9 mm	N/A	N/A	8 mm
	Corner B	8 mm	N/A	N/A	7 mm

7. RF Exposure Conditions (Test Configurations)

Refer to “SAR Photos and Ant locations” Appendix for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1 Standalone SAR Test Exclusion Considerations

Since the *Dedicated Host Approach* is applied, the standalone SAR test exclusion procedure in KDB 447498 § 4.3.1 is applied in conjunction with KDB 616217 § 4.3 to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations for WLAN

Antennas < 50mm to adjacent edges

SISO Max

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi Antenna 1															
Wi-Fi 2.4 GHz	2462	19.00	79	0	0	0	242	110		24.8 -MEASURE-	24.8 -MEASURE-	24.8 -MEASURE-	> 50 mm	> 50 mm	
Wi-Fi Antenna 2															
Wi-Fi 2.4 GHz	2462	18.00	63	0	0	110	242	0		19.8 -MEASURE-	19.8 -MEASURE-	> 50 mm	> 50 mm	19.8 -MEASURE-	

SISO Reduce

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi Antenna 1															
Wi-Fi 2.4 GHz	2462	13.00	20	0	0	0		110		6.3 -MEASURE-	6.3 -MEASURE-	6.3 -MEASURE-		> 50 mm	
Wi-Fi Antenna 2															
Wi-Fi 2.4 GHz	2462	12.00	16	0	0	110		0		5 -MEASURE-	5 -MEASURE-	> 50 mm		5 -MEASURE-	

Note(s):

1. According to KDB 447498, if the calculated threshold value is >3 then SAR testing is required.
2. For Standalone exposure condition, Bluetooth SAR test were additionally evaluated for determining simultaneous transmission SAR test exclusion.

Antennas > 50mm to adjacent edges

SISO Max

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi Antenna 1															
Wi-Fi 2.4 GHz	2462	19.00	79	0	0	0	242	110		< 50 mm	< 50 mm	< 50 mm	2015.6 mW -EXEMPT-	695.6 mW -EXEMPT-	
Wi-Fi Antenna 2															
Wi-Fi 2.4 GHz	2462	18.00	63	0	0	110	242	0		< 50 mm	< 50 mm	695.6 mW -EXEMPT-	2015.6 mW -EXEMPT-	< 50 mm	

SISO Reduce

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi Antenna 1															
Wi-Fi 2.4 GHz	2462	13.00	20	0	0	0		110		< 50 mm	< 50 mm	< 50 mm		695.6 mW -EXEMPT-	
Wi-Fi Antenna 2															
Wi-Fi 2.4 GHz	2462	12.00	16	0	0	110		0		< 50 mm	< 50 mm	695.6 mW -EXEMPT-		< 50 mm	

Note(s):

1. According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.
2. For Standalone exposure condition, Bluetooth SAR test were additionally evaluated for determining simultaneous transmission SAR test exclusion.

7.2 Required Test Configurations

The table below identifies the standalone test configurations required for this device according to the findings in Section 7.1

Test Configurations	Pwr Back-off	Rear	Edge 1 (Top Edge)	Edge 2 (Right Edge)	Edge 3 (Bottom Edge)	Edge 4 (Left Edge)	Corner A Note 2	Corner B Note 3
Wi-Fi 2.4 GHz (Ant 1)	OFF	Yes	Yes	Yes	No	No	Yes	No
	ON	Yes	Yes	Yes	No	No	Yes	No
Wi-Fi 2.4 GHz (Ant 2)	OFF	Yes	Yes	No	No	Yes	No	Yes
	ON	Yes	Yes	No	No	Yes	No	Yes

Note(s):

1. Yes = Testing is required. No = Testing is not required.
2. Corner A side is located between Edge 1 and Edge 2.
3. Corner B side is located between Edge 1 and Edge 4.
4. For Corner A and Corner B, Additional Corner side tests are evaluated for bands that support reduced power due to proximity sensor operation.

8 Dielectric Property Measurements & System Check

8.1 Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head	
	ε_r	σ (S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800 – 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5000	36.2	4.45
5100	36.1	4.55
5200	36.0	4.66
5300	35.9	4.76
5400	35.8	4.86
5500	35.6	4.96
5600	35.5	5.07
5700	35.4	5.17
5800	35.3	5.27

SAR test were performed in All RF exposure conditions using Head tissue according to TCB workshop note of April. 2019.

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

SAR 4 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
3-30-2020	Head 2450	e'	37.8000	Relative Permittivity (ϵ_r):	37.80	39.20	-3.57	5
		e''	13.6100	Conductivity (σ):	1.85	1.80	3.00	5
	Head 2400	e'	37.8400	Relative Permittivity (ϵ_r):	37.84	39.30	-3.71	5
		e''	13.4200	Conductivity (σ):	1.79	1.75	2.24	5
	Head 2480	e'	37.7600	Relative Permittivity (ϵ_r):	37.76	39.16	-3.58	5
		e''	13.7100	Conductivity (σ):	1.89	1.83	3.17	5

8.2 System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 2.5 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 1.4 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

Reference Target SAR Values

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)	
				1g/10g	Head
D2450V2	939	7-25-2019	2450	1g	53.20
				10g	25.10

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

SAR 4 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
3-30-2020	D2450V2	939	Head	1g	5.11	51.10	53.20	-3.95	1, 2
				10g	2.29	22.90	25.10	-8.76	

9 Conducted Output Power Measurements

9.1 Wi-Fi 2.4GHz (DTS Band)

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Max Pwr.			Reduction Pwr.		
					Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)
2.4 SISO Ant 1	802.11b	1 Mbps	1	2412	16.5	17.0	No	13.0	13.0	Yes
			6	2437	18.3	19.0	Yes	12.9	13.0	
			11	2462	18.0	19.0		12.9	13.0	
			12	2467	Not Require	16.0	No	12.7	13.0	
			13	2472		13.0		12.6	13.0	
	802.11g	6 Mbps	1	2412	Not Require	16.0	No	12.9	13.0	No
			6	2437		16.0		13.0	13.0	
			11	2462		16.0		12.9	13.0	
			12	2467		11.0		Not Require	11.0	
			13	2472		8.0			8.0	
	802.11n (HT20)	6.5 Mbps	1	2412	Not Require	16.0	No	12.7	13.0	No
			6	2437		16.0		12.7	13.0	
			11	2462		16.0		12.8	13.0	
			12	2467		12.0		Not Require	12.0	
			13	2472		6.0			6.0	
2.4 SISO Ant 2	802.11b	1 Mbps	1	2412	17.3	18.0	Yes	11.6	12.0	Yes
			6	2437	16.9	18.0		11.6	12.0	
			11	2462	17.4	18.0		11.3	12.0	
			12	2467	17.1	18.0		11.4	12.0	
			13	2472	Not Require	15.0		11.3	12.0	
	802.11g	6 Mbps	1	2412	Not Require	15.0	No	11.4	12.0	No
			6	2437		15.0		11.5	12.0	
			11	2462		15.0		11.7	12.0	
			12	2467		15.0		11.8	12.0	
			13	2472		11.0		Not Require	11.0	
	802.11n (HT20)	6 Mbps	1	2412	Not Require	15.0	No	11.8	12.0	No
			6	2437		15.0		12.0	12.0	
			11	2462		15.0		11.8	12.0	
			12	2467		15.0		11.8	12.0	
			13	2472		10.0		Not Require	10.0	

Note(s):

1. SAR is not required for 802.11g/n modes when the adjusted SAR for 802.11b is < 1.2 W/kg.
2. For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11n/g mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.
3. MIMO DTS SAR test were additionally evaluated for determining simultaneous transmission SAR test exclusion.

10 Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

- Reported SAR(W/kg) for WWAN= Measured SAR *Tune-up Scaling Factor
- Reported SAR(W/kg) for Wi-Fi and Bluetooth= Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor
- Duty Cycle scaling factor = 1 / Duty cycle (%)

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 248227 D01 SAR meas for 802.11:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported* SAR for the *initial test position* is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the *initial test position* to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the *initial test position*, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the *initial test position*.

9.2 Wi-Fi (DTS Band)

Frequency Band	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle (%)	Power (dBm)		1-g SAR (W/kg)		Note	Plot No.
										Tune-up limit	Meas.	Meas.	Scaled		
2.4GHz SISO Ant 1	802.11b 1 Mbps	Standalone	On	0	Rear	1	2412.0	0.571	99.3%	13.0	13.0	0.421	0.428		
					Edge 1	1	2412.0	0.245	99.3%	13.0	13.0				
					Edge 2	1	2412.0	0.508	99.3%	13.0	13.0	0.625	0.635	2	1
					Corner A	1	2412.0	0.213	99.3%	13.0	13.0				
2.4GHz SISO Ant 2	802.11b 1 Mbps	Standalone	On	0	Rear	6	2437.0	0.305	99.3%	12.0	11.6				
					Edge 1	6	2437.0	0.124	99.3%	12.0	11.6				
					Edge 4	6	2437.0	0.358	99.3%	12.0	11.6	0.305	0.339	1	2
					Corner B	6	2437.0	0.064	99.3%	12.0	11.6				

Note(s):

1. Highest *reported* SAR is ≤ 0.4 or 1.0 W/kg (1-g or 10-g respectively). Therefore, further SAR measurements within this exposure condition are not required.
2. Highest *reported* SAR is > 0.4 or 1.0 W/kg (1-g or 10-g respectively). Due to the highest *reported* SAR for this test position, other test positions in this exposure condition were evaluated until a SAR ≤ 0.8 or 2.0 W/kg (1-g or 10-g respectively) was *reported*.
3. Testing for a second channel was required because the *reported* SAR for this test position was > 0.8 or 2.0 W/kg (1-g or 10-g respectively).
4. SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
5. Max. RF Output Power SAR levels are reference to Original filing granted in 03/26/2020

10 SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated	
						Measured SAR (W/kg)	Largest to Smallest SAR Ratio
2400	Wi-Fi 802.11b/g/n	Standalone	Edge 2	No	0.625	N/A	N/A

Note(s):

Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.

11 Simultaneous Transmission SAR Analysis

Simultaneous Transmission Condition

RF Exposure Condition	Item			
Standalone	1	DTS_Ant.1	+	DTS_Ant.2
	2	U-NII_Ant.1	+	U-NII_Ant.2
	3	U-NII_Ant.2	+	BT

Notes:

1. Only U-NII Ant.2 Radio can transmit simultaneously with Bluetooth Radio.
2. DTS Radio cannot transmit simultaneously with Bluetooth Radio.
3. DTS and UNII Radio can operating both SISO and MIMO modes.

Simultaneous transmission SAR test exclusion considerations

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

SAR_1 is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR_2 is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of

$$[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri \leq 0.04$$

When an individual antenna transmits at on two bands simultaneously, the sum of the highest *reported* SAR for the frequency bands should be used to determine SAR_1 or SAR_2. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used. The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

The antennas for the unlicensed transmitters are closely situated. As a result, the associated SAR hotspots are also closely situated. Some of the sum of SAR calculations yielded results over 1.6 W/kg. The SPSLR calculations for these situations were performed by treating the unlicensed SAR values as a single transmitter. The most

conservative distance between all the unlicensed hotspots to the licensed hotspot was used for the value of *d* in the SPSLR calculation.

Simultaneous transmission SAR measurement

When simultaneous transmission SAR measurements are required in different frequency bands not covered by a single probe calibration point then separate tests for each frequency band are performed. The tests are performed using enlarged zoom scans which are processed, by means of superposition, using the DASY5 volume scan postprocessing procedures to determine the 1-g SAR for the aggregate SAR distribution.

The spatial resolution used for all enlarged zoom scans is the same as used for the most stringent zoom scans. I.E. the scan parameters required for the highest frequency assessed are used for all enlarged zoom scans. The scans cover the complete area of the device to ensure all transmitting antennas and radiating structures are assessed.

DASY5 provides the ability to perform Multiband Evaluations according to the latest standards using the Volume Scan job as well as appropriate routines for the Post-processing.

In order to extract and process measurements within different frequency bands, the SEMCAD X Post-processor performs the combination and subsequent superposition of these measurement data via DASY5= Combined MultiBand Averaged SAR.

Combined Multi Band Averaged SAR allows - in addition to the data extraction - an evaluation of the 1 g, 10 g and/or arbitrary averaged mass SAR.
Power Scaling Factor is used to allow the volume scans to be scaled by a value other than "1", this is important when the results need to be scaled to different maximum power levels. The Power Scaling Factor is applied to each individual point of the scan. When power scaling is used in multi-band combinations the scaling factor is applied to each individual point of the first scan, the second factor is then applied to each individual point of the second scan and so on. The scans are then combined.

Estimated SAR for Simultaneous Transmission SAR Analysis

Considerations for SAR estimation

1. When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
2. Dedicated Host Approach criteria for SAR test exclusion is likewise applied to SAR estimation, with certain distinctions between test exclusion and SAR estimation:
    - When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied for SAR estimation; this is the same between test exclusion and SAR estimation calculations.
    - When the separation distance from the antenna to an adjacent edge is > 5 mm but ≤ 50 mm, the actual antenna-to-edge separation distance is applied for SAR estimation.
    - When the minimum test separation distance is > 50 mm, the estimated SAR value is 0.4 W/kg
3. Please refer to Estimated SAR Tables to see which test positions are inherently compliant as they consist of only estimated SAR values for all applicable transmitters and consequently will always have sum of SAR values < 1.2 W/kg. Simultaneous transmission SAR analysis was therefore not performed for these test positions.

Estimated SAR for WLAN

SISO Max

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Estimated 1-g SAR Value (W/kg)					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi Antenna 1															
Wi-Fi 2.4 GHz	2462	19.00	79	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Wi-Fi 5.3 GHz	5320	14.50	28	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Wi-Fi 5.5 GHz	5700	13.00	20	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Wi-Fi 5.8 GHz	5825	14.50	28	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Bluetooth	2480	9.00	8	0	0	0	242	110		0.336	0.336	0.336	0.400	0.400	
Wi-Fi Antenna 2															
Wi-Fi 2.4 GHz	2462	18.00	63	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	
Wi-Fi 5.3 GHz	5320	13.00	20	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	
Wi-Fi 5.5 GHz	5700	13.00	20	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	
Wi-Fi 5.8 GHz	5825	13.00	20	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	

SISO Reduce

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Estimated 1-g SAR Value (W/kg)					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi Antenna 1															
Wi-Fi 2.4 GHz	2462	13.00	20	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Wi-Fi 5.3 GHz	5320	9.00	8	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Wi-Fi 5.5 GHz	5700	9.00	8	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Wi-Fi 5.8 GHz	5825	9.00	8	0	0	0	242	110		-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400	
Wi-Fi Antenna 2															
Wi-Fi 2.4 GHz	2462	12.00	16	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	
Wi-Fi 5.3 GHz	5320	9.00	8	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	
Wi-Fi 5.5 GHz	5700	9.00	8	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	
Wi-Fi 5.8 GHz	5825	9.00	8	0	0	110	242	0		-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-	

Note(s):

Bluetooth SAR test were additionally evaluated for determining simultaneous transmission SAR test exclusion.

11.1 Sum of the SAR for Wi-Fi & BT

Test Position	Standalone SAR (W/kg)					∑ 1-g SAR (W/kg)		
	DTS Ant 1	DTS Ant 2	U-NII Ant 1	U-NII Ant 2	BT	DTS Ant 1 + DTS Ant 2	U-NII Ant 1 + U-NII Ant 2	BT + U-NII Ant 2
	1	2	3	4	5	1+2	3+4	4+5
Rear	0.428	0.339	0.359	0.378	0.279	0.767	0.737	0.657
Edge 1	0.635	0.339	0.579	0.378	0.132	0.974	0.957	0.510
Edge 2	0.635	0.400	0.579	0.400	0.320	1.035	0.979	0.720
Edge 3	0.400	0.400	0.400	0.400	0.400	0.800	0.800	0.800
Edge 4	0.400	0.339	0.400	0.378	0.400	0.739	0.778	0.778

Conclusion:

1. Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is ≤ 0.04 for all circumstances that require SPLSR calculation.
2. MIMO measurements were not taken into test because the sum of the simultaneous transmission of SISO in each position was less than or equal to 1.6W/kg.

Note(s):

1. UNII and BT SAR levels are reference to Original filing granted in 03/26/2020

Appendixes

Refer to separated files for the following appendixes.

4789438507-S1V1 FCC Report SAR_App A_Photos & Ant. Locations

4789438507-S1V1 FCC Report SAR_App B_Highest SAR Test Plots

4789438507-S1V1 FCC Report SAR_App C_System Check Plots

4789438507-S1V1 FCC Report SAR_App D_SAR Tissue Ingredients

4789438507-S1V1 FCC Report SAR_App E_Probe Cal. Certificates

4789438507-S1V1 FCC Report SAR_App F_Dipole Cal. Certificates

END OF REPORT