



**FCC 47 CFR § 2.1093
IEEE Std 1528-2013**

SAR EVALUATION REPORT

FOR

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

MODEL NUMBER: SM-X510

FCC ID: A3LSMX510

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Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	7/19/2023	Initial Issue	--
V2	7/20/2023	Revised SAR Report	Seungyeon.Kim
V3	7/31/2023	Revised Tune-up limit in Sec. 6.3, Sec. 9.1	Seungyeon.Kim
V4	8/1/2023	Revised table in Sec. 7.1, Sec.12	Seungyeon.Kim

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.		
FCC ID	A3LSMX510		
Model Number	SM-X510		
Applicable Standards	FCC 47 CFR § 2.1093 IEEE Std 1528-2013 Published RF exposure KDB procedures		
Exposure Category	SAR Limits (W/Kg)		
	Peak spatial-average (1g of tissue)		
General population / Uncontrolled exposure	1.6		
RF Exposure Conditions	Equipment Class - The Highest Reported SAR (W/kg)		
	DTS	NII	DSS
Standalone	0.94	0.99	0.60
Simultaneous TX	0.94	1.51	1.51
Date Tested	7/10/2022 to 7/19/2023		
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.

Approved & Released By: 	Prepared By: 
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory	Seungyeon Kim Laboratory Engineer UL Korea, Ltd. Suwon Laboratory

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

Equipment Class	Band	Antenna	The Highest Reported SAR (W/kg)
			1g of tissue
			Standalone exposure condition
DTS	2.4GHz WLAN	All	0.941
UNII	5GHz WLAN	Ant.2	0.986
DSS	Bluetooth	Ant.1	0.602

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, IEC_IEEE STD 62209-1528 : 2020, ANSI C63.26-2015 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; RF Exposure Procedures (Bluetooth Duty Factor)
- [TCB workshop](#) October, 2016; RF Exposure Procedures (DUT Holder Perturbations)
- [TCB workshop](#) April, 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))

3. Facilities and Accreditation

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

Suwon
SAR 6 Room
SAR 7 Room
SAR 9 Room

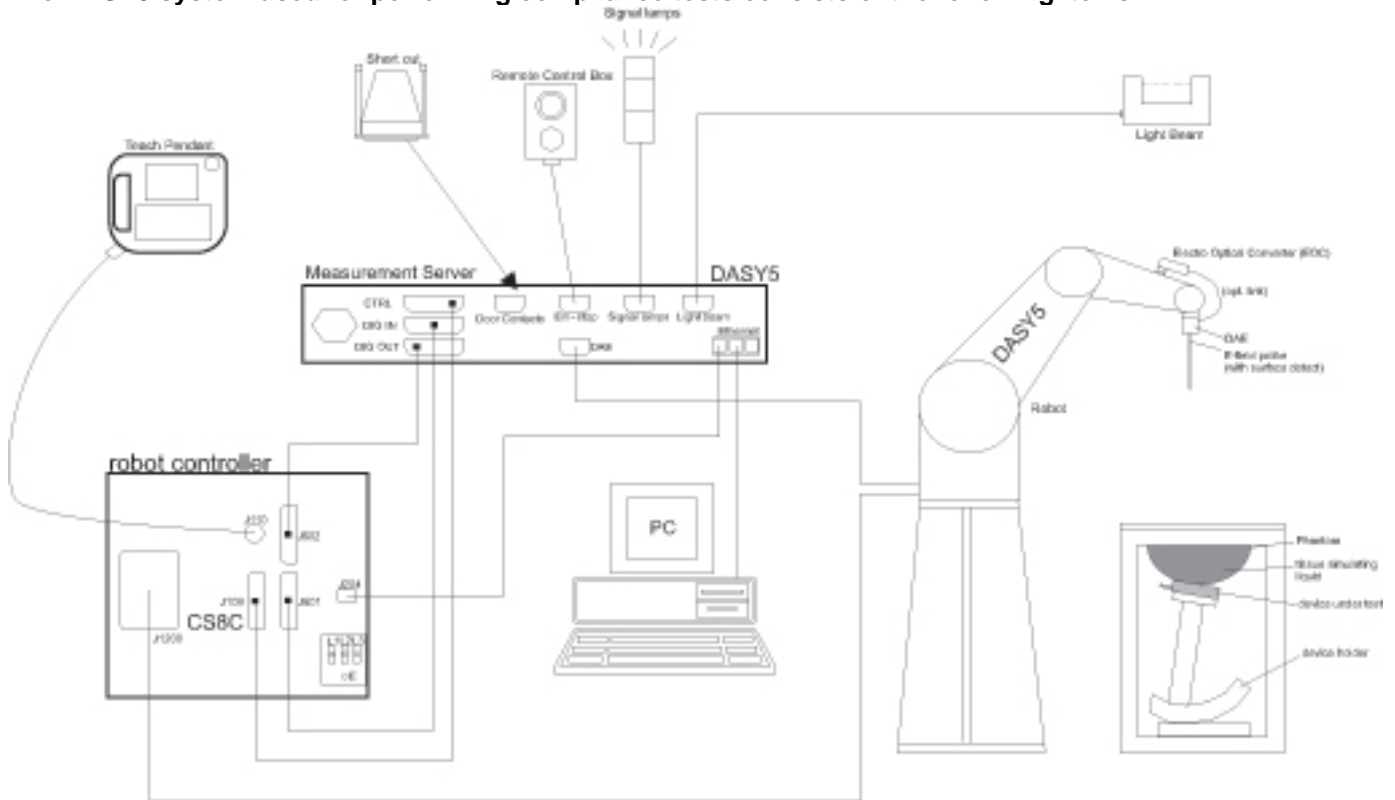
UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.

The full scope of accreditation can be viewed at <https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf>.

4. SAR Measurement System & Test Equipment

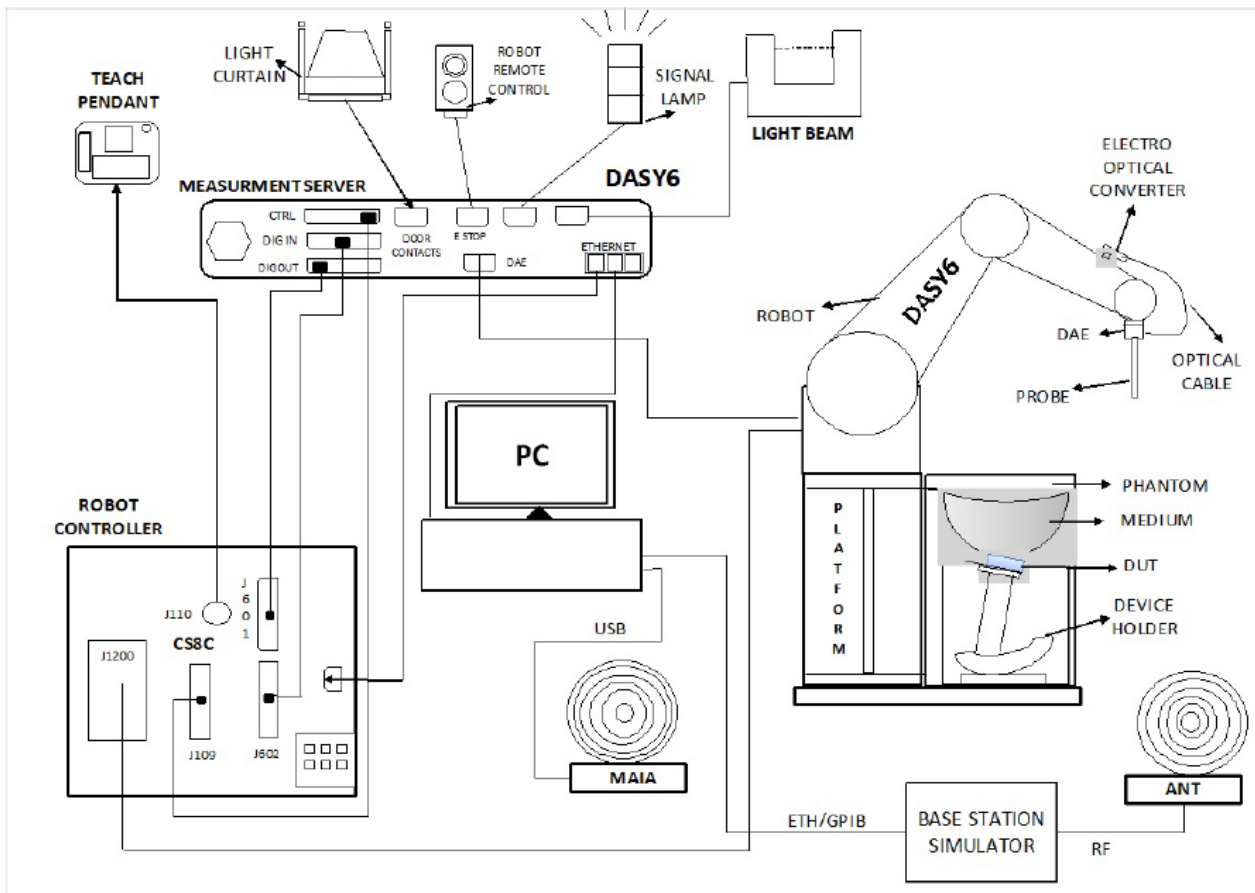
4.1. SAR Measurement System

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.

The DASY6 & 8 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 Win10 and the DASY6 or 8 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	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
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 \leq 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: $\Delta x_{Zoom}, \Delta y_{Zoom}$			≤ 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 1 st 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	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
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 <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> 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	8/5/2023
Network Analyzer	ROHDE & SCHWARZ	ZNB 20	102256	8/5/2023
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	7/25/2023
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3851	8/3/2023
Thermometer	LKM	DTM3000	3862	8/3/2023

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Keysight	N5173B	MY59101083	8/4/2023
Power Sensor	KEYSIGHT	U2000A	MY61060004	8/3/2023
Power Sensor	KEYSIGHT	U2000A	MY54260007	8/3/2023
Power Amplifier	EXODUS	AMP2027ADB	10002	1/6/2024
Directional Coupler	KRYTAR	100318010	215541	1/5/2024
Low Pass Filter	MINI-CIRCUITS	VLF-6000+	S0142	8/2/2023
Attenuator	MINI-CIRCUITS	BW-S3W10+	SUW-S0217	1/6/2024
E-Field Probe	SPEAG	EX3DV4	7313	3/24/2024
E-Field Probe	SPEAG	EX3DV4	7314	5/26/2024
E-Field Probe	SPEAG	EX3DV4	7646	3/23/2024
E-Field Probe	SPEAG	EX3DV4	7330	1/24/2024
Data Acquisition Electronics	SPEAG	DAE4	1447	3/22/2024
Data Acquisition Electronics	SPEAG	DAE4	1494	7/18/2023
Data Acquisition Electronics	SPEAG	DAE4	1670	5/24/2024
Data Acquisition Electronics	SPEAG	DAE4	911	3/21/2024
Data Acquisition Electronics	SPEAG	DAE4	1671	5/25/2024
System Validation Dipole	SPEAG	D2450V2	960	3/24/2024
System Validation Dipole	SPEAG	D5GHzV2	1209	2/28/2024
System Validation Dipole	SPEAG	D5GHzV2	1325	4/21/2024
Thermometer	Lutron	MHB-382SD	AK.12102	8/9/2023
Thermometer	Lutron	MHB-382SD	AK.18789	8/9/2023

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	169803	1/5/2024

Note(s):

1. For System Validation Dipole, Calibration interval applied every 2 years according to referencing KDB 865664 guidance.
2. Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations. (for blue box items)
3. All equipments were used until Cal.Due data.

5. Measurement Uncertainty

Measurement Uncertainty of 100MHz to 6GHz

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 Procedures 2, Clause 4.4.3 in IEC Guide 115:2021.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Refer to Appendix A.		
Back Cover	<input checked="" type="checkbox"/> The Back Cover is not removable.		
Battery Options	<input checked="" type="checkbox"/> The rechargeable battery is not user accessible		
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 5.8 GHz)		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz) <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 5.2 GHz_UNII-1, Wi-Fi 5.8 GHz_UNII-3)		
Test Sample Information	No.	S/N	Notes
	1	74ab47181e397ece	Wi-Fi & BT Conducted
	2	R32W600ACRM	SAR
	3	74ab4711f0397ece	SAR
	4	74ab471816397ece	SAR
	5	R32W4009R3D	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) 802.11ax (HE20)	SISO : 98.9% (802.11b) 96.9% (802.11g) MIMO : 98.7% (802.11b) 96.3% (802.11g)
	5 GHz	802.11a 802.11n (HT20) & (HT40) 802.11ac (VHT20) & (VHT40) & (VHT80) 802.11ax (HE20) & (HE40) & (HE80)	SISO : 96.7% (802.11a) 94.5% (802.11ac (VHT80)) MIMO 96.8% (802.11a) 90.4% (802.11ac (VHT80))
	Does this device support bands 5.60 ~ 5.65 GHz? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
	Does this device support Band gap channel(s)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Bluetooth	2.4 GHz	Version 5.3 LE	76.9% (BDR, EDR DH5)

Notes:

- The Bluetooth protocol is considered source-based averaging. Bluetooth GFSK (DH5) was verified to have the highest duty cycle of 76.9% and was considered and used for SAR Testing.
- Duty Cycle used for Wi-Fi/BT's SAR testing refer to sec.9

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-Output power

RF Air interface	Band	Sensor State	RF Output Power (dBm)												
			802.11 mode												
			SISO : Antenna 1 or Antenna 2						MIMO : Antenna 1 + Antenna 2						
			a	b	g	n	ac	ax	a	b	g	n	ac	ax	
WiFi 2.4 GHz (Ant.1 only)	Ch.1-11	Active		12.0	12.0	12.0		12.0		15.0	15.0	15.0		15.0	
		Inactive		17.0	18.0	16.0		16.0		20.0	21.0	19.0		19.0	
	Ch.12	Active		3.0	6.0	5.0		5.0		6.0	9.0	8.0		8.0	
		Inactive		3.0	6.0	5.0		5.0		6.0	9.0	8.0		8.0	
	Ch.13	Active		-1.0	2.0	1.0		1.0		2.0	5.0	4.0		4.0	
		Inactive		-1.0	2.0	1.0		1.0		2.0	5.0	4.0		4.0	
WiFi 5 GHz (Ant.2 only) (BW : 20MHz)	UNII-1	Active	6.5			6.5	6.5	6.5	9.5			9.5	9.5	9.5	
		Inactive	15.0			14.0	14.0	14.0	18.0			17.0	17.0	17.0	
	UNII-2A	Active	6.5			6.5	6.5	6.5	9.5			9.5	9.5	9.5	
		Inactive	15.0			14.0	14.0	14.0	18.0			17.0	17.0	17.0	
	UNII-2C	Active	8.5			8.5	8.5	8.5	11.5			11.5	11.5	11.5	
		Inactive	17.0			16.0	16.0	16.0	20.0			19.0	19.0	19.0	
	UNII-3	Active	8.5			8.5	8.5	8.5	11.5			11.5	11.5	11.5	
		Inactive	17.0			16.0	16.0	16.0	20.0			19.0	19.0	19.0	
	WiFi 5 GHz (Ant.2 only) (BW : 40MHz)	UNII-1	Active				6.5	6.5	6.5				9.5	9.5	9.5
			Inactive				12.0	12.0	12.0				15.0	15.0	15.0
UNII-2A		Active				6.5	6.5	6.5				9.5	9.5	9.5	
		Inactive				12.0	12.0	12.0				15.0	15.0	15.0	
UNII-2C		Active				8.5	8.5	8.5				11.5	11.5	11.5	
		Inactive				14.0	14.0	14.0				17.0	17.0	17.0	
UNII-3		Active				8.5	8.5	8.5				11.5	11.5	11.5	
		Inactive				14.0	14.0	14.0				17.0	17.0	17.0	
WiFi 5 GHz (Ant.2 only) (BW : 80MHz)	UNII-1	Active					6.5	6.5					9.5	9.5	
		Inactive					8.0	8.0					11.0	11.0	
	UNII-2A	Active					6.5	6.5					9.5	9.5	
		Inactive					8.0	8.0					11.0	11.0	
	UNII-2C	Active					8.5	8.5					11.5	11.5	
		Inactive					13.0	13.0					16.0	16.0	
	UNII-3	Active					8.5	8.5					11.5	11.5	
		Inactive					13.0	13.0					16.0	16.0	

Bluetooth Maximum & Reduced power

RF Air interface	Max. RF Output Power (dBm)	Reduced. RF Output Power (dBm)
Bluetooth-BR	15.0	12.0
Bluetooth-EDR	12.0	12.0
Bluetooth-LE	9.0	9.0

Note(s):

1. This device uses an independent fixed level power reduction mechanism for WLAN & Bluetooth mode operations Detailed descriptions of the power reduction mechanism are included in the operational description.
2. 2.4 GHz operate with Ant.1 & MIMO, and 5GHz only operate with Ant.2 & MIMO

6.4. Power Back-off Operation

This device supports power back-off modes using triggering proximity sensor. For full details on how power back-off mode operates, refer to the Operational Description.

Antenna	Technologies Supported	Proximity sensor	Power Back-off mode	Standalone Exposure Conditions				
				Rear	Top	Left	Bottom	Right
WiFi/BT Ant.1	Wi-Fi 2.4GHz	Proximity sensor.1	Proximity sensor triggering	O	O	O		
	Wi-Fi 5GHz							
	Bluetooth							
WiFi Ant.2	Wi-Fi 2.4GHz	Proximity sensor.2	Proximity sensor triggering	O	O			O
	Wi-Fi 5GHz							

Note(s):

1. Please refer to Section.9 for all power measurements, and Proximity sensor verification is mentioned at Appendix G.

7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A 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 Section 4.3.1 is applied in conjunction with KDB 616217 Section 4.3 to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is $\leq 5\text{mm}$, a distance of 5mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is $> 5\text{mm}$, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations for WLAN/BT

Antennas < 50mm to adjacent edges

Max power, Proximity sensor off														
	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Ant.1	Bluetooth	2480	15.00	32	19	22	19	241.63	117.86	2.7	2.3	2.7	> 50 mm	> 50 mm
Ant.1	Wi-Fi 2.4 GHz	2462	18.00	63	19	22	19	241.63	117.86	5.2	4.5	5.2	> 50 mm	> 50 mm
Ant.2	Wi-Fi 5.2 GHz	5240	15.00	32	19	22	117.86	241.63	19	3.9	3.3	> 50 mm	> 50 mm	3.9
Ant.2	Wi-Fi 5.3 GHz	5320	15.00	32	19	22	117.86	241.63	19	3.9	3.4	> 50 mm	> 50 mm	3.9
Ant.2	Wi-Fi 5.5 GHz	5700	17.00	50	19	22	117.86	241.63	19	6.3	5.4	> 50 mm	> 50 mm	6.3
Ant.2	Wi-Fi 5.8 GHz	5825	17.00	50	19	22	117.86	241.63	19	6.4	5.5	> 50 mm	> 50 mm	6.4
MIMO	Wi-Fi 2.4 GHz	2462	18.00	63	19	22	19	241.63	19	5.2	4.5	5.2	> 50 mm	5.2
MIMO	Wi-Fi 5.2 GHz	5240	15.00	32	19	22	19	241.63	19	3.9	3.3	3.9	> 50 mm	3.9
MIMO	Wi-Fi 5.3 GHz	5320	15.00	32	19	22	19	241.63	19	3.9	3.4	3.9	> 50 mm	3.9
MIMO	Wi-Fi 5.5 GHz	5700	17.00	50	19	22	19	241.63	19	6.3	5.4	6.3	> 50 mm	6.3
MIMO	Wi-Fi 5.8 GHz	5825	17.00	50	19	22	19	241.63	19	6.4	5.5	6.4	> 50 mm	6.4

Reduced power, Proximity sensor On														
	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Ant.1	Bluetooth	2480	12.00	16	0	0	0			5	5	5		
Ant.1	Wi-Fi 2.4 GHz	2462	12.00	16	0	0	0			5	5	5		
Ant.2	Wi-Fi 5.2 GHz	5240	6.50	4	0	0			0	1.8	1.8			1.8
Ant.2	Wi-Fi 5.3 GHz	5320	6.50	4	0	0			0	1.8	1.8			1.8
Ant.2	Wi-Fi 5.5 GHz	5700	10.00	10	0	0			0	4.8	4.8			4.8
Ant.2	Wi-Fi 5.8 GHz	5825	9.50	9	0	0			0	4.3	4.3			4.3
MIMO	Wi-Fi 2.4 GHz	2462	12.00	16	0	0	0		0	5	5	5		5
MIMO	Wi-Fi 5.2 GHz	5240	6.50	4	0	0	0		0	1.8	1.8	1.8		1.8
MIMO	Wi-Fi 5.3 GHz	5320	6.50	4	0	0	0		0	1.8	1.8	1.8		1.8
MIMO	Wi-Fi 5.5 GHz	5700	10.00	10	0	0	0		0	4.8	4.8	4.8		4.8
MIMO	Wi-Fi 5.8 GHz	5825	9.50	9	0	0	0		0	4.3	4.3	4.3		4.3

Note(s):

1. Accordint to KDB 447498, If the calculated threshold value is >3 then SAR testing is required.

Antennas > 50mm to adjacent edges

Max power, Proximity sensor off														
	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Ant.1	Bluetooth	2480	15.00	32	19	22	19	241.63	117.86	< 50 mm	< 50 mm	< 50 mm	2011.6 mW -EXEMPT-	773.9 mW -EXEMPT-
Ant.1	Wi-Fi 2.4 GHz	2462	18.00	63	19	22	19	241.63	117.86	< 50 mm	< 50 mm	< 50 mm	2011.9 mW -EXEMPT-	774.2 mW -EXEMPT-
Ant.2	Wi-Fi 5.2 GHz	5240	15.00	32	19	22	117.86	241.63	19	< 50 mm	< 50 mm	744.1 mW -EXEMPT-	1981.8 mW -EXEMPT-	< 50 mm
Ant.2	Wi-Fi 5.3 GHz	5320	15.00	32	19	22	117.86	241.63	19	< 50 mm	< 50 mm	743.6 mW -EXEMPT-	1981.3 mW -EXEMPT-	< 50 mm
Ant.2	Wi-Fi 5.5 GHz	5700	17.00	50	19	22	117.86	241.63	19	< 50 mm	< 50 mm	741.4 mW -EXEMPT-	1979.1 mW -EXEMPT-	< 50 mm
Ant.2	Wi-Fi 5.8 GHz	5825	17.00	50	19	22	117.86	241.63	19	< 50 mm	< 50 mm	740.8 mW -EXEMPT-	1978.5 mW -EXEMPT-	< 50 mm
MIMO	Wi-Fi 2.4 GHz	2462	18.00	63	19	22	19	241.63	19	< 50 mm	< 50 mm	< 50 mm	2011.9 mW -EXEMPT-	< 50 mm
MIMO	Wi-Fi 5.2 GHz	5240	15.00	32	19	22	19	241.63	19	< 50 mm	< 50 mm	< 50 mm	1981.8 mW -EXEMPT-	< 50 mm
MIMO	Wi-Fi 5.3 GHz	5320	15.00	32	19	22	19	241.63	19	< 50 mm	< 50 mm	< 50 mm	1981.3 mW -EXEMPT-	< 50 mm
MIMO	Wi-Fi 5.5 GHz	5700	17.00	50	19	22	19	241.63	19	< 50 mm	< 50 mm	< 50 mm	1979.1 mW -EXEMPT-	< 50 mm
MIMO	Wi-Fi 5.8 GHz	5825	17.00	50	19	22	19	241.63	19	< 50 mm	< 50 mm	< 50 mm	1978.5 mW -EXEMPT-	< 50 mm

Reduced power, Proximity sensor On														
	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Ant.1	Bluetooth	2480	12.00	16	0	0	0			< 50 mm	< 50 mm	< 50 mm		
Ant.1	Wi-Fi 2.4 GHz	2462	12.00	16	0	0	0			< 50 mm	< 50 mm	< 50 mm		
Ant.2	Wi-Fi 5.2 GHz	5240	6.50	4	0	0			0	< 50 mm	< 50 mm			< 50 mm
Ant.2	Wi-Fi 5.3 GHz	5320	6.50	4	0	0			0	< 50 mm	< 50 mm			< 50 mm
Ant.2	Wi-Fi 5.5 GHz	5700	10.00	10	0	0			0	< 50 mm	< 50 mm			< 50 mm
Ant.2	Wi-Fi 5.8 GHz	5825	9.50	9	0	0			0	< 50 mm	< 50 mm			< 50 mm
MIMO	Wi-Fi 2.4 GHz	2462	12.00	16	0	0	0		0	< 50 mm	< 50 mm	< 50 mm		< 50 mm
MIMO	Wi-Fi 5.2 GHz	5240	6.50	4	0	0	0		0	< 50 mm	< 50 mm	< 50 mm		< 50 mm
MIMO	Wi-Fi 5.3 GHz	5320	6.50	4	0	0	0		0	< 50 mm	< 50 mm	< 50 mm		< 50 mm
MIMO	Wi-Fi 5.5 GHz	5700	10.00	10	0	0	0		0	< 50 mm	< 50 mm	< 50 mm		< 50 mm
MIMO	Wi-Fi 5.8 GHz	5825	9.50	9	0	0	0		0	< 50 mm	< 50 mm	< 50 mm		< 50 mm

Note(s):

1. Accordint to KDB 447498, If the calculated Power threshold is less than the output power then SAR testing is required.

7.2. Required Test Configurations

Antenna	Tx Interface	Proximity sensor (On/Off)	Rear	Top	Left	Bottom	Right
WiFi Ant.1	BT/WiFi 2.4GHz	OFF	Yes	Yes	Yes	No	No
		ON	Yes	Yes	Yes	N/A	N/A
WiFi Ant.2	WiFi 5GHz	OFF	Yes	Yes	No	No	Yes
		ON	Yes	Yes	N/A	N/A	Yes
WiFi MIMO	WiFi 2.4GHz/5Ghz	OFF	Yes	Yes	Yes	No	Yes
		ON	Yes	Yes	Yes	N/A	Yes

Note(s):

1. Yes = Testing is required. No = Testing is not required.
2. BT SAR tested using "max power, proximity sensor off", even if SAR test is exemption at "max power, proximity sensor off".
3. UNII SAR tested using "reduced power, proximity sensor on", even if SAR test is exemption at "reduced power, proximity sensor on".

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 $\pm 2^\circ\text{C}$ 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.

1. Tissue Dielectric Parameters (100MHz to 6GHz)

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

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 6 Room

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
7/11/2023	Head 5250	e'	35.8200	Relative Permittivity (ϵ_r):	35.82	35.93	-0.31	5
		e"	15.4400	Conductivity (σ):	4.51	4.70	-4.15	5
	Head 5260	e'	35.8100	Relative Permittivity (ϵ_r):	35.81	35.92	-0.31	5
		e"	15.4500	Conductivity (σ):	4.52	4.71	-4.11	5
	Head 5600	e'	35.2200	Relative Permittivity (ϵ_r):	35.22	35.53	-0.88	5
		e"	15.6600	Conductivity (σ):	4.88	5.06	-3.64	5
	Head 5750	e'	34.9600	Relative Permittivity (ϵ_r):	34.96	35.36	-1.14	5
		e"	15.7500	Conductivity (σ):	5.04	5.21	-3.42	5
	Head 5895	e'	34.7200	Relative Permittivity (ϵ_r):	34.72	35.21	-1.38	5
		e"	15.8400	Conductivity (σ):	5.19	5.37	-3.31	5
7/18/2023	Head 5250	e'	36.4800	Relative Permittivity (ϵ_r):	36.48	35.93	1.52	5
		e"	15.8800	Conductivity (σ):	4.64	4.70	-1.41	5
	Head 5260	e'	36.4600	Relative Permittivity (ϵ_r):	36.46	35.92	1.50	5
		e"	15.8900	Conductivity (σ):	4.65	4.71	-1.38	5
	Head 5600	e'	35.8700	Relative Permittivity (ϵ_r):	35.87	35.53	0.95	5
		e"	16.2000	Conductivity (σ):	5.04	5.06	-0.31	5
	Head 5750	e'	35.6100	Relative Permittivity (ϵ_r):	35.61	35.36	0.70	5
		e"	16.3400	Conductivity (σ):	5.22	5.21	0.20	5
	Head 5895	e'	35.3700	Relative Permittivity (ϵ_r):	35.37	35.21	0.47	5
		e"	16.4700	Conductivity (σ):	5.40	5.37	0.53	5

SAR 7 Room

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
7/11/2023	Head 2450	e'	38.2400	Relative Permittivity (ϵ_r):	38.24	39.20	-2.45	5
		e"	13.4400	Conductivity (σ):	1.83	1.80	1.72	5
	Head 2400	e'	38.3300	Relative Permittivity (ϵ_r):	38.33	39.30	-2.46	5
		e"	13.4500	Conductivity (σ):	1.79	1.75	2.47	5
	Head 2500	e'	38.1700	Relative Permittivity (ϵ_r):	38.17	39.14	-2.47	5
		e"	13.4400	Conductivity (σ):	1.87	1.85	0.77	5
7/17/2023	Head 5200	e'	36.2000	Relative Permittivity (ϵ_r):	36.20	35.99	0.58	5
		e"	15.9800	Conductivity (σ):	4.62	4.65	-0.66	5
	Head 5250	e'	36.1200	Relative Permittivity (ϵ_r):	36.12	35.93	0.52	5
		e"	16.0200	Conductivity (σ):	4.68	4.70	-0.55	5
	Head 5600	e'	35.5400	Relative Permittivity (ϵ_r):	35.54	35.53	0.02	5
		e"	16.2600	Conductivity (σ):	5.06	5.06	0.05	5
	Head 5750	e'	35.3000	Relative Permittivity (ϵ_r):	35.30	35.36	-0.18	5
		e"	16.3900	Conductivity (σ):	5.24	5.21	0.51	5
	Head 5800	e'	35.2300	Relative Permittivity (ϵ_r):	35.23	35.30	-0.20	5
		e"	16.4200	Conductivity (σ):	5.30	5.27	0.48	5
	Head 5925	e'	35.0200	Relative Permittivity (ϵ_r):	35.02	35.20	-0.51	5
		e"	16.5000	Conductivity (σ):	5.44	5.40	0.66	5

SAR 9 Room

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
7/13/2023	Head 5250	e'	35.2900	Relative Permittivity (ϵ_r):	35.29	35.93	-1.79	5
		e"	15.8200	Conductivity (σ):	4.62	4.70	-1.79	5
	Head 5260	e'	35.2700	Relative Permittivity (ϵ_r):	35.27	35.92	-1.81	5
		e"	15.8600	Conductivity (σ):	4.64	4.71	-1.57	5
	Head 5600	e'	34.6000	Relative Permittivity (ϵ_r):	34.60	35.53	-2.63	5
		e"	16.0000	Conductivity (σ):	4.98	5.06	-1.55	5
	Head 5800	e'	34.6700	Relative Permittivity (ϵ_r):	34.67	35.30	-1.78	5
		e"	16.0400	Conductivity (σ):	5.17	5.27	-1.84	5
	Head 5825	e'	34.6300	Relative Permittivity (ϵ_r):	34.63	35.30	-1.90	5
		e"	16.0000	Conductivity (σ):	5.18	5.27	-1.67	5
7/17/2023	Head 5250	e'	36.6300	Relative Permittivity (ϵ_r):	36.63	35.93	1.94	5
		e"	16.0600	Conductivity (σ):	4.69	4.70	-0.30	5
	Head 5260	e'	36.6100	Relative Permittivity (ϵ_r):	36.61	35.92	1.92	5
		e"	16.0600	Conductivity (σ):	4.70	4.71	-0.32	5
	Head 5600	e'	36.0000	Relative Permittivity (ϵ_r):	36.00	35.53	1.31	5
		e"	16.3100	Conductivity (σ):	5.08	5.06	0.36	5
	Head 5750	e'	35.7400	Relative Permittivity (ϵ_r):	35.74	35.36	1.07	5
		e"	16.4600	Conductivity (σ):	5.26	5.21	0.94	5
	Head 5825	e'	35.6100	Relative Permittivity (ϵ_r):	35.61	35.30	0.88	5
		e"	16.5000	Conductivity (σ):	5.34	5.27	1.41	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 (100MHz to 6GHz):

- 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	Cal. Due Date	Target SAR Values (W/kg)	
				1g/10g	Head
D5GHzV2	1325	4/21/2023	5/21/2025	1g	79.60
				10g	22.70
D5GHzV2	1325	4/21/2023	5/21/2025	1g	83.90
				10g	23.80
D5GHzV2	1325	4/21/2023	5/21/2025	1g	80.50
				10g	22.50
D5GHzV2	1209	2/28/2023	2/28/2025	1g	81.20
				10g	22.90
D2450V2	960	3/24/2022	3/24/2024	1g	51.90
				10g	24.00

Note(s):

1. For System Validation Dipole, Calibration interval applied every 2 years according to referencing KDB 865664 guidance.
2. Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations.
3. All equipments were used until Cal.Due data.

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 6 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				
7/11/2023	D5GHzV2 (5250)	1325	Head	1g	7.48	74.8	79.60	-6.03	1
				10g	2.18	21.8	22.70	-3.96	

SAR 7 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				
7/11/2023	D2450V2	960	Head	1g	4.96	49.6	51.90	-4.43	2
				10g	2.31	23.1	24.00	-3.75	
7/17/2023	D5GHzV2 (5250)	1325	Head	1g	8.33	83.3	79.60	4.65	3
				10g	2.40	24.0	22.70	5.73	
7/17/2023	D5GHzV2 (5600)	1325	Head	1g	8.97	89.7	83.90	6.91	3
				10g	2.57	25.7	23.80	7.98	

SAR 9 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				
7/13/2023	D5GHzV2 (5800)	1209	Head	1g	8.10	81.0	81.20	-0.25	4
				10g	2.31	23.1	22.90	0.87	
7/17/2023	D5GHzV2 (5800)	1325	Head	1g	7.82	78.2	80.50	-2.86	4
				10g	2.24	22.4	22.50	-0.44	

9. Conducted Output Power Measurements

9.1. Wi-Fi 2.4 GHz (DTS Band)

WLAN SISO output power results

Antenna	Mode	Data Rate	Ch #	Freq. (MHz)	Max.Average Power (dBm)			Reduced Average Power (dBm)			
					Meas. Avg Pwr	Max. Tune-up Limit	SAR Test (Yes/No)	Meas. Avg Pwr	Max. Tune-up Limit	SAR Test (Yes/No)	
WiFi 2.4G Ant.1	802.11b	1 Mbps	1	2412.0	Not Required	17.00	No	11.30	12.00	Yes	
			6	2437.0				10.89			
			11	2462.0				11.13			
			12	2467.0				Not Required			3.00
			13	2472.0				Not Required			-1.00
	802.11g	6 Mbps	1	2412.0	17.24	18.00	Yes	Not Required	12.00	No	
			6	2437.0	17.02						
			11	2462.0	17.19						
			12	2467.0	5.54						6.00
	802.11n	6.5 Mbps	1 - 13	2412 - 2472		Not Required	16.00	No	Not Required	12.00	No
802.11ax				7.3 Mbps	1 - 13	2412 - 2472		Not Required	16.00	No	Not Required

WLAN MIMO output power Results

Antenna	Mode	Data Rate	Ch #	Freq. (MHz)	Max.Average Power (dBm)			Reduced Average Power (dBm)			
					Meas. Avg Pwr	Max. Tune-up Limit	SAR Test (Yes/No)	Meas. Avg Pwr	Max. Tune-up Limit	SAR Test (Yes/No)	
WiFi 2.4G MIMO Ant.1	802.11b	1 Mbps	1	2412.0	Not Required	17.00	No	11.43	12.00	Yes	
			6	2437.0				10.84			
			11	2462.0				11.30			
			12	2467.0				Not Required			3.00
			13	2472.0				Not Required			-1.00
	802.11g	6 Mbps	1	2412.0	17.52	18.00	Yes	Not Required	12.00	No	
			6	2437.0	17.28						
			11	2462.0	17.24						
			12	2467.0	5.50						6.00
	802.11n	6.5 Mbps	1 - 13	2412 - 2472		Not Required	16.00	No	Not Required	12.00	No
802.11ax				7.3 Mbps	1 - 13	2412 - 2472		Not Required	16.00	No	Not Required

Antenna	Mode	Data Rate	Ch #	Freq. (MHz)	Max.Average Power (dBm)			Reduced Average Power (dBm)			
					Meas. Avg Pwr	Max. Tune-up Limit	SAR Test (Yes/No)	Meas. Avg Pwr	Max. Tune-up Limit	SAR Test (Yes/No)	
WiFi 2.4G MIMO Ant.2	802.11b	1 Mbps	1	2412.0	Not Required	17.00	No	10.59	12.00	Yes	
			6	2437.0				10.12			
			11	2462.0				10.39			
			12	2467.0				Not Required			3.00
			13	2472.0				Not Required			-1.00
	802.11g	6 Mbps	1	2412.0	16.56	18.00	Yes	Not Required	12.00	No	
			6	2437.0	16.63						
			11	2462.0	17.02						
			12	2467.0	4.98						6.00
	802.11n	6.5 Mbps	1 - 13	2412 - 2472		Not Required	16.00	No	Not Required	12.00	No
802.11ax				7.3 Mbps	1 - 13	2412 - 2472		Not Required	16.00	No	Not Required

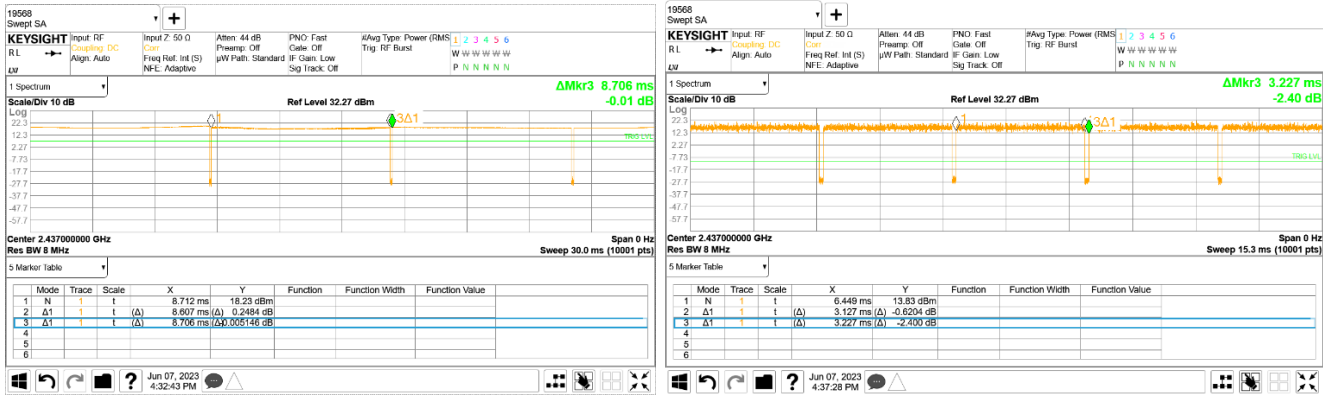
Note(s):

- For Max power, 802.11g mode is higher than 802.11b mode tune-up power. So, 802.11g mode is used for SAR measurement.
- 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/ax 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.
- Additionally, SAR is not required for Channels 12 and 13 because the tune-up limit and the measured output power for these two channels are no greater than those for the default test channels. Refer to §6.3.

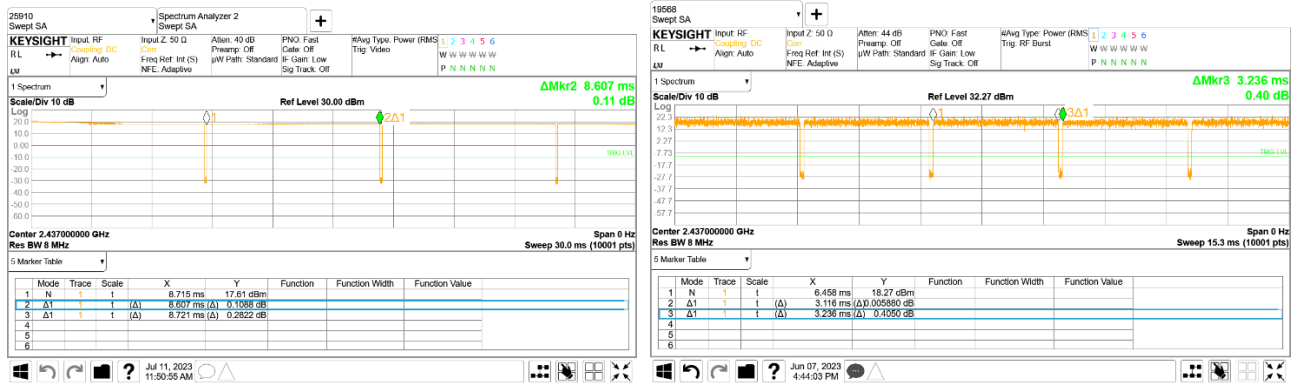
Duty Factor Measured Results

Mode	T on (ms)	Period (ms)	Maximum Duty Cycle	Measured Duty Cycle	Crest Factor (maximum duty/ measured duty cycle)
802.11b-SISO	8.607	8.706	100.00%	98.86%	1.01
802.11g-SISO	3.127	3.227	100.00%	96.90%	1.03
802.11b-MIMO	8.607	8.721	100.00%	98.69%	1.01
802.11g-MIMO	3.116	3.236	100.00%	96.29%	1.04

Duty Cycle plots (802.11b,g - SISO)



Duty Cycle plots (802.11b,g - MIMO)



9.2. Wi-Fi 5GHz (U-NII Bands)

WLAN SISO Ant.2 output power Results

Antenna	Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	WLAN mode power						
						Max. Average Power			Reduced Average Power			
						Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)	Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)	
WiFi 5GHz SISO Ant.2	5.3 (UNII 2A)	802.11a	6 Mbps	52	5260.0	14.26	15.0	Yes	Not Required	6.5	No	
				56	5280.0	13.88						
				60	5300.0	14.10						
				64	5320.0	14.01						
		802.11n (HT20)	6.5 Mbps	Not Required			14.0	No	Not Required	6.5	No	
		802.11n (HT40)	13.5 Mbps	Not Required			12.0	No	Not Required	6.5	No	
		802.11ac (VHT20)	6.5 Mbps	Not Required			14.0	No	Not Required	6.5	No	
		802.11ac (VHT40)	13.5 Mbps	Not Required			12.0	No	Not Required	6.5	No	
	802.11ac (VHT80)	29.3 Mbps	58	5290.0	Not Required	8.0	No	5.34	6.5	Yes		
	802.11ax (HE20)	7.3 Mbps	Not Required			14.0	No	Not Required	6.5	No		
	802.11ax (HE40)	14.6 Mbps	Not Required			12.0	No	Not Required	6.5	No		
	802.11ax (HE80)	36 Mbps	Not Required			8.0	No	Not Required	6.5	No		
	5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500.0	16.37	17.0	Yes	7.76	8.5	Yes	
				120	5600.0	15.95			7.48			
				124	5620.0	16.08			7.17			
				140	5700.0	16.10			9.48			10.0
				144	5720.0	16.13			7.75			8.5
		802.11n (HT20)	6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No	
		802.11n (HT40)	13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No	
		802.11ac (VHT20)	6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No	
	802.11ac (VHT40)	13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No		
	802.11ac (VHT80)	29.3 Mbps	Not Required			13.0	No	Not Required	8.5	No		
	802.11ax (HE20)	7.3 Mbps	Not Required			16.0	No	Not Required	8.5	No		
	802.11ax (HE40)	14.6 Mbps	Not Required			14.0	No	Not Required	8.5	No		
	802.11ax (HE80)	36 Mbps	Not Required			13.0	No	Not Required	8.5	No		
	5.8 (U-NII 3)	802.11a	6 Mbps	149	5745.0	16.07	17.0	Yes	7.33	8.5	No	
				157	5785.0	16.16			9.43	10.0	Yes	
				165	5825.0	16.19			7.12	8.5	No	
Not Required				16.0	No	Not Required			8.5	No		
802.11n (HT20)		6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No		
802.11n (HT40)		13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No		
802.11ac (VHT20)		6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No		
802.11ac (VHT40)		13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No		
802.11ac (VHT80)	29.3 Mbps	Not Required			13.0	No	Not Required	8.5	No			
802.11ax (HE20)	7.3 Mbps	Not Required			16.0	No	Not Required	8.5	No			
802.11ax (HE40)	14.6 Mbps	Not Required			14.0	No	Not Required	8.5	No			
802.11ax (HE80)	36 Mbps	Not Required			13.0	No	Not Required	8.5	No			

Note(s):

- 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 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.
- When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac/ax modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n ac then ax) is selected.
- When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
 - ≤ 1.2 W/kg, SAR is not required for UNII band I
 - > 1.2 W/kg, both bands should be tested independently for SAR.

WLAN MIMO Ant.1 output power Results

Antenna	Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	WLAN mode power					
						Max. Average Power			Reduced Average Power		
						Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)	Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)
WiFi 5GHz MIMO Ant.1	5.3 (UNII 2A)	802.11a	6 Mbps	52	5260.0	14.19	15.0	Yes	Not Required	6.5	No
				56	5280.0	13.84					
				60	5300.0	13.60					
				64	5320.0	14.07					
		802.11n (HT20)	6.5 Mbps	Not Required			14.0	No	Not Required	6.5	No
		802.11n (HT40)	13.5 Mbps	Not Required			12.0	No	Not Required	6.5	No
		802.11ac (VHT20)	6.5 Mbps	Not Required			14.0	No	Not Required	6.5	No
		802.11ac (VHT40)	13.5 Mbps	Not Required			12.0	No	Not Required	6.5	No
		802.11ac (VHT80)	29.3 Mbps	58	5290.0	Not Required	8.0	No	5.02	6.5	Yes
	802.11ax (HE20)	7.3 Mbps	Not Required			14.0	No	Not Required	6.5	No	
	802.11ax (HE40)	14.6 Mbps	Not Required			12.0	No	Not Required	6.5	No	
	802.11ax (HE80)	36 Mbps	Not Required			8.0	No	Not Required	6.5	No	
	5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500.0	15.96	17.0	Yes	Not Required	8.5	No
				120	5600.0	16.38					
				124	5620.0	16.70					
				140	5700.0	16.45					
				144	5720.0	16.13					
		802.11n (HT20)	6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No
		802.11n (HT40)	13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No
		802.11ac (VHT20)	6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No
		802.11ac (VHT40)	13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No
		802.11ac (VHT80)	29.3 Mbps	Not Required			13.0	No	Not Required	8.5	No
	802.11ax (HE20)	7.3 Mbps	Not Required			16.0	No	Not Required	8.5	No	
	802.11ax (HE40)	14.6 Mbps	Not Required			14.0	No	Not Required	8.5	No	
	802.11ax (HE80)	36 Mbps	Not Required			13.0	No	Not Required	8.5	No	
	5.8 (U-NII 3)	802.11a	6 Mbps	149	5745.0	16.29	17.0	Yes	Not Required	8.5	No
				157	5785.0	16.50					
				165	5825.0	16.19					
9.49				9.5	Yes						
802.11n (HT20)		6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No	
802.11n (HT40)		13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No	
802.11ac (VHT20)		6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No	
802.11ac (VHT40)		13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No	
802.11ac (VHT80)		29.3 Mbps	Not Required			13.0	No	Not Required	8.5	No	
802.11ax (HE20)	7.3 Mbps	Not Required			16.0	No	Not Required	8.5	No		
802.11ax (HE40)	14.6 Mbps	Not Required			14.0	No	Not Required	8.5	No		
802.11ax (HE80)	36 Mbps	Not Required			13.0	No	Not Required	8.5	No		

Note(s):

- 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 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.
- When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac/ax modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n ac then ax) is selected.
- When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
 - ≤ 1.2 W/kg, SAR is not required for UNII band I
 - > 1.2 W/kg, both bands should be tested independently for SAR.

WLAN MIMO Ant.2 output power Results

Antenna	Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	WLAN mode power					
						Max. Average Power			Reduced Average Power		
						Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)	Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)
WiFi 5GHz MIMO Ant.2	5.3 (UNII 2A)	802.11a	6 Mbps	52	5260.0	13.91	15.0	Yes	Not Required	6.5	No
				56	5280.0	13.96					
				60	5300.0	14.16					
				64	5320.0	14.35					
		802.11n (HT20)	6.5 Mbps	Not Required			14.0	No	Not Required	6.5	No
		802.11n (HT40)	13.5 Mbps	Not Required			12.0	No	Not Required	6.5	No
		802.11ac (VHT20)	6.5 Mbps	Not Required			14.0	No	Not Required	6.5	No
		802.11ac (VHT40)	13.5 Mbps	Not Required			12.0	No	Not Required	6.5	No
		802.11ac (VHT80)	29.3 Mbps	58	5290.0	Not Required	8.0	No	5.17	6.5	Yes
		802.11ax (HE20)	7.3 Mbps	Not Required			14.0	No	Not Required	6.5	No
	802.11ax (HE40)	14.6 Mbps	Not Required			12.0	No	Not Required	6.5	No	
	802.11ax (HE80)	36 Mbps	Not Required			8.0	No	Not Required	6.5	No	
	5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500.0	16.41	17.0	Yes	Not Required	8.5	No
				120	5600.0	15.24					
				124	5620.0	15.11					
				140	5700.0	15.98					
				144	5720.0	15.74					
		802.11n (HT20)	6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No
		802.11n (HT40)	13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No
		802.11ac (VHT20)	6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No
		802.11ac (VHT40)	13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No
		802.11ac (VHT80)	29.3 Mbps	Not Required			13.0	No	Not Required	8.5	No
	802.11ax (HE20)	7.3 Mbps	Not Required			16.0	No	Not Required	8.5	No	
	802.11ax (HE40)	14.6 Mbps	Not Required			14.0	No	Not Required	8.5	No	
	802.11ax (HE80)	36 Mbps	Not Required			13.0	No	Not Required	8.5	No	
	5.8 (U-NII 3)	802.11a	6 Mbps	149	5745.0	15.49	17.0	Yes	Not Required	8.5	No
				157	5785.0	15.80					
				165	5825.0	15.69					
802.11n (HT20)		6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No	
802.11n (HT40)		13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No	
802.11ac (VHT20)		6.5 Mbps	Not Required			16.0	No	Not Required	8.5	No	
802.11ac (VHT40)		13.5 Mbps	Not Required			14.0	No	Not Required	8.5	No	
802.11ac (VHT80)		29.3 Mbps	Not Required			13.0	No	Not Required	8.5	No	
802.11ax (HE20)		7.3 Mbps	Not Required			16.0	No	Not Required	8.5	No	
802.11ax (HE40)		14.6 Mbps	Not Required			14.0	No	Not Required	8.5	No	
802.11ax (HE80)	36 Mbps	Not Required			13.0	No	Not Required	8.5	No		

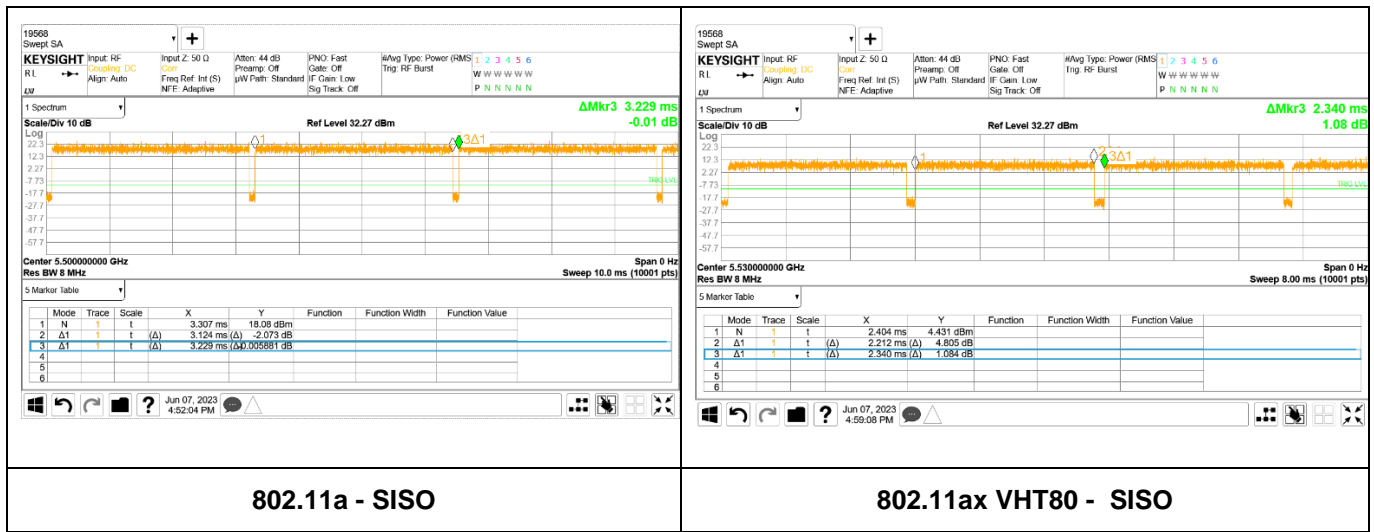
Note(s):

- 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 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.
- When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac/ax modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n ac then ax) is selected.
- When the specified maximum output power is the same for both UNII band 1 and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
 - ≤ 1.2 W/kg, SAR is not required for UNII band 1
 - > 1.2 W/kg, both bands should be tested independently for SAR.

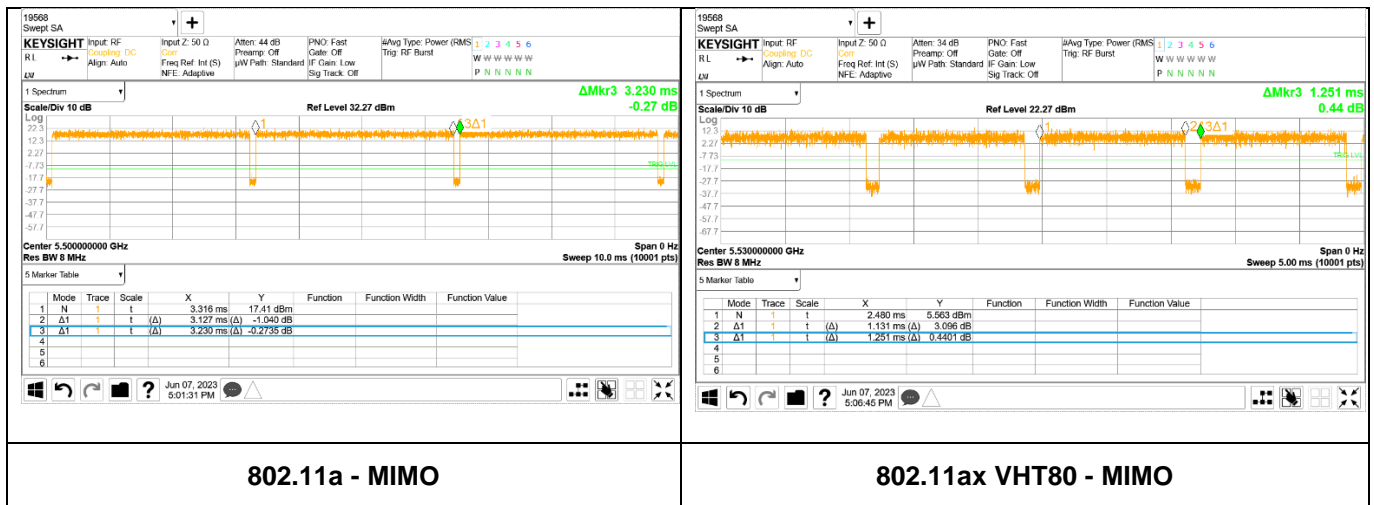
Duty Factor Measured Results

Mode	T on (ms)	Period (ms)	Maximum Duty Cycle	Measured Duty Cycle	Crest Factor (maximum duty/ measured duty cycle)
802.11a-SISO	3.124	3.229	100.00%	96.7%	1.03
802.11ac VHT80-SISO	2.212	2.340	100.00%	94.5%	1.06
802.11a-MIMO	3.127	3.230	100.00%	96.8%	1.03
802.11ac VHT80-MIMO	1.131	1.251	100.00%	90.4%	1.11

Duty Cycle plots (802.11a, ax VHT80 - SISO)



Duty Cycle plots (802.11a, ax VHT80 - MIMO)



9.3. Bluetooth

Bluetooth SISO Measured Results

Band (GHz)	Antenna	Mode	Ch #	Freq. (MHz)	Maximum Average Power (dBm)		Reduced Average Power (dBm)	
					Meas Pwr	Tune-up Limit	Meas Pwr	Tune-up Limit
2.4	BT SISO Ant.1	BDR	0	2402	13.34	15.00	10.44	12.00
			39	2441	13.82		10.25	
			78	2480	13.64		10.26	
		EDR	0	2402	11.39	12.00	11.39	12.00
			39	2441	11.30		11.30	
			78	2480	11.17		11.17	
		LE GFSK-1M	0	2402	8.86	9.00		9.00
			19	2440	8.33			
			39	2480	8.67			
		LE GFSK-2M	0	2402	8.66	9.00		9.00
			19	2440	8.13			
			39	2480	8.50			

Note(s):

SAR test is evaluated at BDR mode in Bluetooth using Max power condition and The SAR test is evaluated in EDR mode with reduced power.

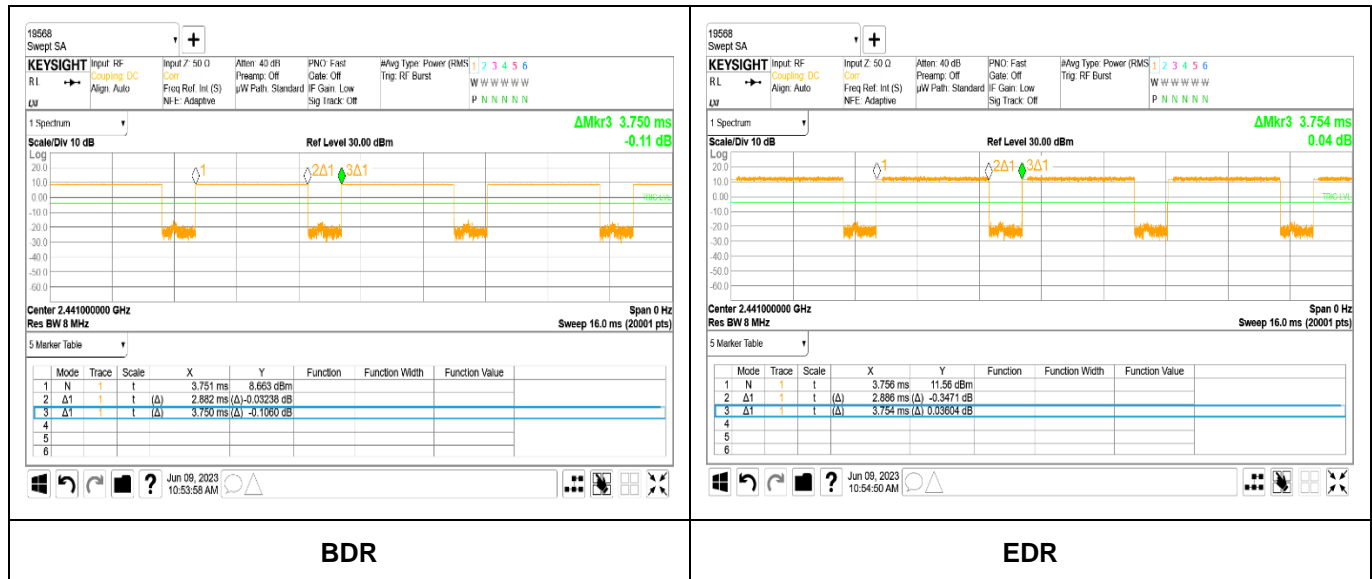
Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Maximum Duty Cycle	Measured Duty Cycle	Crest Factor (Maximum duty / Measured duty cycle)
BDR	DH5	2.882	3.750	78.00%	76.85%	1.01
EDR	DH5	2.886	3.754	78.00%	76.88%	1.01

Note(s):

Maximum Duty Cycle is mentioned in Operational description. Detail of BT Duty Cycle refer to Operational description.

Duty Cycle plots



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.

10.1. Wi-Fi (DTS Band)

DTS SAR results

Frequency Band	Antenna	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Area Scan Max SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Note	Plot No.	
											Tune-up limit	Meas.	Meas.	Scaled			
2.4GHz	WLAN SISO Ant.1	802.11g 6Mbps	Standalone	Off	19	Rear	1	2412.0	96.90%	0.052	18.00	17.24					
					22	Top	1	2412.0	96.90%	0.052	18.00	17.24					
					19	Left	1	2412.0	96.90%	0.071	18.00	17.24	0.058	0.071			
		802.11b 1Mbps		On	0	Rear	1	2412.0	98.86%	0.575	12.00	11.30	0.392	0.466			
					0	Top	1	2412.0	98.86%	0.162	12.00	11.30					
					0	Left	1	2412.0	98.86%	0.736	12.00	11.30	0.516	0.613		1	
2.4GHz	WLAN MIMO Ant.1	802.11g 6Mbps	Standalone	Off	19	Rear	1	2412.0	96.29%	0.070	18.00	17.52					
					22	Top	1	2412.0	96.29%	0.069	18.00	17.52					
					19	Left	1	2412.0	96.29%	0.061	18.00	17.52					
					19	Right	1	2412.0	96.29%	0.162	18.00	17.52					
		802.11b 1Mbps		On	0	Rear	1	2412.0	98.69%	0.964	12.00	11.43					
					11		2462.0	98.69%	0.708	12.00	11.30						
					0	Top	1	2412.0	98.69%	0.295	12.00	11.43					
					0	Left	1	2412.0	98.69%	0.736	12.00	11.43					
					0	Right	1	2412.0	98.69%	0.750	12.00	11.43					
	WLAN MIMO Ant.2	802.11g 6Mbps	Standalone	Off	19	Rear	1	2412.0	96.29%	0.070	18.00	16.56	0.053	0.077	3		
					22	Top	1	2412.0	96.29%	0.069	18.00	16.56					
					19	Left	1	2412.0	96.29%	0.061	18.00	16.56					
		19		Right	1	2412.0	96.29%	0.162	18.00	16.56	0.084	0.122					
		802.11b 1Mbps		On	0	Rear	1	2412.0	98.69%	0.964	12.00	10.59	0.671	0.941		2	
					11		2462.0	98.69%	0.708	12.00	10.39	0.484	0.711		2		
0	Top		1		2412.0	98.69%	0.295	12.00	10.59								
0	Left	1	2412.0	98.69%	0.736	12.00	10.59										
0	Right	1	2412.0	98.69%	0.750	12.00	10.59	0.545	0.764								

10.2. Wi-Fi (U-NII Bands)

U-NII 2A SAR results

Frequency Band	Antenna	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle (%)	Area Scan Max SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Note	Plot No.
											Tune-up limit	Meas.	Meas.	Scaled		
5.3 GHz U-NII 2A	WLAN SISO Ant.2	802.11a 6 Mbps	Standalone	Off	19	Rear	52	5260.0	96.75%	0.062	15.00	14.26	0.040	0.049		
					22	Top	52	5260.0	96.75%	0.014	15.00	14.26				
					19	Right	52	5260.0	96.75%	0.060	15.00	14.26				
		802.11ac VHT80 29.3 Mbps		On	0	Rear	58	5290.0	94.53%	0.127	6.50	5.34	0.171	0.236	3	
					0	Top	58	5290.0	94.53%	0.024	6.50	5.34				
					0	Right	58	5290.0	94.53%	0.416	6.50	5.34	0.283	0.391		3
5.3 GHz U-NII 2A	WLAN MIMO Ant.1	802.11a 6 Mbps	Standalone	Off	19	Rear	64	5320.0	96.81%	0.086	15.00	14.07	0.056	0.072	3	
					22	Top	64	5320.0	96.81%	0.016	15.00	14.07				
					19	Left	64	5320.0	96.81%	0.060	15.00	14.07				
					19	Right	64	5320.0	96.81%	0.071	15.00	14.07				
		802.11ac VHT80 29.3 Mbps		On	0	Rear	58	5290.0	90.41%	0.259	6.50	5.02				
					0	Top	58	5290.0	90.41%	0.054	6.50	5.02				
	0		Left		58	5290.0	90.41%	0.360	6.50	5.02	0.241	0.375	2			
	0		Right		58	5290.0	90.41%	0.542	6.50	5.02						
	WLAN MIMO Ant.2	802.11a 6 Mbps	Standalone	Off	19	Rear	64	5320.0	96.81%	0.086	15.00	14.35				
					22	Top	64	5320.0	96.81%	0.016	15.00	14.35				
					19	Left	64	5320.0	96.81%	0.060	15.00	14.35				
					19	Right	64	5320.0	96.81%	0.071	15.00	14.35				
802.11ac VHT80 29.3 Mbps		On		0	Rear	58	5290.0	90.41%	0.259	6.50	5.17	0.181	0.272	3		
				0	Top	58	5290.0	90.41%	0.054	6.50	5.17					
0	Left	58	5290.0	90.41%	0.360	6.50	5.17									
0	Right	58	5290.0	90.41%	0.542	6.50	5.17	0.364	0.547		4					

Note(s):

1. If Highest reported SAR is <=0.4 W/kg, further SAR measurements within this exposure condition are not required.
2. 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). If second channel SAR is not over 1.2 or 3.0 W/kg (1-g or 10-g respectively), remain channels SAR test are not required.
3. Additional testing required in order satisfy simultaneous transmission criteria

Wi-Fi (U-NII Bands) (Continued)

U-NII 2C SAR results

Frequency Band	Antenna	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle (%)	Area Scan Max SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Note	Plot No.
											Tune-up limit	Meas.	Meas.	Scaled		
5.5 GHz U-NII 2C	WLAN SISO Ant.2	802.11a 6 Mbps	Standalone	Off	19	Rear	100	5500.0	96.75%	0.062	17.00	16.37	0.024	0.029		
					22	Top	100	5500.0	96.75%	0.014	17.00	16.37				
					19	Right	100	5500.0	96.75%	0.060	17.00	16.37	0.109	0.130		
	802.11a 6 Mbps	Standalone	On	0	Rear	100	5500.0	96.75%	0.467	8.50	7.76	0.335	0.411	2		
				0		140	5700.0	96.75%	1.090	10.00	9.48	0.846	0.986	5		
				0	Top	140	5700.0	96.75%	0.024	10.00	9.48					
0	Right	140	5700.0	96.75%	0.616	10.00	9.48	0.440	0.513							
5.5 GHz U-NII 2C	WLAN MIMO Ant.1	802.11a 6 Mbps	Standalone	Off	19	Rear	124	5620.0	96.81%	0.051	17.00	16.70	0.033	0.037		
					22	Top	124	5620.0	96.81%	0.030	17.00	16.70				
					19	Left	124	5620.0	96.81%	0.086	17.00	16.70	0.064	0.071		
		19	Right	124	5620.0	96.81%	0.081	17.00	16.70							
		802.11a 6 Mbps	Standalone	On	0	Rear	140	5700.0	96.81%	1.080	10.00	9.97				
					0		140	5700.0	96.81%	0.05	10.00	9.97				
	0				Left	140	5700.0	96.81%	0.687	10.00	9.97	0.415	0.432			
	0	Right	140	5700.0	96.81%	1.01	10.00	9.97								
	WLAN MIMO Ant.2	802.11a 6 Mbps	Standalone	Off	19	Rear	124	5620.0	96.81%	0.051	17.00	15.11				
					22	Top	124	5620.0	96.81%	0.030	17.00	15.11				
					19	Left	124	5620.0	96.81%	0.086	17.00	15.11				
		19	Right	124	5620.0	96.81%	0.081	17.00	15.11							
		802.11a 6 Mbps	Standalone	On	0	Rear	116	5580.0	96.81%	0.200	8.50	7.17	0.166	0.233	2	
					0		140	5700.0	96.81%	1.080	10.00	9.32	0.679	0.820		
	0				Top	140	5700.0	96.81%	0.050	10.00	9.32					
	0	Left	140	5700.0	96.81%	0.687	10.00	9.32								
	0	Right	116	5700.0	96.81%	0.444	8.50	7.17	0.267	0.375	2					
	0		140	5700.0	96.81%	1.010	10.00	9.32	0.767	0.927	6					

U-NII 3 SAR results

Frequency Band	Antenna	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle (%)	Area Scan Max SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Note	Plot No.
											Tune-up limit	Meas.	Meas.	Scaled		
5.8 GHz U-NII 3	WLAN SISO Ant.2	802.11a 6 Mbps	Standalone	Off	19	Rear	165	5825.0	96.75%	0.104	17.00	16.19	0.074	0.092		
					22	Top	165	5825.0	96.75%	0.031	17.00	16.19				
					19	Right	165	5825.0	96.75%	0.067	17.00	16.19				
	802.11a 6 Mbps	Standalone	On	0	Rear	157	5785.0	96.75%	0.612	9.50	9.43	0.712	0.748	7		
				0		157	5785.0	96.75%	0.126	9.50	9.43					
				0	Right	157	5785.0	96.75%	0.878	9.50	9.43	0.609	0.640			
5.8 GHz U-NII 3	WLAN MIMO Ant.1	802.11a 6 Mbps	Standalone	Off	19	Rear	157	5785.0	96.81%	0.093	17.00	16.50				
					22	Top	157	5785.0	96.81%	0.024	17.00	16.50				
					19	Left	157	5785.0	96.81%	0.061	17.00	16.50				
		19	Right	157	5785.0	96.81%	0.051	17.00	16.50							
		802.11a 6 Mbps	Standalone	On	0	Rear	157	5785.0	96.81%	0.584	9.50	9.49				
					0		157	5785.0	96.81%	0.109	9.50	9.49				
	0				Left	157	5785.0	96.81%	0.735	9.50	9.49	0.659	0.682	8		
	0	Right	157	5785.0	96.81%	0.629	9.50	9.49								
	WLAN MIMO Ant.2	802.11a 6 Mbps	Standalone	Off	19	Rear	157	5785.0	96.81%	0.093	17.00	15.80	0.056	0.076		
					22	Top	157	5785.0	96.81%	0.024	17.00	15.80				
					19	Left	157	5785.0	96.81%	0.061	17.00	15.80				
		19	Right	157	5785.0	96.81%	0.051	17.00	15.80							
802.11a 6 Mbps		Standalone	On	0	Rear	157	5785.0	96.81%	0.584	9.50	9.47	0.655	0.681	3		
				0		157	5785.0	96.81%	0.109	9.50	9.47					
	0			Left	157	5785.0	96.81%	0.735	9.50	9.47						
0	Right	157	5785.0	96.81%	0.629	9.50	9.47	0.413	0.430							

Note(s):

1. If Highest reported SAR is <=0.4 W/kg, further SAR measurements within this exposure condition are not required.
2. 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). If second channel SAR is not over 1.2 or 3.0 W/kg (1-g or 10-g respectively), remain channels SAR test are not required.
3. Additional testing required in order satisfy simultaneous transmission criteria

10.3. Bluetooth

Frequency Band	Antenna	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
										Tune-up limit	Meas.	Meas.	Scaled	
2.4GHz	BT SISO Ant.1	BDR DH5	Standalone	Off	19	Rear	39	2441.0	76.85%	15.00	13.82	0.019	0.025	
					22	Top	39	2441.0	76.85%	15.00	13.82	0.022	0.029	
					19	R/Left	39	2441.0	76.85%	15.00	13.82	0.013	0.017	
	EDR DH5	Standalone	On	0	Rear	0	2402.0	76.88%	12.00	11.39	0.448	0.523		
					Top	0	2402.0	76.88%	12.00	11.39	0.114	0.133		
					R/Left	0	2402.0	76.88%	12.00	11.39	0.516	0.602	9	

11. 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 <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), 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 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Peak spatial-average (1g of tissue)

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
2450	Wi-Fi 802.11b/g/n/ax	Standalone	Rear	No	0.671	N/A	N/A
	Bluetooth	Standalone	Rear	No	0.516	N/A	N/A
5300	Wi-Fi 802.11a/n/ac/ax	Standalone	Right	No	0.364	N/A	N/A
5500	Wi-Fi 802.11a/n/ac/ax	Standalone	Rear	Yes	0.846	0.821	1.03
5800	Wi-Fi 802.11a/n/ac/ax	Standalone	Rear	No	0.712	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.

12. Simultaneous Transmission SAR Analysis

Simultaneous Transmission Condition

RF Exposure Condition	Item	
Standalone	1	DTS MIMO
	2	UNII MIMO
	3	UNII Ant.2 + BT Ant.1
	4	UNII MIMO + BT Ant.1
Notes:		
<ol style="list-style-type: none"> 1. DTS supports Wi-Fi Direct, Hotspot and VoIP. 2. U-NII supports Wi-Fi Direct, Hotspot and VoIP. 3. U-NII Radio can transmit simultaneously with Bluetooth Radio in certain scenario. 4. BT tethering is considered about each RF exposure conditions. 		

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.

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

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	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Ant.1	Bluetooth	2480	15.00	32	19	22	19	241.63	117.86	MEASURE	MEASURE	MEASURE	0.400	0.400
Ant.1	Wi-Fi 2.4 GHz	2462	18.00	63	19	22	19	241.63	117.86	-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400
Ant.2	Wi-Fi 5.2 GHz	5240	15.00	32	19	22	117.86	241.63	19	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Ant.2	Wi-Fi 5.3 GHz	5320	15.00	32	19	22	117.86	241.63	19	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Ant.2	Wi-Fi 5.5 GHz	5700	17.00	50	19	22	117.86	241.63	19	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
Ant.2	Wi-Fi 5.8 GHz	5825	17.00	50	19	22	117.86	241.63	19	-MEASURE-	-MEASURE-	0.400	0.400	-MEASURE-
MIMO	Wi-Fi 2.4 GHz	2462	18.00	63	19	22	19	241.63	19	-MEASURE-	-MEASURE-	-MEASURE-	0.400	-MEASURE-
MIMO	Wi-Fi 5.2 GHz	5240	15.00	32	19	22	19	241.63	19	-MEASURE-	-MEASURE-	-MEASURE-	0.400	-MEASURE-
MIMO	Wi-Fi 5.3 GHz	5320	15.00	32	19	22	19	241.63	19	-MEASURE-	-MEASURE-	-MEASURE-	0.400	-MEASURE-
MIMO	Wi-Fi 5.5 GHz	5700	17.00	50	19	22	19	241.63	19	-MEASURE-	-MEASURE-	-MEASURE-	0.400	-MEASURE-
MIMO	Wi-Fi 5.8 GHz	5825	17.00	50	19	22	19	241.63	19	-MEASURE-	-MEASURE-	-MEASURE-	0.400	-MEASURE-
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	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Ant.1	Bluetooth	2480	12.00	16	0	0	0			-MEASURE-	-MEASURE-	-MEASURE-		
Ant.1	Wi-Fi 2.4 GHz	2462	12.00	16	0	0	0			-MEASURE-	-MEASURE-	-MEASURE-		
Ant.2	Wi-Fi 5.2 GHz	5240	6.50	4	0	0			0	MEASURE	MEASURE			MEASURE
Ant.2	Wi-Fi 5.3 GHz	5320	6.50	4	0	0			0	MEASURE	MEASURE			MEASURE
Ant.2	Wi-Fi 5.5 GHz	5700	10.00	10	0	0			0	-MEASURE-	-MEASURE-			-MEASURE-
Ant.2	Wi-Fi 5.8 GHz	5825	9.50	9	0	0			0	-MEASURE-	-MEASURE-			-MEASURE-
MIMO	Wi-Fi 2.4 GHz	2462	12.00	16	0	0	0		0	-MEASURE-	-MEASURE-	-MEASURE-		-MEASURE-
MIMO	Wi-Fi 5.2 GHz	5240	6.50	4	0	0	0		0	MEASURE	MEASURE	MEASURE		MEASURE
MIMO	Wi-Fi 5.3 GHz	5320	6.50	4	0	0	0		0	MEASURE	MEASURE	MEASURE		MEASURE
MIMO	Wi-Fi 5.5 GHz	5700	10.00	10	0	0	0		0	-MEASURE-	-MEASURE-	-MEASURE-		-MEASURE-
MIMO	Wi-Fi 5.8 GHz	5825	9.50	9	0	0	0		0	-MEASURE-	-MEASURE-	-MEASURE-		-MEASURE-

12.1. Sum of the SAR for Wi-Fi & BT

RF Exposure	Test Position						Sum of SAR (W/kg)	
		DTS Ant.1	DTS MIMO	UNII Ant.2	UNII MIMO	BT Ant.1	UNII Ant.2 + BT Ant.1	UNII MIMO + BT Ant.1
		1	2	3	4	5	3 + 5	4 + 5
Standalone	Rear	0.466	0.941	0.986	0.820	0.523	1.509	1.343
	Top	0.613	0.941	0.986	0.927	0.133	1.119	1.060
	Left	0.613	0.941	0.400	0.682	0.602	1.002	1.284
	Bottom	0.400	0.400	0.400	0.400	0.400	0.800	0.800
	Right	0.400	0.764	0.640	0.927	0.400	1.040	1.327

Note(s):

- Green value is estimated SAR according to calculate of KDB 447498 D01. Please refer to Section.7.
- Blue value is estimated SAR according to initial SAR test procedures.

Conclusion:

Simultaneous Transmission SAR analysis results is satisfied the FCC Limit requirement according to follow procedures with "Sum of SAR"

Appendixes

Refer to separated files for the following appendixes.

4790841159-S1 FCC Report SAR_App A_Photos & Ant. Locations

4790841159-S1 FCC Report SAR_App B_Highest SAR Test Plots

4790841159-S1 FCC Report SAR_App C_System Check Plots

4790841159-S1 FCC Report SAR_App D_SAR Tissue Ingredients

4790841159-S1 FCC Report SAR_App E_Probe Cal. Certificates

4790841159-S1 FCC Report SAR_App F_Dipole Cal. Certificates

4790841159-S1 FCC Report SAR_App G_Proximity Sensor feature

END OF REPORT