



SAR EVALUATION REPORT

IEEE Std 1528-2013

For

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

FCC ID: A3LSMX710

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Prepared for

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Revision History

Rev.	Date	Revisions	Revised By
V1	5/22/2023	Initial Issue	--
V2	5/30/2023	Removed check marks in §6.1 for Hotspot mode since it is not supported. Modified §9.2 titles for each bandwidth to show only their supported modes. Corrected the §9.4 Tune-up limit table.	Lindsay Ryan
V3	6/5/2023	Updated §12 table item numbers. Removed WWAN from title in §12.2 and §12.3 tables. Updated WLAN results in 10.2.	Lindsay Ryan

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1. Attestation of Test Results


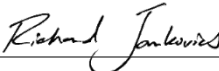
Applicant Name	SAMSUNG ELECTRONICS CO., LTD.		
FCC ID	A3LSMX710		
Applicable Standards	Published RF exposure KDB procedures IEEE Std 1528-2013		
Exposure Category	SAR Limits (W/Kg)		
	Peak spatial-average (1g of tissue)	Extremities (hands, wrists, ankles, etc.) (10g of tissue)	
General population / Uncontrolled exposure	1.6	4	
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)		
	DTS	NII	DSS
Body	0.63	1.18	0.29
Simultaneous TX	1.02	1.48	1.48
Date Tested	5/8/2023 to 5/17/2023		
Test Results	Pass		

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 A2LA, NIST, or any agency of the U.S. Government, or any agency of the U.S. government.

Approved & Released By:	Prepared By:
	
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory.	Richard Jankovics Operations Leader UL LLC

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
- 447498 D03 Supplement C Cross-Reference v01
- 616217 D04 SAR for laptop and tablets v01r02
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D06 Hotspot Mode v02r01

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 May 2017; RF Exposure Procedures (Broadband Liquid Above 3 GHz)
- TCB Workshop April 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))
- TCB Workshop April 2019; RF Exposure Procedures (802.11ax SAR Testing)

3. Facilities and Accreditation

UL LLC is accredited by A2LA, cert. # 0751.06 for all testing performed within the scope of this report. Testing was performed at the locations noted below.

The test sites and measurement facilities used to collect data are located at 2800 Perimeter Park Dr, Morrisville, NC, USA.

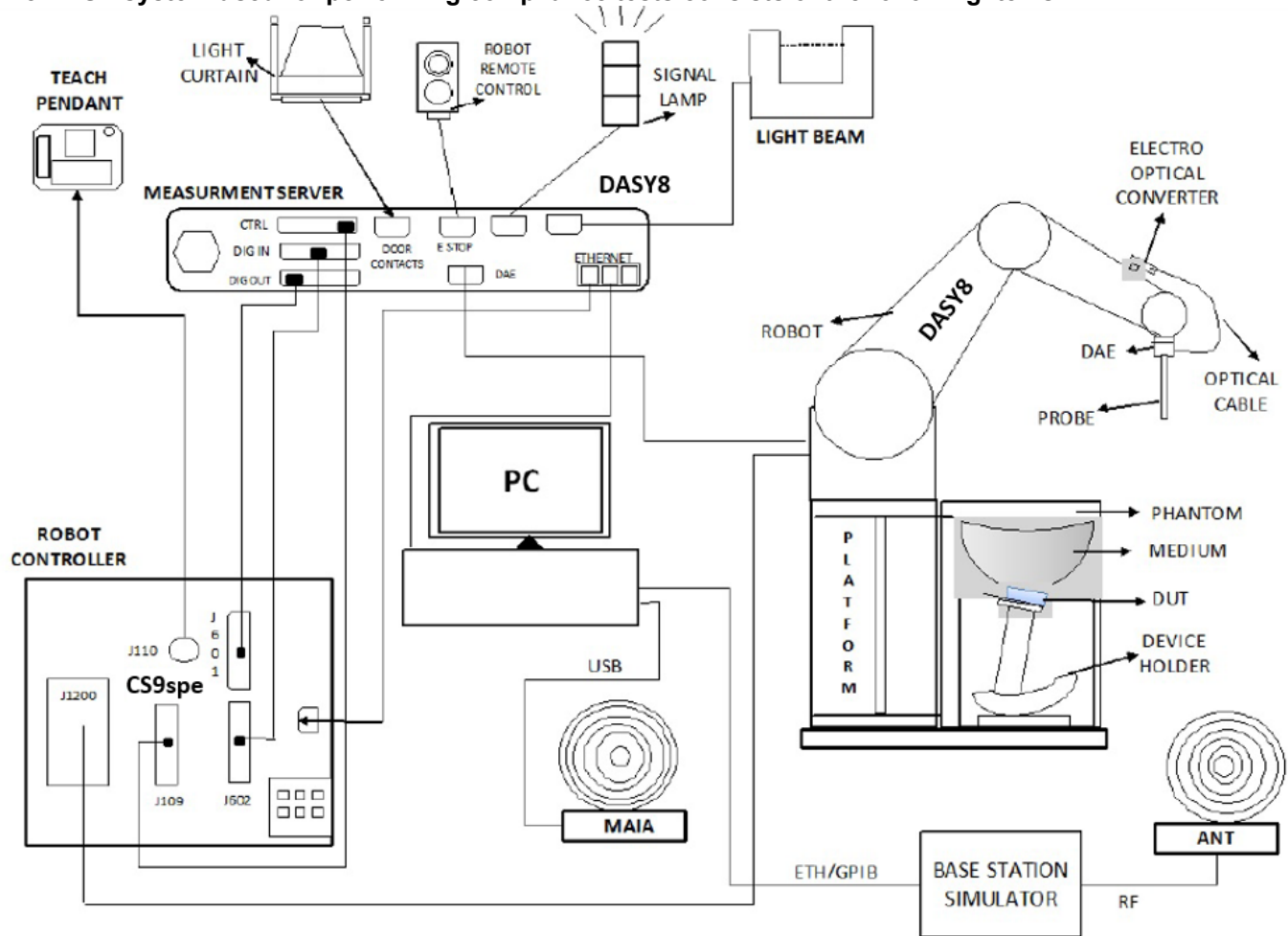
- SAR Lab 2A
- SAR Lab 2B

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	825374

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY 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 DASY8¹ 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.

¹ DASY8 software used: DASY16.0.2.83 and older generations.

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 IEC/IEEE 62209-1528, 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.

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	Keysight	E5063A	MY54100681	9/30/2023
Dielectric Probe	SPEAG	DAKS-3.5	1051	10/17/2023
Shorting Block	SPEAG	DAK-3.5 Short	SM DAK 200 DA	10/17/2023
Thermometer	Fisher Scientific	15-078-181	1817705017	3/30/2024

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Signal Generator	Keysight	N5181A	MY50140788	1/31/2024
Power Meter	Keysight	N1912A	MY55136012	8/30/2023
Power Sensor	Keysight	N1921A	MY55090023	4/03/2024
Power Sensor	Keysight	N1921A	MY55090047	2/02/2024
3-Path Diode Power Sensor	Rohde & Schwarz	NRP8S	112236	5/31/2023
3-Path Diode Power Sensor	Rohde & Schwarz	NRP8S	112237	5/31/2023
Amplifier	MITEQ	AMF-4D-00400600-50-30P	N/A	N/A
Directional coupler	Mini-Circuits	ZUDC10-183+	1438	N/A
DC Power Supply	Miteq	PS 15V1	1990186	N/A
RF Power Source	Speag	PowerSource1	4278	6/21/2023

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe	SPEAG	EX3DV4	7709	12/12/2023
E-Field Probe	SPEAG	EX3DV4	7711	3/29/2024
Data Acquisition Electronics	SPEAG	DAE4	1714	11/23/2023
Data Acquisition Electronics	SPEAG	DAE4	1716	3/16/2024
System Validation Dipole	SPEAG	D2450V2	963	10/18/2023
System Validation Dipole	SPEAG	D5GHzV2	1213	10/11/2023
System Validation Dipole	SPEAG	D6.5GHzV2	1068	12/1/2023
Environmental Indicator	Control Company	06-662-4	200037610	2/24/2024
Environmental Indicator	Control Company	06-662-4	200037635	2/24/2024

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
3-Path Diode Power Sensor	Rohde & Schwarz	NRP8S	112237	5/31/2023
RF Power Meter	Keysight	N1912a	MY55116004	9/2/2023
RF Power Sensor	Keysight	N1921a	MY55090025	9/27/2023
RF Power Sensor	Keysight	N1921a	MY55090030	6/15/2023
Bluetooth Tester	R & S	CBT	1153.9000K35-100913-Xm	N/A

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 $\leq 30\%$, 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.

Therefore, the measurement uncertainty is not required.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Overall (Length x Width): 254 mm x 167 mm Overall Diagonal: 296 mm Display Diagonal: 277 mm This is a Tablet device (overall diagonal dimension of the display section of a laptop or tablet is > 20 cm)												
Back Cover	The Back Cover is not removable												
Battery Options	The rechargeable battery is not user accessible.												
Accessory	Keyboard												
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. <input type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) <input type="checkbox"/> Mobile Hotspot (Wi-Fi 5.2 GHz & 5.8 GHz)												
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other Per Manufacturer, the DUT support only as a group client and not support as a group owner.												
Test sample information	<table border="1"> <thead> <tr> <th>S/N</th> <th>Notes</th> </tr> </thead> <tbody> <tr> <td>R32W2005BLK</td> <td>WLAN Conducted</td> </tr> <tr> <td>R3LW00HFKK</td> <td>Bluetooth Conducted</td> </tr> <tr> <td>R32W2005B3D</td> <td>WLAN Radiated</td> </tr> <tr> <td>R32W2005BEP</td> <td>WLAN Radiated</td> </tr> <tr> <td>R32W300HPRB</td> <td>Bluetooth Radiated</td> </tr> </tbody> </table>	S/N	Notes	R32W2005BLK	WLAN Conducted	R3LW00HFKK	Bluetooth Conducted	R32W2005B3D	WLAN Radiated	R32W2005BEP	WLAN Radiated	R32W300HPRB	Bluetooth Radiated
S/N	Notes												
R32W2005BLK	WLAN Conducted												
R3LW00HFKK	Bluetooth Conducted												
R32W2005B3D	WLAN Radiated												
R32W2005BEP	WLAN Radiated												
R32W300HPRB	Bluetooth Radiated												
Hardware Version	REV0.1												
Software Version	X710.001												

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) 802.11n (HT40) 802.11ax (VHT160)	98.8% _(802.11b) ¹
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80) 802.11ac (VHT160) 802.11ax (HE20) 802.11ax (HE40) 802.11ax (HE80) 802.11ax (HE160)	86.4% _(802.11n 40MHz BW) ¹ 97.4% _(802.11ac 80MHz BW) ¹ 97.4% _(802.11ac 160MHz BW) ¹
	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		
	6 GHz	802.11a 802.11ax (HE20) 802.11ax (HE40) 802.11ax (HE80) 802.11ax (HE160)	99.7% _(802.11ax 160MHz BW) ¹
Bluetooth	2.4 GHz	BR, EDR, LE	76.5% ¹

Notes:

1. Duty cycle is referenced from the Section 9.

6.3. Power Reduction by Proximity Sensing

Refer to Appendix G for details on the manufacturer's declared proximity sensing.

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 § 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

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
			dBm	mW	Back	Edge Top	Edge Right	Edge Bottom	Edge Left	Front	Back	Edge Top	Edge Right	Edge Bottom	Edge Left	Front
Full Power, Proximity Sensor Off																
BT/WIFI1 Antenna	Wi-Fi 2.4 GHz	2462	19.0	79	0	0	0		116			24.8	24.8	24.8		> 50 mm
	Wi-Fi 5.2 GHz	5240	20.0	100	0	0	0		116			45.8	45.8	45.8		> 50 mm
	Wi-Fi 5.3 GHz	5320	20.0	100	0	0	0		116			46.1	46.1	46.1		> 50 mm
	Wi-Fi 5.5 GHz	5700	20.0	100	0	0	0		116			47.7	47.7	47.7		> 50 mm
	Wi-Fi 5.8 GHz	5825	20.0	100	0	0	0		116			48.3	48.3	48.3		> 50 mm
	Wi-Fi 5.9 GHz	5895	20.0	100	0	0	0		116			48.6	48.6	48.6		> 50 mm
	Wi-Fi 6 GHz	7125	11.0	13	0	0	0		116			6.9	6.9	6.9		> 50 mm
Bluetooth	2480	18.0	63	0	0	0		116			19.8	19.8	19.8		> 50 mm	
BT/WIFI2 Antenna	Wi-Fi 2.4 GHz	2462	19.0	79	0	0	116		0			24.8	24.8	24.8		24.8
	Wi-Fi 5.2 GHz	5240	20.0	100	0	0	116		0			45.8	45.8	45.8		45.8
	Wi-Fi 5.3 GHz	5320	20.0	100	0	0	116		0			46.1	46.1	46.1		46.1
	Wi-Fi 5.5 GHz	5700	20.0	100	0	0	116		0			47.7	47.7	47.7		47.7
	Wi-Fi 5.8 GHz	5825	20.0	100	0	0	116		0			48.3	48.3	48.3		48.3
	Wi-Fi 5.9 GHz	5895	20.0	100	0	0	116		0			48.6	48.6	48.6		48.6
	Wi-Fi 6 GHz	7125	11.0	13	0	0	116		0			6.9	6.9	6.9		6.9
Bluetooth	2480	18.0	63	0	0	116		0			19.8	19.8	19.8		19.8	
Power Back-off, Proximity Sensor On																
BT/WIFI1 Antenna	Wi-Fi 2.4 GHz	2462	12.0	16	0	0	0		116			5	5	5		> 50 mm
	Wi-Fi 5.2 GHz	5240	11.5	14	0	0	0		116			6.4	6.4	6.4		> 50 mm
	Wi-Fi 5.3 GHz	5320	11.5	14	0	0	0		116			6.5	6.5	6.5		> 50 mm
	Wi-Fi 5.5 GHz	5700	11.5	14	0	0	0		116			6.7	6.7	6.7		> 50 mm
	Wi-Fi 5.8 GHz	5825	11.5	14	0	0	0		116			6.8	6.8	6.8		> 50 mm
	Wi-Fi 5.9 GHz	5895	11.5	14	0	0	0		116			6.8	6.8	6.8		> 50 mm
	Wi-Fi 6 GHz	7125	11.0	13	0	0	0		116			6.9	6.9	6.9		> 50 mm
Bluetooth	2480	10.0	10	0	0	0		116			3.1	3.1	3.1		> 50 mm	
BT/WIFI2 Antenna	Wi-Fi 2.4 GHz	2462	12.0	16	0	0	116		0			5	5	5		5
	Wi-Fi 5.2 GHz	5240	11.5	14	0	0	116		0			6.4	6.4	6.4		6.4
	Wi-Fi 5.3 GHz	5320	11.5	14	0	0	116		0			6.5	6.5	6.5		6.5
	Wi-Fi 5.5 GHz	5700	11.5	14	0	0	116		0			6.7	6.7	6.7		6.7
	Wi-Fi 5.8 GHz	5825	11.5	14	0	0	116		0			6.8	6.8	6.8		6.8
	Wi-Fi 5.9 GHz	5895	11.5	14	0	0	116		0			6.8	6.8	6.8		6.8
	Wi-Fi 6 GHz	7125	11.0	13	0	0	116		0			6.9	6.9	6.9		6.9
Bluetooth	2480	10.0	10	0	0	116		0			3.1	3.1	3.1		3.1	

Note(s):

According to KDB 447498, if the calculated threshold value is >3 then SAR testing is required.

Antennas > 50mm to adjacent edges

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
			dBm	mW	Back	Edge Top	Edge Right	Edge Bottom	Edge Left	Front	Back	Edge Top	Edge Right	Edge Bottom	Edge Left	Front
Full Power, Proximity Sensor Off																
BT/WiFi1 Antenna	Wi-Fi 2.4 GHz	2462	19.0	79	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		755.6 mW -EXEMPT.	
	Wi-Fi 5.2 GHz	5240	20.0	100	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		725.5 mW -EXEMPT.	
	Wi-Fi 5.3 GHz	5320	20.0	100	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		725 mW -EXEMPT.	
	Wi-Fi 5.5 GHz	5700	20.0	100	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		722.8 mW -EXEMPT.	
	Wi-Fi 5.8 GHz	5825	20.0	100	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		722.2 mW -EXEMPT.	
	Wi-Fi 5.9 GHz	5895	20.0	100	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		721.8 mW -EXEMPT.	
	Wi-Fi 6 GHz	7125	11.0	13	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		716.2 mW -EXEMPT.	
Bluetooth	2480	18.0	63	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		755.3 mW -EXEMPT.		
BT/WiFi2 Antenna	Wi-Fi 2.4 GHz	2462	19.0	79	0	0	116		0		< 50 mm	< 50 mm	755.6 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.2 GHz	5240	20.0	100	0	0	116		0		< 50 mm	< 50 mm	725.5 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.3 GHz	5320	20.0	100	0	0	116		0		< 50 mm	< 50 mm	725 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.5 GHz	5700	20.0	100	0	0	116		0		< 50 mm	< 50 mm	722.8 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.8 GHz	5825	20.0	100	0	0	116		0		< 50 mm	< 50 mm	722.2 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.9 GHz	5895	20.0	100	0	0	116		0		< 50 mm	< 50 mm	721.8 mW -EXEMPT.		< 50 mm	
	Wi-Fi 6 GHz	7125	11.0	13	0	0	116		0		< 50 mm	< 50 mm	716.2 mW -EXEMPT.		< 50 mm	
Bluetooth	2480	18.0	63	0	0	116		0		< 50 mm	< 50 mm	755.3 mW -EXEMPT.		< 50 mm		
Power Back-off, Proximity Sensor On																
BT/WiFi1 Antenna	Wi-Fi 2.4 GHz	2462	12.0	16	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		755.6 mW -EXEMPT.	
	Wi-Fi 5.2 GHz	5240	11.5	14	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		725.5 mW -EXEMPT.	
	Wi-Fi 5.3 GHz	5320	11.5	14	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		725 mW -EXEMPT.	
	Wi-Fi 5.5 GHz	5700	11.5	14	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		722.8 mW -EXEMPT.	
	Wi-Fi 5.8 GHz	5825	11.5	14	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		722.2 mW -EXEMPT.	
	Wi-Fi 5.9 GHz	5895	11.5	14	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		721.8 mW -EXEMPT.	
	Wi-Fi 6 GHz	7125	11.0	13	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		716.2 mW -EXEMPT.	
Bluetooth	2480	10.0	10	0	0	0		116		< 50 mm	< 50 mm	< 50 mm		755.3 mW -EXEMPT.		
BT/WiFi2 Antenna	Wi-Fi 2.4 GHz	2462	12.0	16	0	0	116		0		< 50 mm	< 50 mm	755.6 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.2 GHz	5240	11.5	14	0	0	116		0		< 50 mm	< 50 mm	725.5 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.3 GHz	5320	11.5	14	0	0	116		0		< 50 mm	< 50 mm	725 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.5 GHz	5700	11.5	14	0	0	116		0		< 50 mm	< 50 mm	722.8 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.8 GHz	5825	11.5	14	0	0	116		0		< 50 mm	< 50 mm	722.2 mW -EXEMPT.		< 50 mm	
	Wi-Fi 5.9 GHz	5895	11.5	14	0	0	116		0		< 50 mm	< 50 mm	721.8 mW -EXEMPT.		< 50 mm	
	Wi-Fi 6 GHz	7125	11.0	13	0	0	116		0		< 50 mm	< 50 mm	716.2 mW -EXEMPT.		< 50 mm	
Bluetooth	2480	10.0	10	0	0	116		0		< 50 mm	< 50 mm	755.3 mW -EXEMPT.		< 50 mm		

Note(s):

According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.

7.2. Required Test Configurations

The tables below identify the standalone test configurations required for this device according to the findings in Section 7.1:

Antenna	Test Configurations	Rear	Edge Top	Edge Right	Edge Bottom	Edge Left	Front
BT/WIFI1 Antenna	Wi-Fi 2.4 GHz	Yes	Yes	Yes	No	No	No
	Wi-Fi 5.2 GHz	Yes	Yes	Yes	No	No	No
	Wi-Fi 5.3 GHz	Yes	Yes	Yes	No	No	No
	Wi-Fi 5.5 GHz	Yes	Yes	Yes	No	No	No
	Wi-Fi 5.8 GHz	Yes	Yes	Yes	No	No	No
	Wi-Fi 5.9 GHz	Yes	Yes	Yes	No	No	No
	Wi-Fi 6 GHz	Yes	Yes	Yes	No	No	No
	Bluetooth	Yes	Yes	Yes	No	No	No
BT/WIFI2 Antenna	Wi-Fi 2.4 GHz	Yes	Yes	No	No	Yes	No
	Wi-Fi 5.2 GHz	Yes	Yes	No	No	Yes	No
	Wi-Fi 5.3 GHz	Yes	Yes	No	No	Yes	No
	Wi-Fi 5.5 GHz	Yes	Yes	No	No	Yes	No
	Wi-Fi 5.8 GHz	Yes	Yes	No	No	Yes	No
	Wi-Fi 5.9 GHz	Yes	Yes	No	No	Yes	No
	Wi-Fi 6 GHz	Yes	Yes	No	No	Yes	No
	Bluetooth	Yes	Yes	No	No	Yes	No

Note(s):

Yes = Testing is required.

No = Testing is not required.

Some additional configurations were tested to support simultaneous transmission considerations.

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.

The dielectric constant (ϵ_r) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within $\pm 5\%$ of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for ϵ_r and σ may be relaxed to $\pm 10\%$. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

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

Dielectric Property Measurements Results:

SAR Lab	Date	Band (MHz)	Tissue Type	Frequency (MHz)	Relative Permittivity (ϵ_r)			Conductivity (σ)		
					Measured	Target	Delta (%)	Measured	Target	Delta (%)
2A	5/8/2023	5250	Head	5250	34.78	35.93	-3.21	4.51	4.70	-4.06
				5150	34.96	36.05	-3.02	4.40	4.60	-4.34
				5350	34.59	35.82	-3.43	4.62	4.80	-3.82
2A	5/8/2023	5600	Head	5600	34.14	35.53	-3.92	4.90	5.06	-3.23
				5500	34.32	35.65	-3.73	4.78	4.96	-3.57
				5725	33.91	35.39	-4.19	5.05	5.19	-2.76
2A	5/12/2023	5750	Head	5750	33.95	35.36	-4.00	5.12	5.21	-1.87
				5700	34.05	35.42	-3.87	5.08	5.16	-1.64
				5850	33.76	35.30	-4.36	5.22	5.32	-1.82
2A	5/12/2023	5850	Head	5850	33.76	35.30	-4.36	5.22	5.32	-1.82
				5900	33.68	35.20	-4.32	5.29	5.38	-1.64
				5925	33.67	35.20	-4.35	5.32	5.40	-1.50
2A	5/16/2023	5600	Head	5600	34.70	35.53	-2.35	4.95	5.06	-2.26
				5500	34.88	35.65	-2.15	4.83	4.96	-2.54
				5725	34.45	35.39	-2.66	5.10	5.19	-1.76
2A	5/16/2023	5750	Head	5750	34.43	35.36	-2.64	5.13	5.21	-1.64
				5700	34.51	35.42	-2.57	5.06	5.16	-1.97
				5850	34.26	35.30	-2.95	5.24	5.32	-1.52
2A	5/16/2023	5850	Head	5850	34.26	35.30	-2.95	5.24	5.32	-1.52
				5900	34.15	35.20	-2.98	5.30	5.38	-1.58
				5925	34.12	35.20	-3.07	5.33	5.40	-1.37
2B	5/5/2023	2450	Head	2450	39.46	39.20	0.66	1.86	1.80	3.11
				2400	39.52	39.30	0.57	1.81	1.75	3.50
				2480	39.41	39.16	0.63	1.88	1.83	2.38
2B	5/11/2023	6500	Head	6500	33.63	34.50	-2.52	6.11	6.07	0.71
				5925	34.68	35.20	-1.48	5.42	5.40	0.43
				7125	32.52	33.80	-3.79	6.87	6.80	1.07
2B	5/15/2023	6500	Head	6500	33.29	34.50	-3.51	6.09	6.07	0.30
				5925	34.32	35.20	-2.50	5.40	5.40	0.04
				7125	32.19	33.80	-4.76	6.86	6.80	0.81

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 5 mm (above 6 GHz), 10 mm (1-6 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 3 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was recorded and the results are normalized to 1 W input power.

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 $\pm 10\%$ of the manufacturer calibrated dipole SAR target. Refer to Appendix B for the SAR System Check Plots.

SAR Lab	Date	Tissue Type	Dipole Type_Serial #	Dipole Cal. Due Data	Dipole Power (dBm)	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
						Zoom Scan	Normalize to 1 W	Target (Ref. Value)	Delta $\pm 10\%$	Zoom Scan	Normalize to 1 W	Target (Ref. Value)	Delta $\pm 10\%$	
2A	5/8/2023	Head	D5GHzV2 SN: 1213 (5.25 GHz)	10/11/2023	17	3.73	74.42	79.4	-6.27	1.07	21.35	22.7	-5.95	1
2A	5/8/2023	Head	D5GHzV2 SN: 1213 (5.60 GHz)	10/11/2023	17	4.07	81.21	82.4	-1.45	1.15	22.95	23.5	-2.36	2
2A	5/12/2023	Head	D5GHzV2 SN: 1213 (5.75 GHz)	10/11/2023	17	3.62	72.23	78.8	-8.34	1.03	20.55	22.4	-8.25	
2A	5/12/2023	Head	D5GHzV2 SN: 1213 (5.85 GHz)	10/11/2023	17	3.85	76.82	81.4	-5.63	1.09	21.75	23.1	-5.85	3
2A	5/16/2023	Head	D5GHzV2 SN: 1213 (5.60 GHz)	10/11/2023	17	4.12	82.20	82.4	-0.24	1.17	23.34	23.5	-0.66	
2A	5/16/2023	Head	D5GHzV2 SN: 1213 (5.75 GHz)	10/11/2023	17	3.6	71.83	78.8	-8.85	1.02	20.35	22.4	-9.14	4
2A	5/16/2023	Head	D5GHzV2 SN: 1213 (5.85 GHz)	10/11/2023	17	3.86	77.02	81.4	-5.38	1.08	21.55	23.1	-6.72	
2B	5/5/2023	Head	D2450V2 SN: 963	10/18/2023	17	2.45	48.88	52.4	-6.71	1.14	22.75	24.5	-7.16	5
2B	5/9/2023	Head	D2450V2 SN: 963	10/18/2023	17	2.48	49.48	52.4	-5.57	1.16	23.15	24.5	-5.53	
2B	5/11/2023	Head	D6.5GHzV2 SN: 1068	12/1/2023	17	15.5	309.27	293	5.55	2.87	57.26	54.6	4.88	6
2B	5/15/2023	Head	D6.5GHzV2 SN: 1068	12/1/2023	17	15	299.29	293	2.15	2.82	56.27	54.6	3.05	

9. Conducted Output Power Measurements

Tune-Up Power Limits provided by the manufacturer are used to scale measured SAR values.

9.1. Wi-Fi 2.4GHz (DTS Band)

Maximum Output Power (Tune-up Limit) for Wi-Fi 2.4 GHz

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

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 802.11b/g/n 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.

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.

Mode	Tune-up PowerLimit (dBm)			
	BT/WIFI1 Antenna		BT/WIFI2 Antenna	
	Max	Reduced	Max	Reduced
802.11b DSSS SISO			19.0	12.0
802.11g/n/ax OFDMA SISO	18.0	12.0	18.0	12.0
802.11b DSSS MIMO	19.0	12.0	19.0	12.0
802.11g/n/ax OFDMA MIMO	18.0	12.0	18.0	12.0

Wi-Fi 2.4GHz Max Power SISO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
DSSS 2.4 GHz	802.11b	1	2412				18.5	19.0	Yes
		6	2437				18.6	19.0	
		11	2462				18.4	19.0	
		12	2467				2.7	3.0	
		13	2472				-0.5	0.0	

Note(s):

SAR is not required for channel 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels. Refer to KDB 248227 D01 section 3.1

Wi-Fi 2.4GHz Reduced Power SISO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
DSSS 2.4 GHz	802.11b	1	2412				11.5	12.0	Yes
		6	2437				11.9	12.0	
		11	2462				11.4	12.0	
		12	2467				2.7	3.0	
		13	2472				-0.5	0.0	

Note(s):

SAR is not required for channel 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels. Refer to KDB 248227 D01 section 3.1

Wi-Fi 2.4GHz Max Power MIMO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
DSSS 2.4 GHz	802.11b	1	2412	18.1	19.0	Yes	18.3	19.0	Yes
		6	2437	18.0	19.0		18.8	19.0	
		11	2462	18.1	19.0		18.5	19.0	
		12	2467	1.0	3.0		2.6	3.0	
		13	2472	-1.9	0.0		-0.7	0.0	

Note(s):

SAR is not required for channel 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels. Refer to KDB 248227 D01 section 3.1

Wi-Fi 2.4GHz Reduced Power MIMO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
DSSS 2.4 GHz	802.11b	1	2412	11.3	12.0	Yes	11.3	12.0	Yes
		6	2437	11.5	12.0		12.0	12.0	
		11	2462	11.4	12.0		11.7	12.0	
		12	2467	1.0	3.0		2.6	3.0	
		13	2472	-1.9	0.0		-0.7	0.0	

Note(s):

SAR is not required for channel 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels. Refer to KDB 248227 D01 section 3.1

Duty Factor Measured Results

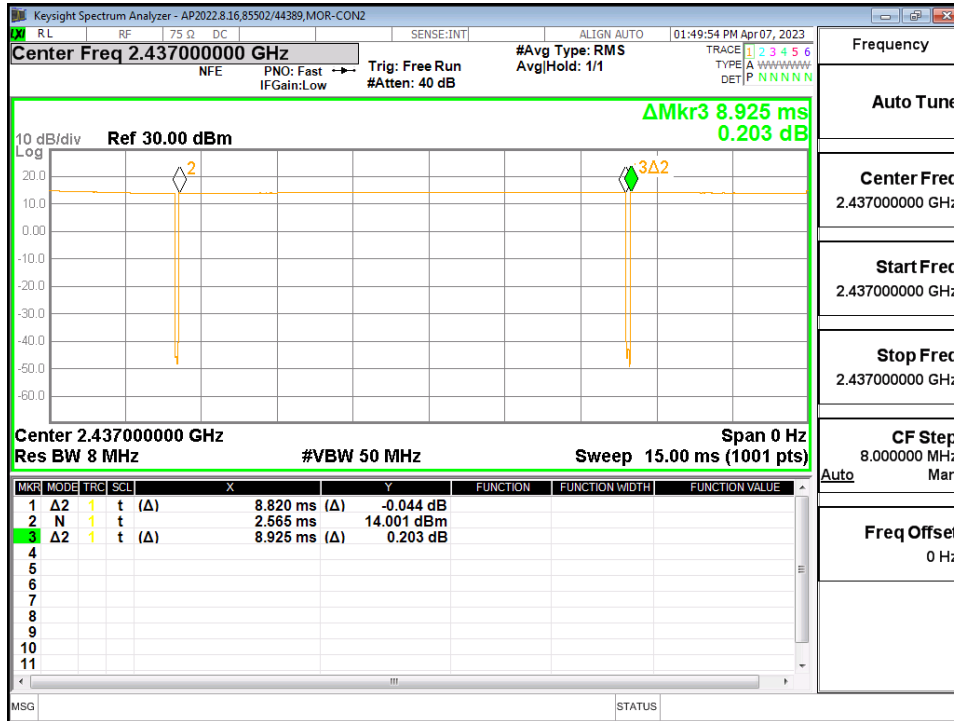
Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
802.11b	1 Mbps	8.820	8.925	98.8%	1.01

Note(s):

Duty Cycle = (T on / period) * 100%

WLAN 2.4GHz Duty Cycle

802.11b



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

Maximum Output Power (Tune-up Limit) for Wi-Fi 5 GHz

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 transmission mode is selected.

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

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/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.

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.

Mode	Bandwidth	Tune-up PowerLimit (dBm)			
		BT/WIFI1 Antenna		BT/WIFI2 Antenna	
		Max	Reduced	Max	Reduced
802.11 a/n/ac/ax MIMO	20 MHz	17.0	9.0	17.0	9.0
802.11 n/ac/ax MIMO	40 MHz	17.0	9.0	17.0	9.0
802.11 ac/ax MIMO	80 MHz	16.0	9.0	16.0	9.0
802.11 ac/ax MIMO	160 MHz	15.0	9.0	15.0	9.0

Wi-Fi 5 GHz Max Power MIMO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-1 5.2 GHz	802.11n (HT40)	38	5190	16.9	17.0	Yes	16.8	17.0	Yes
		46	5230	16.5	17.0		16.7	17.0	
Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
UNII-2A 5.3 GHz	802.11n (HT40)	54	5270	16.0	17.0	Yes	16.1	17.0	Yes
		62	5310	17.0	17.0		16.7	17.0	
Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
UNII-2C 5.5 GHz	802.11n (HT40)	102	5510	16.5	17.0	Yes	16.4	17.0	Yes
		118	5590	16.5	17.0		16.4	17.0	
		126	5630	16.4	17.0		16.4	17.0	
		142	5710	16.3	17.0		16.4	17.0	
Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
UNII-3 5.8 GHz	802.11n (HT40)	151	5755	16.5	17.0	Yes	16.4	17.0	Yes
		159	5795	15.7	17.0		16.8	17.0	
UNII-3 & 4	802.11n (HT40)	167	5835	15.8	17.0	Yes	16.6	17.0	Yes
Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
UNII-4 5.9 GHz	802.11n (HT40)	175	5875	15.2	17.0	Yes	16.9	17.0	Yes

Wi-Fi 5 GHz Reduced Power MIMO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-1	802.11ac (VHT80)	42	5210	8.8	9.0	Yes	8.8	9.0	Yes
Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
UNII-1 & 2A	802.11ac (VHT160)	50	5250	8.4	9.0	Yes	8.1	9.0	Yes
Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
UNII-2C 5.5 GHz	802.11ac (VHT160)	114	5570	8.7	9.0	Yes	8.3	9.0	Yes
Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
UNII-3	802.11ac (VHT80)	155	5775	7.1	9.0	Yes	8.9	9.0	Yes
UNII-3 & 4	802.11ac (VHT160)	163	5815	7.0	9.0	Yes	8.9	9.0	Yes

Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
802.11n HT40	MCS0	0.6195	0.717	86.4%	1.16
802.11ac VHT80	MCS0	3.62	3.716	97.4%	1.03
802.11ac VHT160	MCS0	3.624	3.720	97.4%	1.03

Note(s):

Duty Cycle = (T on / period) * 100%

WLAN 5GHz Duty Cycle

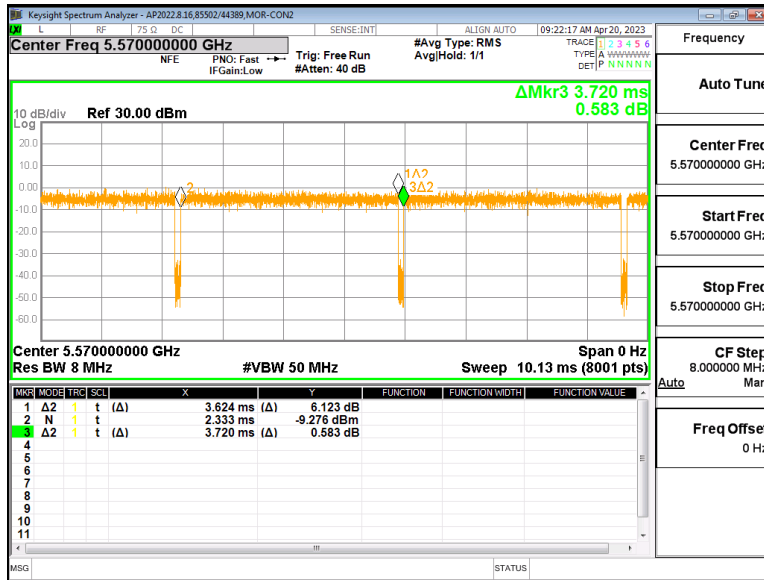
802.11n HT40



802.11ac VHT80



802.11ac VHT160



9.3. Wi-Fi 6 GHz Band (U-NII Bands)

Maximum Output Power (Tune-up Limit) for Wi-Fi 6 GHz

Mode	Bandwidth	Tune-up Power Limit (dBm)			
		BT/WIFI1 Antenna		BT/WIFI2 Antenna	
		Max	Reduced	Max	Reduced
802.11a/ax MIMO	20 MHz	10.0	8.0	10.0	8.0
802.11ax MIMO	40 MHz	10.0	8.0	10.0	8.0
802.11ax MIMO	80 MHz	10.0	8.0	10.0	8.0
802.11ax MIMO	160 MHz	10.0	8.0	10.0	8.0

Wi-Fi 6 GHz Max Power MIMO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-5 & 6 & 7 & 8	802.11ax (HE160)	15	6025	8.2	10.0	Yes	9.6	10.0	Yes
		47	6185	9.9	10.0		9.3	10.0	
		111	6505	8.2	10.0		9.9	10.0	
		143	6665	8.4	10.0		9.5	10.0	
		207	6985	9.8	10.0		8.4	10.0	

Wi-Fi 6 GHz Reduced Power MIMO Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-5 & 6 & 7 & 8	802.11ax (HE160)	15	6025	6.0	8.0	Yes	7.7	8.0	Yes
		47	6185	8.0	8.0		7.0	8.0	
		111	6505	6.5	8.0		7.9	8.0	
		143	6665	7.1	8.0		7.9	8.0	
		207	6985	7.8	8.0		6.2	8.0	

Duty Factor Measured Results

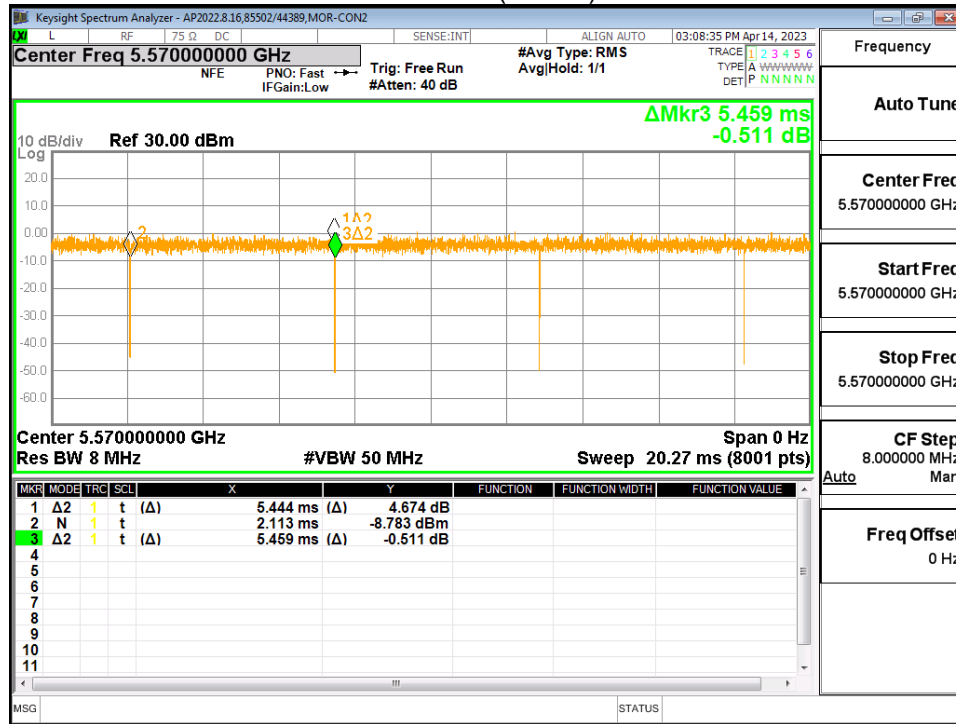
Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
802.11ax	MCS0	5.444	5.459	99.7%	1.00

Note(s):

Duty Cycle = (T on / period) * 100%

WLAN 6GHz Duty Cycle

802.11ax (HE160)



9.4. Bluetooth

Maximum Output Power (Tune-up Limit) for Bluetooth

From October 2016 TCB workshop, Power and SAR were measured with the device connected to a call box with hopping disabled using DH5 modulation. The duty cycle value from the device is taken from the Duty Cycle plot below.

SAR measurement is not required for the EDR and LE. When the secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode.

Band	Mode	Tune-up PowerLimit (dBm)			
		BT/WIFI1 Antenna		BT/WIFI2 Antenna	
		Max	Reduced	Max	Reduced
2.4	BR	18.0	11.0	17.0	9.0
	EDR	16.5	11.0	15.0	9.0
	BLE	14.0	10.0	13.0	8.0

Bluetooth Max Power Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
2.4	BR GFSK	0	2402	17.2	18.0	Yes	15.7	17.0	Yes
		39	2441	17.8	18.0		16.3	17.0	
		78	2480	16.7	17.0		15.6	16.0	

Bluetooth Reduced Power Measured Results

Band	Mode	Ch #	Freq. (MHz)	BT/WIFI1 Average Power (dBm)			BT/WIFI2 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
2.4	BR GFSK	0	2402	9.4	11.0	Yes	7.9	9.0	Yes
		39	2441	10.0	11.0		8.3	9.0	
		78	2480	8.9	10.0		7.7	8.0	

Duty Factor Measured Results

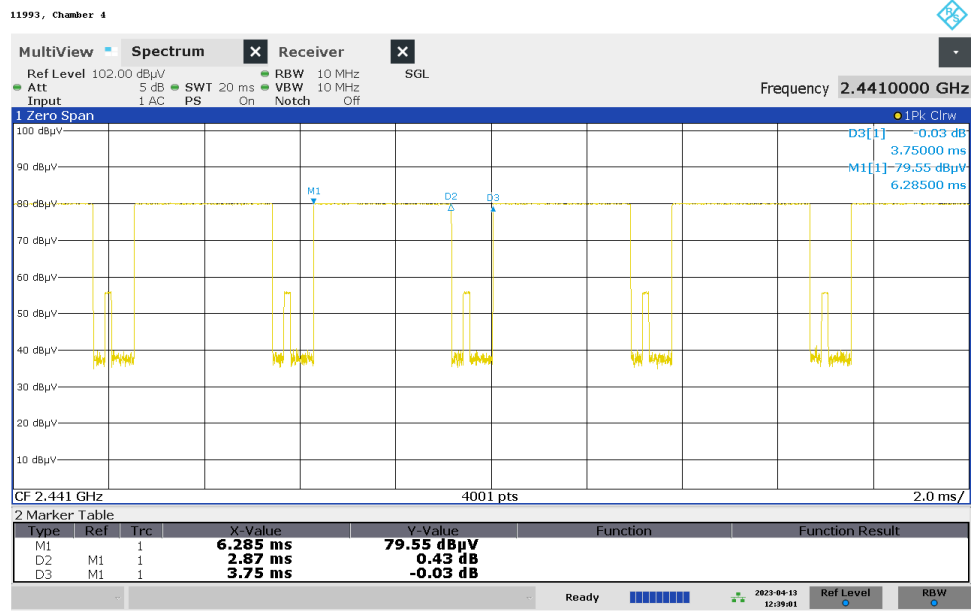
Mode	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
BR GFSK	2.87	3.750	76.5%	1.31

Note(s):

Duty Cycle = (T on / period) * 100%

Bluetooth Duty Cycle

BT BR GFSK



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10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

- Reported SAR(W/kg) for WWAN and Bluetooth = Measured SAR *Tune-up Scaling Factor
- Reported SAR(W/kg) for Wi-Fi = 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 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 648474 D04 Handset SAR (Phablet Only):

For smart phones, with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm.

When hotspot mode does not apply, 10-g Extremity SAR is required for all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge in direct contact with a flat phantom, to address interactive hand use exposure conditions. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg; however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.

KDB 941225 D01 SAR test for 3G devices:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

KDB 941225 D05 SAR for LTE Devices:

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
- When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.
- For LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing; therefore, the requirement for H, M and L channels may not fully apply.

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)

When the 802.11b reported SAR of the highest measured maximum output power channel is ≤ 0.8 W/kg, no further SAR testing is required. If SAR is > 0.8 W/kg and ≤ 1.2 W/kg, SAR is required for the next highest measured output power channel. Finally, if SAR is > 1.2 W/kg, SAR is required for the third channel.

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.

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
										Tune-up Limit	Meas.	Meas.	Scaled	
Body	802.11b MIMO	BT/WIFI1	Max	18	Back	6	2437	0.061	98.8%	19.0	18.0			1
					Edge Top	6	2437	0.048	98.8%	19.0	18.0			
					Edge Right	6	2437	0.229	98.8%	19.0	18.0	0.230	0.293	
					Edge Left	6	2437	-	98.8%	19.0	18.0			
Body	802.11b SISO	BT/WIFI2	Max	18	Back	6	2437	0.04	98.8%	19.0	18.6	0.038	0.042	2
					Edge Top	6	2437	0.028	98.8%	19.0	18.6	0.027	0.030	
					Edge Right	6	2437	0.001	98.8%	19.0	18.6			
					Edge Left	6	2437	0.207	98.8%	19.0	18.6	0.205	0.228	
Body	802.11b MIMO	BT/WIFI2	Max	18	Back	6	2437	0.063	98.8%	19.0	18.8			3
					Edge Top	6	2437	0.088	98.8%	19.0	18.8			
					Edge Right	6	2437	-	98.8%	19.0	18.8			
					Edge Left	6	2437	0.205	98.8%	19.0	18.8	0.206	0.218	
Body	802.11b MIMO	BT/WIFI1	Reduced	0	Back	6	2437	0.386	98.8%	12.0	11.5	0.380	0.432	4
					Edge Top	6	2437	0.243	98.8%	12.0	11.5	0.254	0.288	
					Edge Right	6	2437	0.530	98.8%	12.0	11.5	0.554	0.629	
					Edge Left	6	2437	-	98.8%	12.0	11.5			
Body	802.11b SISO	BT/WIFI2	Reduced	0	Back	6	2437	0.193	98.8%	12.0	11.9	0.195	0.202	5
					Edge Top	6	2437	0.138	98.8%	12.0	11.9			
					Edge Right	6	2437	-	98.8%	12.0	11.9			
					Edge Left	6	2437	0.211	98.8%	12.0	11.9	0.209	0.216	
Body	802.11b MIMO	BT/WIFI2	Reduced	0	Back	6	2437	0.393	98.8%	12.0	12.0	0.382	0.387	6
					Edge Top	6	2437	0.157	98.8%	12.0	12.0			
					Edge Right	6	2437	-	98.8%	12.0	12.0			
					Edge Left	6	2437	0.21	98.8%	12.0	12.0	0.213	0.216	

Note(s):

For results listed with “-”, the SAR result is less than 0.001 W/kg.

10.2. Wi-Fi (U-NII Band)

UNII-1 & 2A

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.

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
Body	802.11n HT40 MIMO	BT/WIFI1	Max	18	Back	62	5310	0.099	86.4%	17.0	17.0	0.082	0.095	7											
					Edge Top	62	5310	0.081	86.4%	17.0	17.0														
					Edge Right	62	5310	0.529	86.4%	17.0	17.0	0.567	0.656												
					Edge Left	62	5310	-	86.4%	17.0	17.0														
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11n HT40 MIMO	BT/WIFI2	Max		18	Back	62	5310	0.091	86.4%	17.0	16.7			8
																Edge Top	62	5310	0.023	86.4%	17.0	16.7			
Edge Right	62	5310	-	86.4%	17.0	16.7																			
Edge Left	62	5310	0.190	86.4%	17.0	16.7	0.195	0.242																	
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT160 MIMO	BT/WIFI1	Reduced		0	Back	50	5250	0.515	97.4%	9.0	8.4	0.458	0.540	9
																Edge Top	50	5250	0.183	97.4%	9.0	8.4	0.185	0.218	
Edge Right	50	5250	0.881	97.4%	9.0	8.4	0.933	1.100																	
Edge Left	50	5250	-	97.4%	9.0	8.4																			
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT160 MIMO	BT/WIFI2	Reduced		0	Back	50	5250	0.573	97.4%	9.0	8.1	0.593	0.749	10
																Edge Top	50	5250	0.041	97.4%	9.0	8.1	0.064	0.081	
Edge Right	50	5250	-	97.4%	9.0	8.1																			
Edge Left	50	5250	0.457	97.4%	9.0	8.1	0.482	0.609																	

Note(s):

1. For results listed with "-", the SAR result is less than 0.001 W/kg.

UNII-2C

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
Body	802.11n HT40 MIMO	BT/WIFI1	Max	18	Back	118	5590	0.050	86.4%	17.0	16.5	0.049	0.064	11											
					Edge Top	118	5590	0.027	86.4%	17.0	16.5														
					Edge Right	118	5590	0.349	86.4%	17.0	16.5	0.356	0.462												
					Edge Left	118	5590	-	86.4%	17.0	16.5														
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11n HT40 MIMO	BT/WIFI2	Max		18	Back	118	5590	0.053	86.4%	17.0	16.4			12
																Edge Top	118	5590	0.043	86.4%	17.0	16.4			
Edge Right	118	5590	-	86.4%	17.0	16.4																			
Edge Left	118	5590	0.165	86.4%	17.0	16.4	0.167	0.222																	
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT160 MIMO	BT/WIFI1	Reduced		7	Back	114	5570	0.020	97.4%	9.0	8.7	0.022	0.024	13
																Back	114	5570	0.547	97.4%	9.0	8.7	0.572	0.629	
Edge Top	114	5570	0.056	97.4%	9.0	8.7	0.048	0.053																	
Edge Right	114	5570	0.892	97.4%	9.0	8.7	0.917	1.009																	
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT160 MIMO	BT/WIFI2	Reduced		7	Back	114	5570	0.044	97.4%	9.0	8.3	0.041	0.049	14
																Back	114	5570	0.617	97.4%	9.0	8.3	0.980	1.182	
Edge Top	114	5570	0.062	97.4%	9.0	8.3	0.049	0.059																	
Edge Right	114	5570	-	97.4%	9.0	8.3																			
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT160 MIMO	BT/WIFI2	Reduced		0	Edge Left	114	5570	0.477	97.4%	9.0	8.3	0.509	0.614	14
																Edge Left	114	5570	0.477	97.4%	9.0	8.3	0.509	0.614	
Edge Left	114	5570	0.477	97.4%	9.0	8.3	0.509	0.614																	
Edge Left	114	5570	0.477	97.4%	9.0	8.3	0.509	0.614																	

Note(s):

1. For results listed with "-", the SAR result is less than 0.001 W/kg.

UNII-3

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
Body	802.11n HT40 MIMO	BT/WIFI1	Max	18	Back	151	5755	0.026	86.4%	17.0	16.5	0.027	0.035	15											
				22	Edge Top	151	5755	0.019	86.4%	17.0	16.5														
				11	Edge Right	151	5755	0.206	86.4%	17.0	16.5	0.212	0.275												
				10	Edge Left	151	5755	-	86.4%	17.0	16.5														
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11n HT40 MIMO	BT/WIFI2	Max		18	Back	159	5795	0.031	86.4%	17.0	16.8			16
															22	Edge Top	159	5795	0.027	86.4%	17.0	16.8			
11	Edge Right	159	5795	-	86.4%	17.0	16.8																		
10	Edge Left	159	5795	0.128	86.4%	17.0	16.8	0.128	0.155																
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT80 MIMO	BT/WIFI1	Reduced		0	Back	155	5775	0.157	97.4%	9.0	7.1	0.256	0.407	17
																Edge Top	155	5775	0.034	97.4%	9.0	7.1	0.029	0.046	
Edge Right	155	5775	0.341	97.4%	9.0	7.1	0.334	0.531																	
Edge Left	155	5775	-	97.4%	9.0	7.1																			
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT80 MIMO	BT/WIFI2	Reduced		0	Back	155	5775	0.188	97.4%	9.0	8.9			18
																Edge Top	155	5775	0.017	97.4%	9.0	8.9			
Edge Right	155	5775	-	97.4%	9.0	8.9																			
Edge Left	155	5775	0.336	97.4%	9.0	8.9	0.353	0.371																	

Note(s):

- For results listed with "-", the SAR result is less than 0.001 W/kg.

UNII-4

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
Body	802.11n HT40 MIMO	BT/WIFI1	Max	18	Back	167	5835	0.027	86.4%	17.0	15.8			19											
					Edge Top	167	5835	0.016	86.4%	17.0	15.8														
					Edge Right	167	5835	0.191	86.4%	17.0	15.8	0.186	0.284												
					Edge Left	167	5835	-	86.4%	17.0	15.8														
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11n HT40 MIMO	BT/WIFI2	Max		18	Back	175	5875	0.031	86.4%	17.0	16.9			20
																Edge Top	175	5875	0.020	86.4%	17.0	16.9			
Edge Right	175	5875	-	86.4%	17.0	16.9																			
Edge Left	175	5875	0.126	86.4%	17.0	16.9	0.131	0.155																	

Note(s):

- For results listed with "-", the SAR result is less than 0.001 W/kg.

UNII-3 & 4

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
Body	802.11ac VHT160 MIMO	BT/WIFI1	Reduced	0	Back	163	5815	0.145	97.4%	9.0	7.0	0.221	0.360	21											
					Edge Top	163	5815	0.021	97.4%	9.0	7.0														
					Edge Right	163	5815	0.482	97.4%	9.0	7.0	0.523	0.851												
					Edge Left	163	5815	-	97.4%	9.0	7.0														
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ac VHT160 MIMO	BT/WIFI2	Reduced		0	Back	163	5815	0.807	97.4%	9.0	8.9	0.762	0.801	22
																Edge Top	163	5815	0.038	97.4%	9.0	8.9	0.035	0.037	
Edge Right	163	5815	-	97.4%	9.0	8.9																			
Edge Left	163	5815	0.471	97.4%	9.0	8.9	0.524	0.551																	

Note(s):

- For results listed with "-", the SAR result is less than 0.001 W/kg.

UNII-5 & 6 & 7 & 8

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
Body	802.11ax HE160 MIMO	BT/WIFI1	Max	18	Back	47	6185	0.000	99.7%	10.0	9.9			23											
					Edge Top	47	6185	0.002	99.7%	10.0	9.9														
					Edge Right	47	6185	0.036	99.7%	10.0	9.9	0.047	0.048												
					Edge Left	47	6185	-	99.7%	10.0	9.9														
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ax HE160 MIMO	BT/WIFI2	Max		18	Back	111	6505	-	99.7%	10.0	9.9			24
																Edge Top	111	6505	-	99.7%	10.0	9.9			
Edge Right	111	6505	-	99.7%	10.0	9.9																			
Edge Left	111	6505	0.002	99.7%	10.0	9.9	0.006	0.006																	
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ax HE160 MIMO	BT/WIFI1	Reduced		0	Back	47	6185	0.225	99.7%	8.0	8.0	0.249	0.250	25
																Edge Top	47	6185	0.007	99.7%	8.0	8.0			
Edge Right	47	6185	0.410	99.7%	8.0	8.0	0.418	0.419																	
Edge Left	47	6185	-	99.7%	8.0	8.0																			
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.											
										Tune-up Limit	Meas.	Meas.	Scaled												
										Body	802.11ax HE160 MIMO	BT/WIFI2	Reduced		0	Back	15	6025	0.503	99.7%	8.0	7.7	0.615	0.661	26
																	47	6185	0.262	99.7%	8.0	7.0	0.402	0.508	
																	111	6505	0.399	99.7%	8.0	7.9	0.536	0.550	
																	143	6665	0.415	99.7%	8.0	7.9	0.692	0.710	
																Edge Top	111	6505	0.030	99.7%	8.0	7.9			
																Edge Right	111	6505	-	99.7%	8.0	7.9			
Edge Left	111	6505	0.161	99.7%	8.0	7.9	0.151	0.155																	

Note(s):

- For results listed with "-", the SAR result is less than 0.001 W/kg.

10.3. Bluetooth

RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.										
									Tune-up Limit	Meas.	Meas.	Scaled											
Body	BR GFSK	BT/WIFI1	Max	18	Back	39	2441	100%	18.0	17.8	0.059	0.062	27										
				22	Edge Top	39	2441	100%	18.0	17.8	0.031	0.032											
				11	Edge Right	39	2441	100%	18.0	17.8	0.153	0.160											
				0	Edge Left	39	2441	100%	18.0	17.8	-	-											
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.										
									Tune-up Limit	Meas.	Meas.	Scaled											
									Body	BR GFSK	BT/WIFI2	Max		18	Back	39	2441	100%	17.0	16.3	0.030	0.035	28
														25	Edge Top	39	2441	100%	17.0	16.3	0.012	0.014	
0	Edge Right	39	2441	100%	17.0	16.3	-	-															
10	Edge Left	39	2441	100%	17.0	16.3	0.081	0.095															
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.										
									Tune-up Limit	Meas.	Meas.	Scaled											
									Body	BR GFSK	BT/WIFI1	Reduced		0	Back	39	2441	100%	11.0	10.0	0.222	0.279	29
															Edge Top	39	2441	100%	11.0	10.0	0.087	0.110	
Edge Right	39	2441	100%	11.0	10.0	0.233	0.293																
Edge Left	39	2441	100%	11.0	10.0	-	-																
RF Exposure Conditions	Mode	Antenna	Power State	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.										
									Tune-up Limit	Meas.	Meas.	Scaled											
									Body	BR GFSK	BT/WIFI2	Reduced		0	Back	39	2441	100%	9.0	8.3	0.106	0.125	30
															Edge Top	39	2441	100%	9.0	8.3	0.041	0.048	
Edge Right	39	2441	100%	9.0	8.3	-	-																
Edge Left	39	2441	100%	9.0	8.3	0.064	0.075																

Note(s):

- For results listed with “-”, the SAR result is less than 0.001 W/kg.

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.

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
Max Power							
2400	Wi-Fi 802.11b/g/n/ax	Body	Edge Right	No	0.230	N/A	N/A
	BT	Body	Edge Right	No	0.153	N/A	N/A
5300	Wi-Fi 802.11a/n/ac/ax	Body	Edge Right	No	0.567	N/A	N/A
5500	Wi-Fi 802.11a/n/ac/ax	Body	Edge Right	No	0.356	N/A	N/A
5800	Wi-Fi 802.11a/n/ac/ax	Body	Edge Right	No	0.212	N/A	N/A

Note(s):

Repeated measurement is not required since the original highest measured SAR is <0.8 W/kg (1-g).

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated		Second Repeated	
						Measured SAR (W/kg)	Largest to Smallest SAR Ratio	Measured SAR (W/kg)	Largest to Smallest SAR Ratio
Reduced Power									
2400	Wi-Fi 802.11b/g/n/ax	Body	Edge Right	No	0.554	N/A	N/A	N/A	N/A
	BT	Body	Edge Right	No	0.233	N/A	N/A	N/A	N/A
5300	Wi-Fi 802.11a/n/ac/ax	Body	Edge Right	Yes	0.933	0.921	1.01	N/A	N/A
5500	Wi-Fi 802.11a/n/ac/ax	Body	Back	Yes	0.980	1.03	1.05	N/A	N/A
5800	Wi-Fi 802.11a/n/ac/ax	Body	Back	No	0.762	N/A	N/A	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 < 1.20.

12. Simultaneous Transmission Conditions

Item	Simultaneous scenario	DTS	DTS	UNII	UNII	BT	BT
		Ant.1	Ant.2	Ant.1	Ant.2	Ant.1	Ant.2
1	DTS MIMO	On	On				
2	DTS + BT		On			On	
3	UNII MIMO + BT			On	On	On	
4				On	On		On

12.1. 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:

SAR₁ 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

SAR₂ 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 **SAR₁**, or **SAR₂**. 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

12.2. Sum of the SAR for DTS MIMO – Max Power

RF Exposure Conditions	Standalone SAR (W/kg)		Σ 1-g SAR (W/kg)
	WLAN 2.4 GHz MIMO		WLAN 2.4 GHz MIMO
	BT/WIFI1 ①	BT/WIFI2 ②	① + ②
Body	0.293	0.228	0.521

12.3. Sum of the SAR for DTS MIMO – Reduced Power

RF Exposure Conditions	Standalone SAR (W/kg)		Σ 1-g SAR (W/kg)
	WLAN 2.4 GHz MIMO		WLAN 2.4 GHz MIMO
	BT/WIFI1 ①	BT/WIFI2 ②	① + ②
Body	0.629	0.387	1.016

12.4. Sum of the SAR for DTS & BT – Max Power

RF Exposure Conditions	WLAN 2.4 GHz	BT	WLAN 2.4 GHz + BT
	BT/WIFI2 ①	BT/WIFI1 ②	① + ②
Body	0.228	0.160	0.388

12.5. Sum of the SAR for DTS & BT – Reduced Power

RF Exposure Conditions	Standalone SAR (W/kg)		Σ 1-g SAR (W/kg)
	WLAN 2.4 GHz	BT	WLAN 2.4 GHz + BT
	BT/WIFI2 ①	BT/WIFI1 ②	① + ②
Body	0.216	0.293	0.509

12.6. Sum of the SAR for UNII MIMO & BT – Max Power

RF Exposure Conditions	Standalone SAR (W/kg)			Σ 1-g SAR (W/kg)	
	WLAN 5/6 GHz MIMO	BT		WLAN 5/6 GHz + BT	
	BT/WIFI1 + BT/WIFI2 ①	BT/WIFI1 ②	BT/WIFI2 ③	① + ②	① + ③
Body	0.222	0.160	0.095	0.382	0.317

12.7. Sum of the SAR for UNII MIMO & BT – Reduced Power

RF Exposure Conditions	Standalone SAR (W/kg)			Σ 1-g SAR (W/kg)	
	WLAN 5/6 GHz MIMO	BT		WLAN 5/6 GHz + BT	
	BT/WIFI1 + BT/WIFI2 ①	BT/WIFI1 ②	BT/WIFI2 ③	① + ②	① + ③
Body	1.182	0.293	0.125	1.475	1.307

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

Appendixes

Refer to separated files for the following appendixes.

Appendix A: SAR Setup Photos

Appendix B: SAR System Check Plots

Appendix C: SAR Highest Test Plots

Appendix D: SAR Tissue Ingredients

Appendix E: SAR Probe Certificates

Appendix F: SAR Dipole Certificates

Appendix G: Proximity Sensor Triggering

END OF REPORT