FCC 47 CFR § 2.1093
IEEE Std 1528-2013

SAR EVALUATION REPORT

FOR

BT/BLE Smart Wearable + DTS/UNII a/b/g/n

MODEL NUMBER: SM-L320

FCC ID: A3LSML320

REPORT NUMBER: S-4791706338-S1V2

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Prepared for
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TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	2025-04-30	Initial Issue	--
V2	2025-05-13	Revised EUT description	Guyun Jeong

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1. Attestation of Test Results

Applicant Name		SAMSUNG ELECTRONICS CO.,LTD.	
FCC ID		A3LSML320	
Model Number		SM-L320	
Applicable Standards		FCC 47 CFR § 2.1093 IEEE Std 1528-2013 Published RF exposure KDB procedures	
Exposure Category		SAR Limits (W/kg)	
		1g SAR	10g SAR
General population / Uncontrolled exposure		1.6	4.0
RF Exposure Conditions		The Highest Reported SAR (W/kg)	
Next-to-Mouth 1-g SAR		**0.09**	
Extremity (Wrist) 10-g SAR		**0.32**	
Simultaneous transmission	1-g SAR	**0.13**	
	10-g SAR	**0.59**	
SAR test distance (mm)			
Next-to-Mouth		**10 mm**	
Extremity (Wrist)		**0 mm**	
Date Tested		2025-03-17 to 2025-04-15	
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	Guyun Jeong Laboratory Technician UL Korea, Ltd. Suwon Laboratory

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

Equipment Class	Band	The Highest Reported SAR (W/kg) of RF exposure conditions	
		1g of tissue	10g of tissue
		Next-to-Mouth	Extremity
DTS	2.4GHz WLAN	**0.070**	**0.270**
NII	5GHz WLAN	**0.045**	**0.315**
Bluetooth	Bluetooth	**0.086**	**0.277**
Simultaneous Transmission SAR		**0.131**	**0.592**

Note(s):

1. The Highest Reported SAR Results were listed for each RF exposure conditions for each supported bands based on SAR test results of Section.10.

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, ANSI C63.26-2015 the following FCC Published RF exposure KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D04 Interim General RF Exposure Guidance v01
- 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 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 7 Room

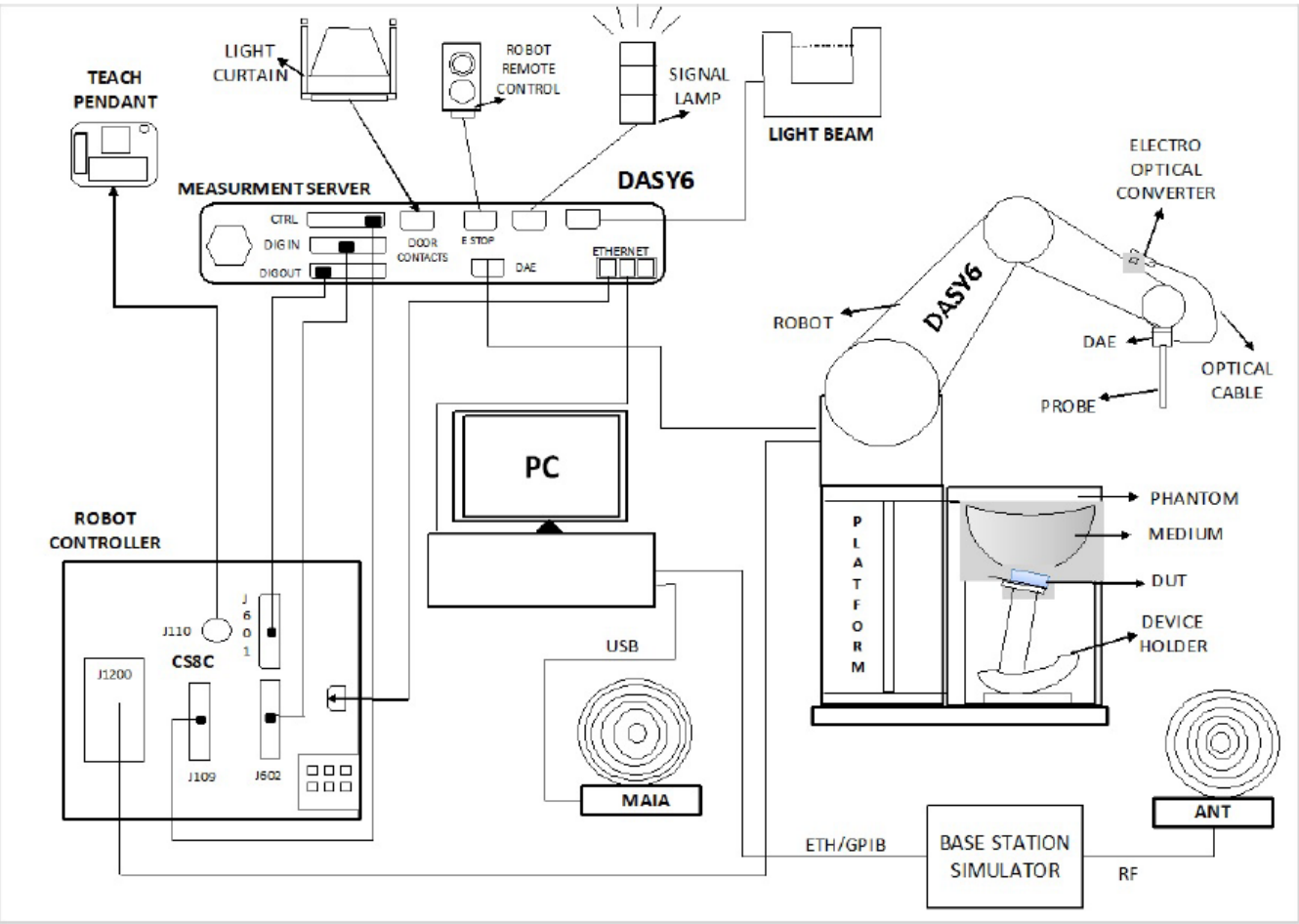
UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at;

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 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 Win11 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.

4.1.1 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 1.4 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

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

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

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

Step 3: Zoom Scan

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

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

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

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

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

Step 4: Power drift measurement

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

4.2. 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	ROHDE & SCHWARZ	ZNB 20	102256	2025-07-22
Dielectric Assessment Kit	SPEAG	DAK-3.5	1133	2026-03-18
Dielectric Assessment Kit	SPEAG	DAK-3.5	1134	2025-04-22
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	2025-06-10
Vector Network Analyzer	SPEAG	DAKS_VNA R140	SN0050221	2025-04-15
Vector Network Analyzer	SPEAG	DAKS_VNA R140	SN0060221	2026-03-20
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3862	2025-07-23

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Keysight	N5173B	MY59101083	2025-07-23
Power Sensor	KEYSIGHT	U2000A	MY61010010	2025-12-16
Power Sensor	KEYSIGHT	U2000A	MY60160004	2025-07-23
Power Amplifier	EXODUS	AMP2027ADB	10002	2025-12-16
Directional Coupler	KRYTAR	100318010	215542	2026-01-02
Low Pass Filter	KRYTAR	WLKX10-11000-13640-21000-60TS	1	2025-07-23
Attenuator	KEYSIGHT	BW-S3W10+	N/A	2026-01-02
Attenuator	KEYSIGHT	8491B010	MY39272293	2025-07-25
Attenuator	KEYSIGHT	8491B/020	MY39271973	2025-07-23
E-Field Probe	SPEAG	EX3DV4	7645	2025-09-23
Data Acquisition Electronics	SPEAG	DAE4	1494	2025-07-15
System Validation Dipole	SPEAG	D2450V2	939	2025-07-10
System Validation Dipole	SPEAG	D5GHzV2	1184	2025-11-21
Thermometer	Lutron	MHB-382SD	AK.18789	2025-07-24

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	169800	2025-07-24

Note(s):

1. All equipments were used until Cal.Due data.

5. Measurement Uncertainty

SAR 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

Measurement Uncertainty is not applied when providing statements of conformity in accordance with IEC Guide 115:2023, 4.3.3.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Refer to Appendix A.		
Back Cover	☒ The Back Cover is not removable.		
Battery Options	☒ The rechargeable battery is not user accessible		
Wireless Router (Hotspot)	☒ Mobile Hotspot is not supported		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz, Wi-Fi 5GHz (36~48ch, 149~165ch)		
Test Sample Information	**No.**	**S/N**	**Notes**
	1	R3AY100J7XV	WLAN Conduction
	2	R3AY400QL6J	SAR Radiation
	3	R3AY400QL3L	SAR Radiation

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)	98.49% (802.11b)
	5 GHz	802.11a / 802.11n (HT20)	95.36% (802.11a)
	Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No		
	Does this device support Band gap channel(s)? ☒ Yes ☐ No		
Bluetooth	2.4 GHz	Version 5.3 LE	76.80% (BDR)

Notes:

1. Wi-Fi & Bluetooth were tested SAR using highest duty cycle. Measured duty cycle plots are in Section.9.

6.3. Maximum Allowed Output Power

WLAN Bands maximum allowed output power

Maximum allowed output power means that target power + 1.0dB device uncertainty

RF Air interface	Band		Maximum allowed output power (dBm)			
			802.11 mode			
			a	b	g	n
WiFi 2.4 GHz	DTS	Ch 1 - 11		19.0	17.5	17.5
		Ch12		9.0	9.0	9.0
		Ch 13		7.0	7.0	7.0
WiFi 5 GHz (BW : 20MHz)	UNII-1		16.5			16.5
	UNII-2A		16.5			16.5
	UNII-2C		16.5			16.5
	UNII-3		16.5			16.5
	UNII-4		16.5			16.5

Bluetooth maximum allowed output power

Maximum allowed output power means that target power + 1.0dB device uncertainty

RF Air Interface	Maximum allowed output power (dBm)
Bluetooth (BDR) (1Mbps)	19
Bluetooth (EDR)	12
Bluetooth LE	10

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.

Wireless technologies	RF Exposure Conditions	Test Positions / distance			
		Test distance	Rear	Front	Antenna-to-edge/surface
WLAN/BT	Next-to-Mouth	10 mm	No	Yes	N/A
	Extremity	0mm	Yes	No	N/A

8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The Tissue Dielectric parameters (100MHz to 6GHz) 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	
	ε_r	σ (S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800 – 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5000	36.2	4.45
5100	36.1	4.55
5200	36.0	4.66
5300	35.9	4.76
5400	35.8	4.86
5500	35.6	4.96
5600	35.5	5.07
5700	35.4	5.17
5800	35.3	5.27
6000	35.1	5.48

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:
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Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
2025-04-14	Head 2450	e'	39.0700	Relative Permittivity (ε_r):	39.07	39.20	-0.33	5
		e''	12.7100	Conductivity (σ):	1.73	1.80	-3.81	5
	Head 2400	e'	39.0800	Relative Permittivity (ε_r):	39.08	39.30	-0.55	5
		e''	12.7500	Conductivity (σ):	1.70	1.75	-2.87	5
	Head 2500	e'	39.0900	Relative Permittivity (ε_r):	39.09	39.14	-0.12	5
		e''	12.7200	Conductivity (σ):	1.77	1.85	-4.63	5
2025-04-14	Head 5200	e'	36.3700	Relative Permittivity (ε_r):	36.37	35.99	1.06	5
		e''	15.6900	Conductivity (σ):	4.54	4.65	-2.46	5
	Head 5250	e'	36.2400	Relative Permittivity (ε_r):	36.24	35.93	0.85	5
		e''	15.7500	Conductivity (σ):	4.60	4.70	-2.22	5
	Head 5600	e'	35.5500	Relative Permittivity (ε_r):	35.55	35.53	0.05	5
		e''	16.0900	Conductivity (σ):	5.01	5.06	-0.99	5
	Head 5750	e'	35.2900	Relative Permittivity (ε_r):	35.29	35.36	-0.21	5
		e''	16.2400	Conductivity (σ):	5.19	5.21	-0.41	5
	Head 5800	e'	35.1900	Relative Permittivity (ε_r):	35.19	35.30	-0.31	5
		e''	16.2600	Conductivity (σ):	5.24	5.27	-0.50	5
	Head 5925	e'	34.9900	Relative Permittivity (ε_r):	34.99	35.20	-0.60	5
		e''	16.3500	Conductivity (σ):	5.39	5.40	-0.25	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 of 100MHZ to 6GHz frequency range 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
D2450V2	939	2024-07-10	2025-07-10	1g	52.20
				10g	24.40
D5GHzV2(5250)	1184	2024-11-21	2025-11-21	1g	81.20
				10g	23.20
D5GHzV2(5600)	1184	2024-11-21	2025-11-21	1g	84.00
				10g	24.00
D5GHzV2(5750)	1184	2024-11-21	2025-11-21	1g	79.90
				10g	22.90
D5GHzV2(5800)	1184	2024-11-21	2025-11-21	1g	77.50
				10g	22.20

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.

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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			
2025-04-14	D5GHzV2(5250)	1184	Head	1g	7.67	76.7	81.20	-5.54	1
				10g	2.26	22.6	23.20	-2.59	
2025-04-14	D5GHzV2(5600)	1184	Head	1g	8.01	80.1	84.00	-4.64	
				10g	2.32	23.2	24.00	-3.33	
2025-04-14	D5GHzV2(5750)	1184	Head	1g	8.22	82.2	79.90	2.88	
				10g	2.39	23.9	22.90	4.37	
2025-04-14	D5GHzV2(5800)	1184	Head	1g	7.66	76.6	77.50	-1.16	
				10g	2.22	22.2	22.20	0.00	
2025-04-15	D2450V2	939	Head	1g	4.82	48.2	52.20	-7.66	2
				10g	2.35	23.5	24.40	-3.69	

9. Conducted Output Power Measurements

9.1. Wi-Fi 2.4 GHz (DTS Band)

Measured output power results

Antenna	Mode	Data Rate	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)
WiFi 2.4G	802.11b	1 Mbps	1	2412	18.13	19	Yes
			6	2437	18.32		
			11	2462	18.21		
			12	2467	Not Required	9	No
			13	2472		7	
	802.11g	6 Mbps	Not Required			17.5	No
	802.11n (HT20)	MCS 0	Not Required			17.5	No

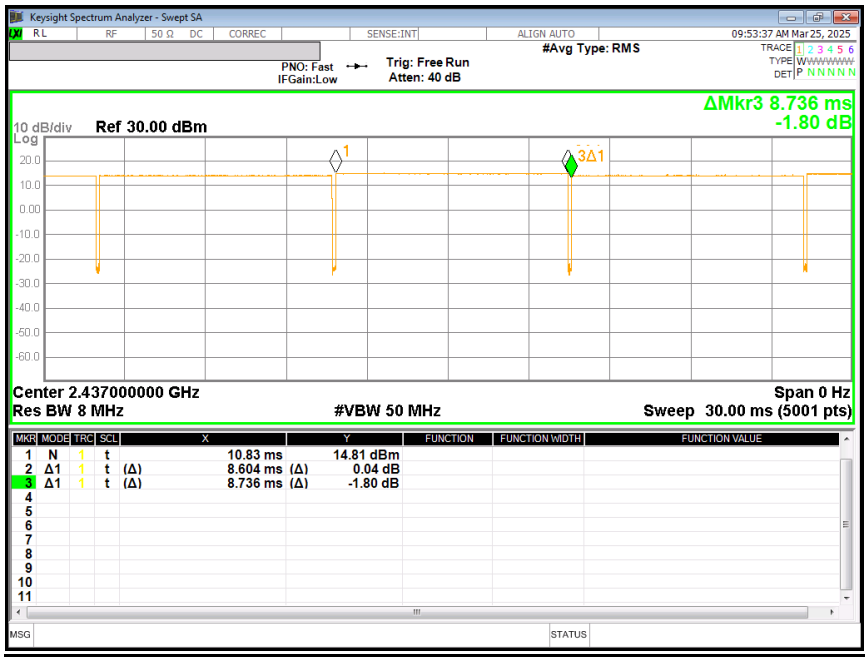
Note(s):

1. SAR is not required for 802.11g/n modes when the adjusted SAR for 802.11b is < 1.2 W/kg.
2. For "Not required", SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11g/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.
3. 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 Cyle	Measured Duty Cycle	Crest Factor (maximum duty/ measured duty cycle)
802.11b	SISO	8.604	8.736	100.00%	98.49%	1.02

Duty Cycle plots (802.11b-SISO)



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

Measured output power results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Normal WLAN mode power		
					Max. Average Power		
					Avg Pwr (dBm)	Target Pwr	SAR Test (Yes/No)
UNII-2A	802.11a	6 Mbps	52	5260	15.71	16.5	Yes
			56	5280	15.68		
			60	5300	15.49		
			64	5320	15.74		
	802.11n (HT20)	MCS0	Not Required			16.5	No
UNII-2C	802.11a	6 Mbps	100	5500	15.55	16.5	Yes
			120	5600	15.46		
			124	5620	15.64		
			144	5720	15.79		
	802.11n (HT20)	MCS0	Not Required			16.5	No
UNII-3 or §15.247	802.11a	6 Mbps	149	5745	15.56	16.5	Yes
			157	5785	15.58		
			165	5825	15.75		
	802.11n (HT20)	MCS0	Not Required			16.5	No
UNII-4	802.11a	6 Mbps	169	5845	15.69	16.5	Yes
			173	5865	15.84		
			177	5885	15.53		
	802.11n (HT20)	MCS0	Not Required			16.5	No

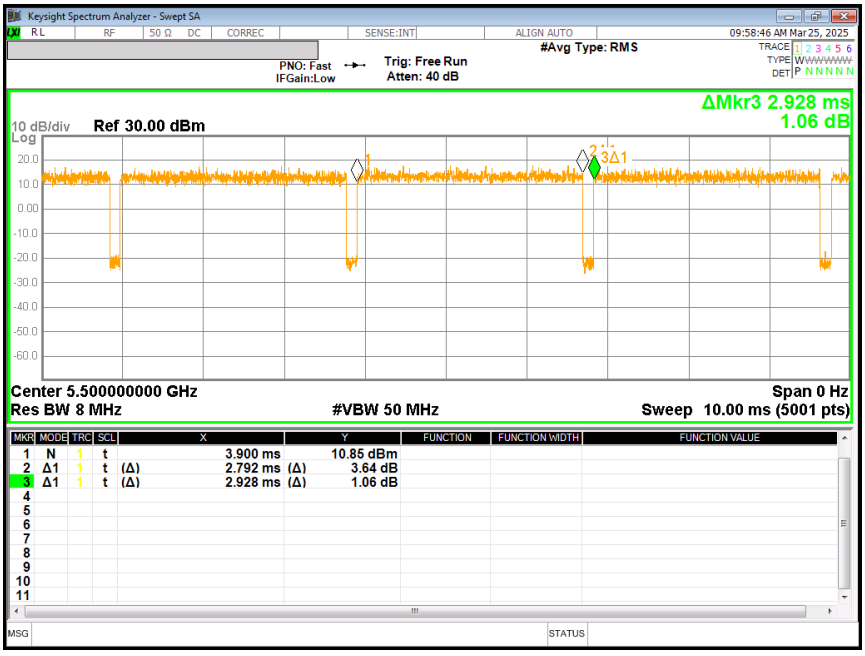
Note(s):

1. 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/n mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.
2. When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/n modes, the channel in the lower order/sequence 802.11 mode (i.e. a, n) is selected.
3. 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.

Duty Factor Measured Results

Mode	T on (ms)	Period (ms)	Maximum Duty Cyle	Measured Duty Cycle	Crest Factor (maximum duty/ measured duty cycle)
802.11a	2.792	2.928	100.00%	95.36%	1.05

Duty Cycle plots (802.11a)



9.3. Bluetooth

Measured output power results

Band (GHz)	Mode	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)	Max. Tune-up Limit (dBm)	SAR Test (Yes/No)
Bluetooth 2.4G	Bluetooth (BDR)	0	2402	18.07	19	Yes
		39	2441	17.84		
		78	2480	17.06		
	Bluetooth (EDR)	0	2402	Not Required	12	No
		39	2441			
		78	2480			
	Bluetooth (LE 1M)	37	2402	Not Required	10	No
		19	2440			
		39	2480			
	Bluetooth (LE 2M)	37	2402	Not Required	10	No
		19	2440			
		39	2480			

Note(s):

1. For BT/BLE SISO SAR test, BDR has highest time-based averaged power in all modes. So SAR test performed at BDR.

Duty Factor Measured Results

Mode	T on (ms)	Period (ms)	Maximum Duty Cyle	Measured Duty Cycle	Crest Factor (maximum duty/ measured duty cycle)
BDR - DH5	2.880	3.750	78.00%	76.80%	1.02

Duty Cycle plots (BDR)

Note(s):

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

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
- Wi-Fi Duty Cycle scaling factor = 1 / Duty cycle (%)
- BT Duty Cycle scaling factor = Maximum Duty cycle / Duty cycle (%)

KDB 447498 D04 Interim 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 447498 D04 Interim General RF Exposure Guidance Wrist watch SAR:

Transmitters that are built-in within a wristwatch, or similar wrist-worn devices, typically operate in speakerphone mode for voice communication, with the device worn on the wrist and positioned next to the mouth. Operations next to the mouth requires 1-g SAR measurement, while the wrist-worn condition requires 10-g extremity SAR measurement. Next-to-mouth use is evaluated with the front of the device positioned at 10 mm from a flat phantom to measure head SAR. The wrist bands shall be strapped together to represent normal use conditions. SAR for wrist exposure is evaluated with the back of the device positioned in direct contact against a flat phantom filled with body tissue-equivalent medium. The wrist bands shall be unstrapped and touching the phantom.

KDB 248227 D01 SAR meas for 802.11:

The SAR measurement and test reduction procedures are structured according to either the DSSS or OFDM transmission mode configurations used in each standalone frequency band and aggregated band. SAR is measured using the highest measured maximum output power channel for the initial test configuration. SAR measurement and test reduction for the remaining 802.11 modes and test channels are determined according to measured or specified maximum output power and reported SAR of the initial measurements. The general test reduction and SAR measurement approaches are summarized in the following:

- 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 OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, an “initial test configuration” is first determined for each standalone and aggregated frequency band according to the maximum output power and tune-up tolerance specified for production units.
- The Initial test configuration does not apply to DSSS. The 2.4 GHz band SAR test requirements and 802.11b DSSS procedures are used to establish the transmission configurations required for SAR measurement.
- An “initial test position” is applied to further reduce the number of SAR tests for devices operating in next to the ear, UMPC mini-tablet or hotspot mode exposure configurations that require multiple test positions.
  - SAR is measured for 802.11b according to the 2.4 GHz DSSS procedure using the exposure condition established by the initial test position.
  - SAR is measured for 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration.
- The Initial test position does not apply to devices that require a fixed exposure test position.
- The “subsequent test configuration” procedures are applied to determine if additional SAR measurements are required for the remaining OFDM transmission modes that have not been tested in the initial test configuration.
- 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.

802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure.

- When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel.

OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements

The initial test configuration for 2.4 GHz and 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined by applying the following steps sequentially.

- The largest channel bandwidth configuration is selected among the multiple configurations in a frequency band with the same specified maximum output power.
- If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
- If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
- When multiple transmission modes (802.11a/g/n/ac/ax/be) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected.

After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following.

- The channel closest to mid-band frequency is selected for SAR measurement.
- For channels with equal separation from mid-band frequency the higher frequency (number) channel is selected for SAR measurement.

Initial Test Configuration Procedures

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required. SAR test reduction for subsequent highest output test channels is determined according to reported SAR of the initial test configuration.

- When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Subsequent Test Configuration Procedures

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration.

- When SAR test exclusion provisions of KDB Publication 447498 D01 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.
- When the highest reported SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.
- When SAR measurement is required for a subsequent test configuration and the channel bandwidth is smaller than that in the initial test configuration, all channels in the subsequent test configuration that overlap with the larger bandwidth channel tested in the initial test configuration should be used to determine the highest maximum output power channel.

- SAR should first be measured for the channel with highest measured output power in the subsequent test configuration.
- SAR for subsequent highest measured maximum output power channels in the subsequent test configuration is required only when the reported SAR of the preceding higher maximum output power channel(s) in the subsequent test configuration is > 1.2 W/kg or until all required channels are tested. For channels with the same measured maximum output power, SAR should be measured using the channel closest to the center frequency of the larger channel bandwidth channel in the initial test configuration.

- SAR measurements for the remaining highest specified maximum output power OFDM transmission mode configurations that have not been tested in the initial test configuration or subsequent test configuration is determined by recursively applying the subsequent test configuration procedures in this subclause to the remaining configurations according to the following:
  - replace “subsequent test configuration” with “next subsequent test configuration”
  - replace “initial test configuration” with “all tested higher output power configurations”

10.1. Wi-Fi (DTS Band)

DTS SISO SAR results

RF Exposure Condition	Mode	Dist (mm)	Test Position	Channel	Freq. (MHz)	Area scan Max. SAR (W/kg)	Duty Cycle (%)	Tune-up Limit (dBm)	Meas. (dBm)	Meas. 1g (W/kg)	Reported. 1g (W/kg)	Meas. 10g (W/kg)	Reported. 10g (W/kg)	Plot No.
Next to Mouth	802.11b 1Mbps	10	Front	6	2437.0	0.075	98.49%	19.00	18.32	0.059	0.070			1
Extremity	802.11b 1Mbps	0	Rear	6	2437.0	0.671	98.49%	19.00	18.32			0.227	0.270	2

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

U-NII 2A SISO SAR results

RF Exposure Condition	Mode	Dist (mm)	Test Position	Channel	Freq. (MHz)	Area scan Max. SAR (W/kg)	Duty Cycle (%)	Tune-up Limit (dBm)	Meas. (dBm)	Meas. 1g (W/kg)	Reported. 1g (W/kg)	Meas. 10g (W/kg)	Reported. 10g (W/kg)	Plot No.
Next to Mouth	802.11a 6Mbps	10	Front	64	5320.0	0.057	95.36%	16.50	15.74	0.029	0.036			
Extremity	802.11a 6Mbps	0	Rear	64	5320.0	0.492	95.36%	16.50	15.74			0.047	0.059	

U-NII 2C SISO SAR results

RF Exposure Condition	Mode	Dist (mm)	Test Position	Channel	Freq. (MHz)	Area scan Max. SAR (W/kg)	Duty Cycle (%)	Tune-up Limit (dBm)	Meas. (dBm)	Meas. 1g (W/kg)	Reported. 1g (W/kg)	Meas. 10g (W/kg)	Reported. 10g (W/kg)	Plot No.
Next to Mouth	802.11a 6Mbps	10	Front	144	5720.0	0.067	95.36%	16.50	15.79	0.029	0.036			
Extremity	802.11a 6Mbps	0	Rear	144	5720.0	1.370	95.36%	16.50	15.79			0.233	0.288	

U-NII 3 SISO SAR results

RF Exposure Condition	Mode	Dist (mm)	Test Position	Channel	Freq. (MHz)	Area scan Max. SAR (W/kg)	Duty Cycle (%)	Tune-up Limit (dBm)	Meas. (dBm)	Meas. 1g (W/kg)	Reported. 1g (W/kg)	Meas. 10g (W/kg)	Reported. 10g (W/kg)	Plot No.
Next to Mouth	802.11a 6Mbps	10	Front	165	5825.0	0.082	95.36%	16.50	15.75	0.036	0.045			3
Extremity	802.11a 6Mbps	0	Rear	165	5825.0	1.350	95.36%	16.50	15.75			0.253	0.315	4

U-NII 4 SISO SAR results

RF Exposure Condition	Mode	Dist (mm)	Test Position	Channel	Freq. (MHz)	Area scan Max. SAR (W/kg)	Duty Cycle (%)	Tune-up Limit (dBm)	Meas. (dBm)	Meas. 1g (W/kg)	Reported. 1g (W/kg)	Meas. 10g (W/kg)	Reported. 10g (W/kg)	Plot No.
Next to Mouth	802.11a 6Mbps	10	Front	173	5865.0	0.061	95.36%	16.50	15.84	0.020	0.024			
Extremity	802.11a 6Mbps	0	Rear	173	5865.0	1.450	95.36%	16.50	15.84			0.232	0.283	

10.3. Bluetooth

RF Exposure Condition	Mode	Dist (mm)	Test Position	Channel	Freq. (MHz)	Duty Cycle (%)	Tune-up Limit (dBm)	Meas. (dBm)	Meas. 1g (W/kg)	Reported. 1g (W/kg)	Meas. 10g (W/kg)	Reported. 10g (W/kg)	Plot No.
Next to Mouth	GFSK DH5	10	Front	0	2402.0	76.80%	19.00	18.07	0.068	0.086			5
Extremity	GFSK DH5	0	Rear	0	2402.0	76.80%	19.00	18.07			0.220	0.277	6

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	DTS	Next-to-Mouth	Front	No	0.059	N/A	N/A
	Bluetooth	Next-to-Mouth	Front	No	0.068	N/A	N/A
5300	U-NII 2A	Next-to-Mouth	Front	No	0.029	N/A	N/A
5600	U-NII 2C	Next-to-Mouth	Front	No	0.029	N/A	N/A
5800	U-NII 3	Next-to-Mouth	Front	No	0.036	N/A	N/A
5900	U-NII 4	Next-to-Mouth	Front	No	0.020	N/A	N/A

Peak spatial-average (10g 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	DTS	Extremity	Rear	No	0.227	N/A	N/A
	Bluetooth	Extremity	Rear	No	0.220	N/A	N/A
5300	U-NII 2A	Extremity	Rear	No	0.047	N/A	N/A
5600	U-NII 2C	Extremity	Rear	No	0.233	N/A	N/A
5800	U-NII 3	Extremity	Rear	No	0.253	N/A	N/A
5900	U-NII 4	Extremity	Rear	No	0.232	N/A	N/A

Note(s):

1. In above table, Only some bands above 0.8 or 2.0 W/kg (1-g or 10-g Measured SAR) were listed.

2. 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	Capable Transmit Configurations
Next-to-Mouth & Extremity	1	BT + UNII

Notes:

1. DTS supports Wi-Fi Direct.
2. U-NII supports Wi-Fi Direct.
3. U-NII Radio can transmit simultaneously with Bluetooth Radio.

Simultaneous transmission SAR test exclusion considerations

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.

12.1. Sum of the SAR for Wi-Fi & BT in Next-to-Mouth

RF Exposure conditions	UNII	BT	UNII+BT	
			1+2	
	1	2	∑1-g SAR (W/kg)	SPLSR (Yes/No)
Next to Mouth (1g)	0.045	0.086	0.131	No

12.2. Sum of the SAR for Wi-Fi & BT in Extremity

RF Exposure conditions	UNII	BT	UNII+BT	
			1+2	
	1	2	∑10-g SAR (W/kg)	SPLSR (Yes/No)
Extremity (10g)	0.315	0.277	0.592	No

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.

S-4791706338-S1 FCC Report SAR_App A_Photos

S-4791706338-S1 FCC Report SAR_App B_Test Plots

S-4791706338-S1 FCC Report SAR_App C_System Plots

S-4791706338-S1 FCC Report SAR_App D_SAR Tissue

S-4791706338-S1 FCC Report SAR_App E_Probe Certi

S-4791706338-S1 FCC Report SAR_App F_Dipole Certi

END OF REPORT