SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std. 1528-2013

For

Wireless Speaker

Model: CHARGE 5 Wi-Fi

FCC ID: APICHARGE5WIFI

Report Number: 4790526351_FCC_SAR_2

Issue Date: Sep 5, 2022

Prepared for

Harman International Industries, Inc.
8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES

Prepared by

UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch
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Revision History

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	9/5/2022	Initial Issue	

Note:
1.This test report is only published to and used by the applicant, and it is not for evidence purpose in China.
2. The measurement result for the sample received is <Pass> according to < IEEE Std. 1528, when <Accuracy Method> decision rule is applied.

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1. Attestation of Test Results

Applicant Name	Harman International Industries, Inc.		
Address	8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES		
Manufacturer	Harman International Industries, Inc.		
Address	8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES		
EUT Name	Wireless Speaker		
Model	CHARGE 5 Wi-Fi		
Sample Status	Normal		
Sample Received Date	Aug 12, 2022		
Date of Tested	Aug 31-Sep 1, 2022		
Applicable Standards	FCC 47 CFR § 2.1093 IEEE Std. 1528-2013 KDB publication		
SAR Limits (W/Kg)			
Exposure Category	Peak spatial-average (1g of tissue)	Extremities (hands, wrists, ankles, etc.) (10g of tissue)	
General population / Uncontrolled exposure	1.6	4	
The Highest Reported SAR (W/kg)			
RF Exposure Conditions	**Equipment Class**		
	DTS	**NII**	**DSS**
Body (1-g)	0.327	0.714	0.024
Simultaneous Transmission(1-g)	0.908		
Test Results	Pass		
Prepared By: Burt Hu Burt Hu Laboratory Engineer	Reviewed By: Denny Huang Denny Huang Senior Project Engineer	Approved By: Stephen Guo Stephen Guo Laboratory Manager	

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2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with IEEE Std.1528-2013, the following FCC Published RF exposure KDB procedures:

- 447498 D01 General RF Exposure Guidance
- 690783 D01 SAR Listings on Grants
- 865664 D01 SAR measurement 100 MHz to 6 GHz
- 865664 D02 RF Exposure Reporting
- 941225 D06 Hotspot Mode

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3. Facilities and Accreditation

Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi-tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to be compliance with A2LA. **FCC (FCC Recognized No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules **IC (Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320. **VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011
Description	All measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi-tech Development Zone, Dongguan, 523808, China

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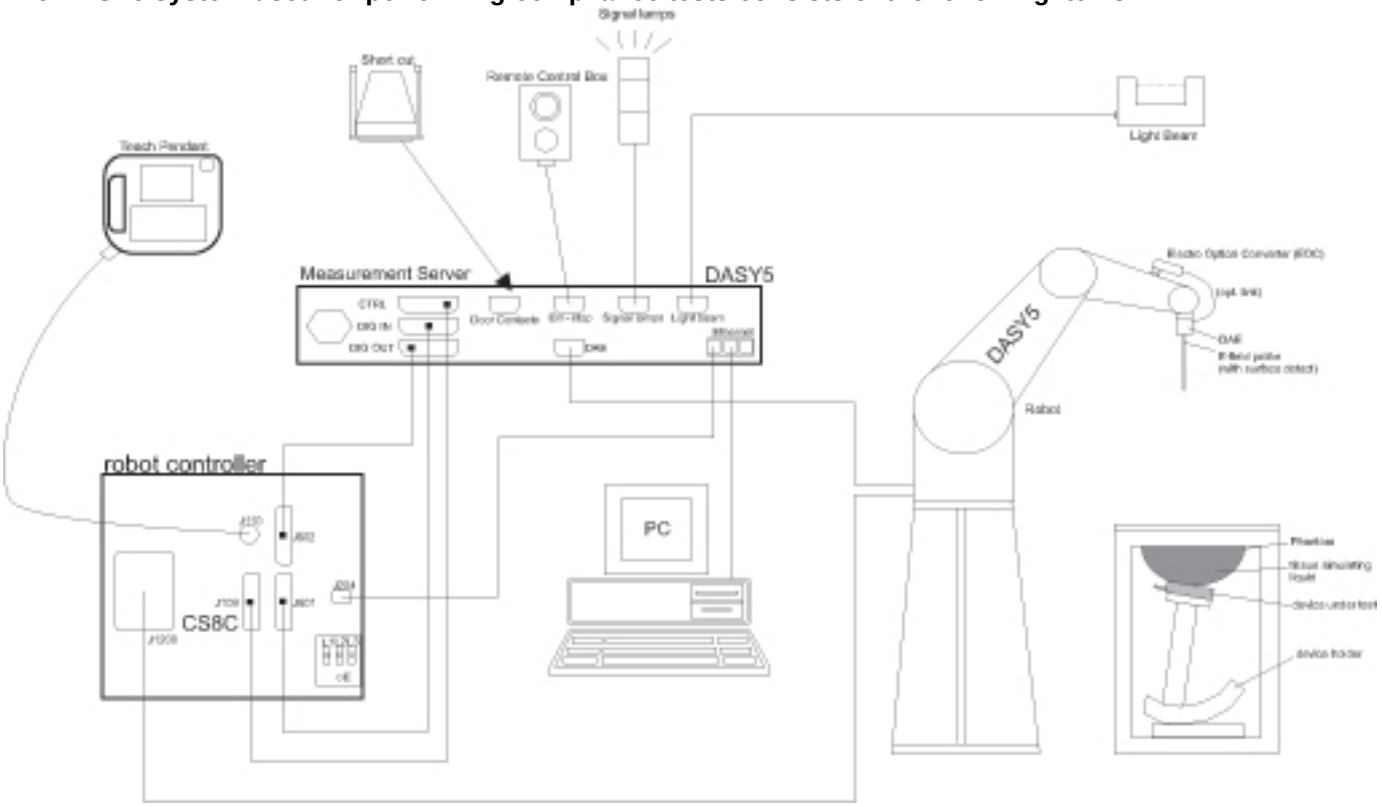
4. SAR Measurement System & Test Equipment

4.1.SAR Measurement System

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 and the DASY52 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.

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4.2.SAR Scan Procedures

Step 1: Power Reference Measurement
The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in Db) is specified in the standards for compliance testing. For example, a 2 Db range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 Db is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.
Area Scan Parameters extracted from KDB 865664 D01 v01r04 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.	

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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 v01r04 SAR Measurement 100 MHz to 6 GHz

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

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

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

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

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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.

Name of equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
ENA Network Analyzer	Keysight	E5080A	MY55100583	2022.10.29
Dielectric Probe kit	SPEAG	SM DAK 040 SA	1155	NCR
DC power supply	Keysight	E36103A	MY55350020	2022.10.29
Signal Generator	Rohde & Schwarz	SME06	837633\001	2022.10.29
BI-Directional Coupler	WERLATONE	C8060-102	3423	2022.10.29
Peak and Average Power Sensor	Keysight	E9323A	MY55440013	2022.10.29
Peak and Average Power Sensor	Keysight	E9323A	MY55420006	2022.10.29
Dual Channel PK Power Meter	Keysight	N1912A	MY55416024	2022.10.29
Amplifier	CORAD TECHNOLOGY LTD	AMF-4D-00400600-50-30P	1983561	NCR
Dosimetric E-Field Probe	SPEAG	EX3DV4	7733	2023.8.1
Data Acquisition Electronic	SPEAG	DAE4	1739	2023.7.28
Dipole Kit 2450 MHz	SPEAG	D2450V2	977	2024.12.16
Dipole Kit 5 GHz	SPEAG	D5GHzV2	1231	2024.12.15
Software	SPEAG	DASY8	N/A	NCR
Twin Phantom	SPEAG	ELI V8.0	2178	NCR
Thermometer	/	GX-138	150709653	2022.10.29
Thermometer	VICTOR	ITHX-SD-5	18470005	2022.10.29

Note:

1) Per KDB865664D01 v01r04 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.

a) There is no physical damage on the dipole;

b) System check with specific dipole is within 10% of calibrated value;

c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.

d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

2) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

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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, the extensive SAR measurement uncertainty analysis described in IEEE Std. 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

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6. Device Under Test (DUT) Information

6.1.DUT Description

EUT is a portable audio system. EUT supports IEEE802.11b/g/n/a/ac/ax, bluetooth	
EUT Dimension	Overall (Length x Width x Height): 222.6mm x 94 mm x 97.2mm

6.2.Wireless Technology

Wireless technology	Frequency band
bluetooth	2.4 GHz
Wi-Fi	2.4 GHz
Wi-Fi	5 GHz

6.3.Antenna Gain

Antenna type	Band	Gain(dBi)
BT Ant	2.4GHz	2.6
WiFi Ant 1	2.4GHz	2.91
	5 GHz	4.33
WiFi Ant 2	2.4GHz	2.36
	5 GHz	4.59

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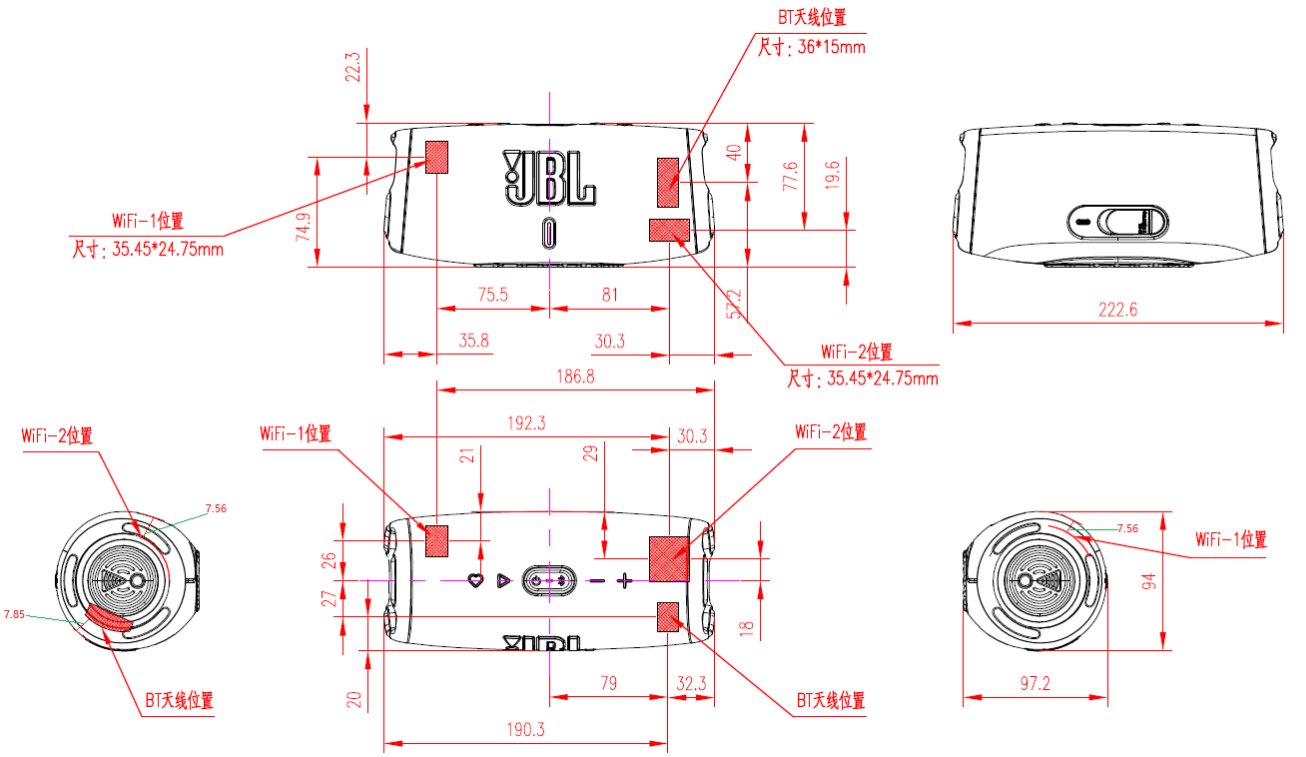
7. Evaluation scenario

Refer to the diagram inside the device which attached below for the specific details of the antenna-to-edges distances. As per KDB 941225 D06, when the antenna to-edge-distance is greater than 2.5 cm, SAR evaluation is not required for the corresponding position.

Antenna location diagram



	Test Position	antenna to-edge-distance	Test required
Wi-Fi Ant 1	Front Surface	>25mm	No
	Back Surface	<25mm	Yes
	Left Edge	>25mm	No
	Right Edge	>25mm	No
	Top Edge	<25mm	Yes
	Bottom Edge	>25mm	No

	Test Position	antenna to-edge-distance	Test required
Wi-Fi Ant 2	Front Surface	>25mm	No
	Back Surface	<25mm	Yes
	Left Edge	>25mm	No
	Right Edge	>25mm	No
	Top Edge	>25mm	No
	Bottom Edge	>25mm	No

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BT Ant	Test Position	antenna to-edge-distance	Test required
	Front Surface	<25mm	Yes
	Back Surface	>25mm	No
	Left Edge	>25mm	No
	Right Edge	>25mm	No
	Top Edge	>25mm	No
	Bottom Edge	>25mm	No

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8. Dielectric Property Measurements & System Check

8.1.Dielectric Property Measurements

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

Tissue Dielectric Parameters

FCC KDB 865664 D01 v01r04 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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013 Dielectric Property Measurements Results:

Liquid	Freq.	Liquid Parameters				Delta(%)		Limit (%)	Temp. (℃)	Test Date
		Measured		Target						
		ϵ_r	σ	ϵ_r	σ	ϵ_r	σ			
Head 2450	2402	39.52	1.82	39.29	1.76	0.59	3.41	±5	21.2	2022.8.31
	2412	39.48	1.79	39.27	1.77	0.53	1.13			
	2450	39.55	1.83	39.20	1.80	0.89	1.67			
	2462	39.25	1.85	39.18	1.81	0.18	2.21			
	2480	39.38	1.87	39.16	1.83	0.56	2.19			
Head 5250	5180	36.48	4.72	36.01	4.63	1.31	1.94	±5	21.2	2022.8.31
	5250	36.14	4.73	35.93	4.71	0.58	0.42			
Head 5600	5580	36.01	4.95	35.55	5.04	1.29	-1.79	±5	21.2	2022.8.31
	5600	35.98	4.93	35.30	5.07	1.93	-2.76			
Head 5750	5750	36.11	5.16	35.36	5.22	2.12	-1.15	±5	21.2	2022.8.31
	5825	36.15	5.15	35.27	5.30	2.50	-2.83			

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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 10mm (above 1GHZ) and 15mm (below 1GHz) from dipole center to the simulating liquid surface.
- For area scan, standard grid spacing for head measurements is 15 mm in x- and y- dimension(≤2GHz), 12 mm in x- and y-dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz).
- For zoom scan, Δ x_{zoom}, Δ y_{zoom}≤ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; Δ z_{zoom} ≤3GHz - ≤5 mm, 3-4 GHz- ≤4mm and 4-6GHz-≤2mm.
- Distance between probe sensors and phantom surface was set to 3 mm except for 5 GHz band. For 5GHz band, Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was set to 100 mW or 250 mW depend on the certificate of the dipoles.
- 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 10% of the manufacturer calibrated dipole SAR target.

T.S. Liquid		Measured Results		Target (Ref. value)	Delta (%)	Limit (%)	Temp. (℃)	Test Date
		Zoom Scan (W/Kg)	Normalize to 1W (W/Kg)					
Head 2450	1-g	13.900	55.60	53.20	4.51	±10	21.2	2022.8.31
	10-g	6.520	26.08	24.20	7.77	±10		
Head 5250	1-g	8.200	82.00	77.90	5.26	±10	21.5	2022.9.1
	10-g	2.360	23.60	22.60	4.42	±10		
Head 5600	1-g	8.700	87.00	80.90	7.54	±10	21.5	2022.9.1
	10-g	2.480	24.80	23.30	6.44	±10		
Head 5750	1-g	7.530	75.30	78.30	-3.83	±10	21.5	2022.9.1
	10-g	2.150	21.50	22.40	-4.02	±10		

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9. Measured and Reported (Scaled) SAR Results

As per KDB 447498 D01 sec.4.1.e), When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported.

Scaled SAR calculation formula:

Scaled SAR = Tune-up in mW / Conducted power in mW * (100 / Duty cycle (if available)) * SAR value

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

A）Per KDB447498 D01, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.

B）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.

Per KDB865664 D01 v01r04:

For each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤ 20%, and the measured SAR <1.45W/Kg, only one repeated measurement is required.

Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions /configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Note:
The same procedure is applied to extremity SAR evaluation, and the corresponding limitation is 2.5 times of 1-g SAR.

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10.Measured SAR Results

10.1.SAR Test Results of 2.4GHz Wi-Fi.

Test Position (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Cycle (%)	Scaled 1g (W/Kg)
			Tune-up	Meas.	1g (W/Kg)			
Ant 1								
Back Surface	11b	2462	16.00	15.78	0.088	0.01	99.64	0.093
Top edge	11b	2462	16.00	15.78	0.310	-0.03	99.64	0.327
Top edge	11b	2412	16.00	15.56	0.246	-0.06	99.64	0.273
Top edge	11b	2437	16.00	15.70	0.269	-0.03	99.64	0.289
Ant 2								
Back Surface	11b	2462	16.00	16.00	0.206	-0.09	99.64	0.207
Back Surface	11b	2412	16.00	15.88	0.197	0.04	99.64	0.203
Back Surface	11b	2437	16.00	15.98	0.260	-0.03	99.64	0.262

OFDM mode SAR evaluation exclusion analysis(Ant 1)

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11b	16.0	0.327	\	\
802.11g	14.5	\	0.231	Excluded
802.11n20	14.5	\	0.231	Excluded
802.11n40	12.0	\	0.130	Excluded
802.11ax20	14.0	\	0.206	Excluded
802.11ax40	14.5	\	0.231	Excluded
802.11ax20RU	11.5	\	0.116	Excluded
802.11ax40RU	11.5	\	0.116	Excluded

Note:
The adjusted SAR of other modes of 802.11 is less than 1.2w/kg, so the SAR test of other modes of 802.11 is not required.

OFDM mode SAR evaluation exclusion analysis(Ant 2)

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11b	16.0	0.262	\	\
802.11g	14.5	\	0.185	Excluded
802.11n20	14.5	\	0.185	Excluded
802.11n40	12.0	\	0.104	Excluded
802.11ax20	14.0	\	0.165	Excluded
802.11ax40	14.5	\	0.185	Excluded
802.11ax20RU	11.5	\	0.093	Excluded
802.11ax40RU	11.5	\	0.093	Excluded

Note:
The adjusted SAR of other modes of 802.11 is less than 1.2w/kg, so the SAR test of other modes of 802.11 is not required.

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10.2.SAR Test Results of 5GHz Wi-Fi.

Test Position (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Cycle (%)	Scaled 1g (W/Kg)
			Tune-up	Meas.	1-g(W/Kg)			
Ant 1								
U-NII-1								
Back Surface	11A	5200	15.00	14.32	0.079	0.10	97.90	0.094
Top edge	11A	5200	15.00	14.32	0.218	-0.04	97.90	0.260
U-NII-2C								
Back Surface	11A	5500	14.50	14.27	0.179	0.02	97.20	0.194
Top edge	11A	5500	14.50	14.27	0.377	-0.04	97.20	0.409
U-NII-3								
Back Surface	11N40	5755	15.00	14.25	0.016	0.02	89.74	0.021
Top edge	11N40	5755	15.00	14.25	0.288	-0.12	89.74	0.381
Ant 2								
U-NII-1								
Back Surface	11A	5180	15.00	14.99	0.648	-0.01	97.90	0.663
U-NII-2C								
Back Surface	11A	5580	14.50	14.03	0.623	0.00	97.20	0.714
U-NII-3								
Back Surface	11N40	5755	15.00	14.99	0.230	-0.04	89.74	0.257

Subsequent test configuration SAR evaluation exclusion analysis for U-NII-1 band（Ant 1）

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	15.0	0.260	\	\
802.11n20	13.5	\	0.184	Excluded
802.11n40	14.5	\	0.232	Excluded
802.11ac20	13.5	\	0.184	Excluded
802.11ac40	14.5	\	0.232	Excluded
802.11ax20	13.5	\	0.184	Excluded
802.11ax40	14.0	\	0.207	Excluded
802.11ac 80M	12.5	\	0.146	Excluded
802.11ax 80M	14.0		0.207	Excluded
802.11ax20RU	1.5	\	0.012	Excluded
802.11ax40RU	1.0	\	0.010	Excluded
802.11ax80RU	5.0	\	0.026	Excluded

Note:
The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration 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 test for the other 802.11 modes are not required.

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Subsequent test configuration SAR evaluation exclusion analysis for U-NII-2C band（Ant 1）

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	14.5	0.409	\	\
802.11n20	12.5	\	0.258	Excluded
802.11n40	14.0	\	0.365	Excluded
802.11ac20	12.5	\	0.258	Excluded
802.11ac40	14.0	\	0.365	Excluded
802.11ax20	13.0	\	0.290	Excluded
802.11ax40	13.0	\	0.290	Excluded
802.11ac 80M	12.5	\	0.258	Excluded
802.11ax 80M	13.5	\	0.325	Excluded
802.11ax20RU	1.5	\	0.020	Excluded
802.11ax40RU	1.0	\	0.018	Excluded
802.11ax80RU	5.0	\	0.046	Excluded

Note:
The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration 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 test for the other 802.11 modes are not required.

Subsequent test configuration SAR evaluation exclusion analysis for U-NII-3 band（Ant 1）

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11n40	15.0	0.381	\	\
11a	15.0	\	0.381	Excluded
11n20	12.0	\	0.191	Excluded
802.11ac20	12.0	\	0.191	Excluded
802.11ac40	15.0	\	0.381	Excluded
802.11ax20	12.5	\	0.214	Excluded
802.11ax40	13.0	\	0.240	Excluded
802.11ac 80M	13.0	\	0.240	Excluded
802.11ax 80M	12.0	\	0.191	Excluded
802.11ax20RU	1.5	\	0.017	Excluded
802.11ax40RU	1.0	\	0.015	Excluded
802.11ax80RU	5.0	\	0.038	Excluded

Note:
The 802.11n40 mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration 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 test for the other 802.11 modes are not required.

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Subsequent test configuration SAR evaluation exclusion analysis for U-NII-1 band（Ant 2）

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	15.0	0.663	\	\
802.11n20	13.5	\	0.469	Excluded
802.11n40	14.5	\	0.591	Excluded
802.11ac20	13.5	\	0.469	Excluded
802.11ac40	14.5	\	0.591	Excluded
802.11ax20	13.5	\	0.469	Excluded
802.11ax40	14.0	\	0.527	Excluded
802.11ac 80M	12.5	\	0.373	Excluded
802.11ax 80M	14.0		0.527	Excluded
802.11ax20RU	1.5	\	0.030	Excluded
802.11ax40RU	1.0	\	0.026	Excluded
802.11ax80RU	5.0	\	0.066	Excluded

Note:
The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration 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 test for the other 802.11 modes are not required.

Subsequent test configuration SAR evaluation exclusion analysis for U-NII-2C band（Ant 2）

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	14.5	0.714	\	\
802.11n20	12.5	\	0.451	Excluded
802.11n40	14.0	\	0.636	Excluded
802.11ac20	12.5	\	0.451	Excluded
802.11ac40	14.0	\	0.636	Excluded
802.11ax20	13.0	\	0.505	Excluded
802.11ax40	13.0	\	0.505	Excluded
802.11ac 80M	12.5	\	0.451	Excluded
802.11ax 80M	13.5	\	0.567	Excluded
802.11ax20RU	1.5	\	0.036	Excluded
802.11ax40RU	1.0	\	0.032	Excluded
802.11ax80RU	5.0	\	0.080	Excluded

Note:
The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration 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 test for the other 802.11 modes are not required.

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Subsequent test configuration SAR evaluation exclusion analysis for U-NII-3 band（Ant 2）

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11n40	15.0	0.257	\	\
11a	15.0	\	0.257	Excluded
11n20	12.0	\	0.129	Excluded
802.11ac20	12.0	\	0.129	Excluded
802.11ac40	15.0	\	0.257	Excluded
802.11ax20	12.5	\	0.145	Excluded
802.11ax40	13.0	\	0.162	Excluded
802.11ac 80M	13.0	\	0.162	Excluded
802.11ax 80M	12.0	\	0.129	Excluded
802.11ax20RU	1.5	\	0.011	Excluded
802.11ax40RU	1.0	\	0.010	Excluded
802.11ax80RU	5.0	\	0.026	Excluded

Note:
The 802.11n40 mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration 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 test for the other 802.11 modes are not required.

10.3.SAR Test Results of Bluetooth.

Test Position (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Cycle (%)	Scaled 1g (W/Kg)
			Tune-up	Meas.	1g (W/Kg)			
Front Surface	3DH5	2402	10.50	9.62	0.008	0.02	57.60	0.017
Front Surface	3DH5	2441	10.50	9.39	0.009	-0.11	57.60	0.020
Front Surface	3DH5	2480	10.50	9.55	0.011	0.11	57.60	0.024

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11.Multiple Transmission SAR Analysis

According to FCC OET KDB447498 D01, when the sum of 1g SAR for all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

11.1.Simultaneous Transmission combination.

NO.	Combination
1	Ant1 2.4g Wifi+ Ant2 2.4g Wifi+BT
2	Ant1 5g Wifi+ Ant2 5g Wifi+BT

Test Position	Highest Reported SAR(1g)(W/kg)				
	2.4G Wi-Fi Ant 1	2.4G Wi-Fi Ant 2	5G Wi-Fi Ant 1	5G Wi-Fi Ant 2	Bluetooth
Front surface	/	/	/	/	0.024
Back surface	0.091/0.093	0.308/0.262	0.206/0.194	0.716/0.714	/
Top Edge	0.325/0.327	/	0.434/0.409	/	/

Antenna placed vertical					
Test Position	Simultaneous Tx Antenna Combination(W/kg)			∑SAR 1g (W/kg)	Limit(W/kg)
	2.4 Wi-Fi Ant 1	2.4 Wi-Fi Ant 2	Bluetooth		
Front Surface	/	/	0.024	0.024	1.6
Test Position	Simultaneous Tx Antenna Combination(W/kg)			∑SAR 1g (W/kg)	Limit(W/kg)
	2.4 Wi-Fi Ant 1	2.4 Wi-Fi Ant 2	Bluetooth		
Back surface	0.093	0.262	/	0.355	1.6
Test Position	Simultaneous Tx Antenna Combination(W/kg)			∑SAR 1g (W/kg)	Limit(W/kg)
	2.4 Wi-Fi Ant 1	2.4 Wi-Fi Ant 2	Bluetooth		
Top edge	0.327	/	/	0.327	1.6

Antenna placed vertical					
Test Position	Simultaneous Tx Antenna Combination(W/kg)			∑SAR 1g (W/kg)	Limit(W/kg)
	5 Wi-Fi Ant 1	5 Wi-Fi Ant 2	Bluetooth		
Front Surface	/	/	0.024	0.024	1.6
Test Position	Simultaneous Tx Antenna Combination(W/kg)			∑SAR 1g (W/kg)	Limit(W/kg)
	5 Wi-Fi Ant 1	5 Wi-Fi Ant 2	Bluetooth		
Back surface	0.194	0.714	/	0.908	1.6
Test Position	Simultaneous Tx Antenna Combination(W/kg)			∑SAR 1g (W/kg)	Limit(W/kg)
	5 Wi-Fi Ant 1	5 Wi-Fi Ant 2	Bluetooth		
Top edge	0.409	/	/	0.409	1.6

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Appendixes

Refer to separated files for the following appendixes.

4790526351_FCC_SAR_2 App A conducted Power

4790526351_FCC_SAR_2 App B Photo

4790526351_FCC_SAR_2 App C System Check Plots

4790526351_FCC_SAR_2 App D Highest Test Plots

4790526351_FCC_SAR_2 App E Cal. Certificates

---------End of Report---------

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