SAR EVALUATION REPORT

IEEE Std 1528-2013
IEC/IEEE 62209-1528:2020

For
Sensor Device

FCC IDs: 2AJ2X-WG50
2AJ2X-WB50
2AJ2X-WD50

Model Names: WG50
WB50
WD50

Report Number: R14956064-S4
Issue Date: 2025-03-05

Prepared for
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ACCREDITED
CERT #0751.06

Revision History

Rev.	Date	Revisions	Revised By
V1	2024-11-08	Initial Issue	--
V2	2024-11-27	Added Accessory WD50 (FCC ID: 2AJ2X-WD50) to report. §1 – Simultaneous TX results updated to include WD50. Notes updated to include WD50. Updated Date Tested. Changed DXX to 8CC. §4.3 – Added System Check equipment (Keysight N1912A, 2x Keysight N1921A, Amplifier, Mini-Circuits Directional Coupler, DC Power Supply). Corrected D2450V2 calibration date. §6.1 – Added WD50 as an accessory. Added WD50 sample serial number and software version. §6.2 – Split table to clarify WG50, WB50, and WD50 wireless technologies. §7 – Added Device Configuration column. Added configurations “WG50 Tx with WD50 Mounted” and “WD50 Tx Mounted on WG50”. §8 – Added Dielectric Property Measurements and System Checks for measurements with WD50. §9 – Added WD50 to WPT note. §10 – Added WG50 BLE measurements with WD50 mounted and WD50 WPT measurements mounted on WG50. Split out tables by Device Configuration for clarity. §12 – Added WG50 with WD50 simultaneous transmission condition and Sum of SAR. Changed DXX to 8CC. Appendix A – Added setup photo of WG50 with WD50. Added photos of WD50 accessories. Appendix C – Added highest test plots for “WG50 Tx with WD50 Mounted” and “WD50 Tx Mounted on WG50” device configurations.	Sarah Kuhaneck
V3	2025-02-19	Added FCC IDs 2AJ2X-WB50 and 2AJ2X-WD50 and Model Names WB50 and WD50 to cover page and §1	Sarah Kuhaneck
V4	2025-03-05	Corrected BLE equipment class to DTS. Corrected BLE tune-up to match Operational Description. Updated BLE tune-up and scaled values in §9, 10, and 11.	Lindsay Ryan

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1. Attestation of Test Results

Applicant Name		WHOOP, Inc.	
FCC ID		2AJ2X-WG50, 2AJ2X-WB50, and 2AJ2X-WD50	
Model Name		WG50, WB50, and WD50	
Applicable Standards		Published RF exposure KDB procedures. IEEE Std 1528-2013 IEC/IEEE 62209-1528:2020	
Exposure Category		SAR Limits (W/Kg)	
		Extremities (hands, wrists, ankles, etc.) (10g of tissue)	
General population / Uncontrolled exposure		4	
RF Exposure Conditions		Equipment Class - Highest Reported SAR (W/kg)	
		DTS	DXX[1]
Extremity		0.033	N/A
Simultaneous TX		0.033	0.033
Simultaneous Tx	WG50 + WB50[2]	0.032	0.032
	WG50 + WD50[3]	0.033	0.033
Date Tested		2024-10-24 to 2024-11-13	
Test Results		Pass	

Note: This report includes Simultaneous Transmission analysis with the WPT charger accessories model WB50 (FCC ID: 2AJ2X-WB50) and model WD50 (FCC ID: 2AJ2X-WD50). Model WB50's standalone SAR assessment is covered by UL Report R14956064-S1. Model WD50 requires no standalone SAR assessment.

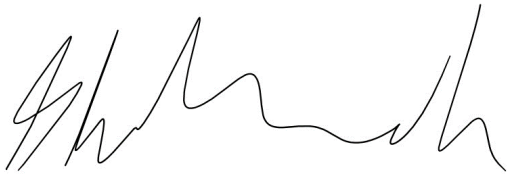
1. DXX (WPT) is only supported on models WB50 (FCC ID: 2AJ2X-WB50) and WD50 (FCC ID: 2AJ2X-WD50). It is included here for Simultaneous Transmission analysis only.
2. For a more accurate simultaneous transmission scenario of the WG50 + WB50 system, only the Device Configurations "WG50 Tx with WB50 Mounted" and "WB50 Tx Mounted on WG50" are considered.
3. For a more accurate simultaneous transmission scenario of the WG50 + WD50 system, only the Device Configurations "WG50 Tx with WD50 Mounted" and "WD50 Tx Mounted on WG50" are considered

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 can demonstrate 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 ensure 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 considered unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are 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:
	
Richard Jankovics Staff Engineer UL LLC	Sarah Kuhaneck Engineer Project Associate 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, IEC.IEEE 62209-1528:2020, and the following FCC Published RF exposure KDB procedures:

- 447498 D01 General RF Exposure Guidance v06
- 447498 D03 Supplement C Cross-Reference v01
- 680106 D01 RF Exposure Wireless Charging Apps v03r01
- 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 (DUT Holder Perturbations)
- TCB Workshop April 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))

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.

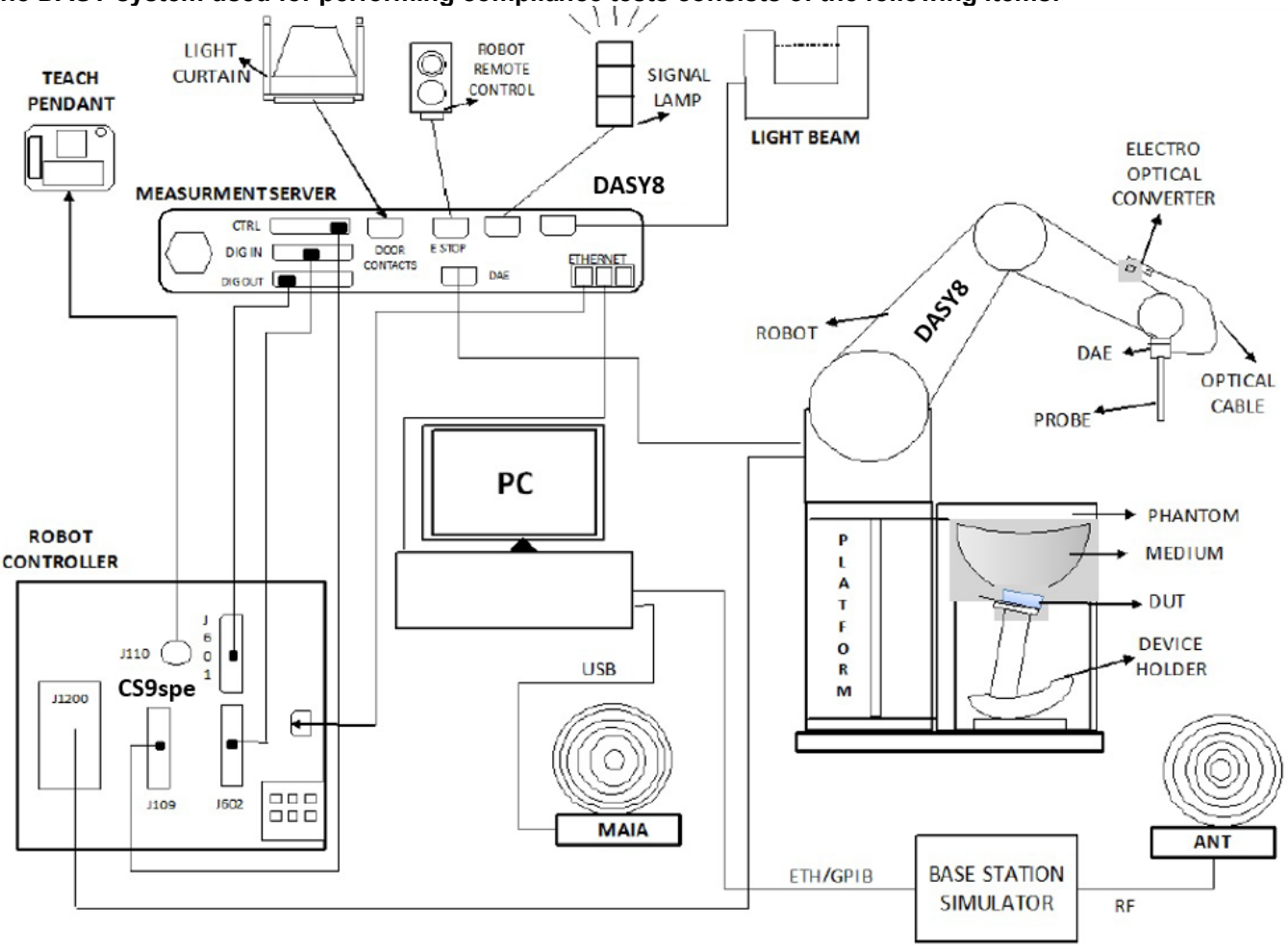
- SAR Lab 1A
- SAR Lab 2A

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
☒	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 DASY8[1] 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: DASY16.4.0.5005 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	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	≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$	
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 *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.

4.3. 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. Date	Cal. Due Date
Network Analyzer	Keysight	E5063A	MY54100681	2024-07-31	2025-07-31
Vector Reflectometer	Copper Mountain Technologies	R140	190514	2024-04-05	2025-04-05
Dielectric Probe	SPEAG	DAKS-3.5	1147	2024-03-11	2025-03-11
Shorting Block	SPEAG	DAK-3.5 Short	SM DAK 200 DB	2024-03-11	2025-03-11
Dielectric Probe	SPEAG	DAKS-12	1037	2024-03-11	2025-03-11
Shorting Block	SPEAG	DAK-12 Short	2044	2024-03-11	2025-03-11
Thermometer	Fisher Scientific	15-078-181	181705017	2023-03-30	2025-03-30

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Date	Cal. Due Date
Signal Generator	Keysight	N5181A	MY50140788	2024-08-01	2025-08-01
3-Path Diode Power Sensor	Rohde & Schwarz	NRP8S	112236	2024-07-12	2025-07-12
3-Path Diode Power Sensor	Rohde & Schwarz	NRP8S	112237	2024-07-12	2025-07-12
RF Power Meter	Keysight	N1912A	MY55136012	2024-08-02	2025-08-02
RF Power Sensor	Keysight	N1921A	MY55090025	2024-08-16	2025-08-16
RF Power Sensor	Keysight	N1921A	MY55090030	2024-07-09	2025-07-09
Amplifier	Mini-Circuits	ZVA-183WA-S+	S C484802241	N/A	N/A
Directional Coupler	Mini-Circuits	ZUDC10-183+	2214	N/A	N/A
Dual Directional Coupler	Werlatone	C5100-10	92249	N/A	N/A
DC Power Supply	Miteq	PS 15V1	1990186	N/A	N/A
RF Power Source	Speag	PowerSource1	4278	2024-06-17	2025-06-17

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Date	Cal. Due Date
E-Field Probe	SPEAG	EX3DV4	7710	2024-01-16	2025-01-16
E-Field Probe	SPEAG	EX3DV4	7711	2024-03-15	2025-03-15
Data Acquisition Electronics	SPEAG	DAE4	1715	2024-02-12	2025-02-12
Data Acquisition Electronics	SPEAG	DAE4	1716	2024-03-13	2025-03-13
System Validation Dipole	SPEAG	CLA13	1017	2024-03-07	2025-03-07
System Validation Dipole	SPEAG	D2450V2	963	2024-10-11	2025-10-11
Environmental Indicator	Fisher Scientific	Traceable	240072452	2024-01-24	2026-01-24
Environmental Indicator	Fisher Scientific	Traceable	240072459	2024-01-24	2026-01-24

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Date	Cal. Due Date
3-Path Diode Power Sensor	Rohde & Schwarz	NRP8S	112236	2024-07-12	2025-07-12
3-Path Diode Power Sensor	Rohde & Schwarz	NRP8S	112237	2024-07-12	2025-07-12

5. Measurement Uncertainty

Per KDB 865664 D01, 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.

Therefore, the measurement uncertainty is not required.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Overall (Length x Width x Thickness): 38.87 mm x 27.85 mm x 12.03 mm Overall Diagonal: 47.82 mm This is a wrist-worn device
Back Cover	The Back Cover is not removable
Battery Options	The rechargeable battery is not user accessible.
Accessory	Chargers WB50 and WD50
Test sample information	**S/N** — **Notes** 5AGE004701 — WG50 BLE Conducted 5AGE005715 — WG50 BLE Radiated 5AGE005972 — WG50 Load for WB50 WPT B5APD001494 — WB50 BLE Radiated and WPT D5ZPE200050 — WD50 WPT
Hardware Version	A
Software Version	WG50 BLE: 50.25.0.1 WG50 WPT Load: 50.20.1.0 WB50: 3.15.1.0 WD50: 23.19.1.0

6.2. Wireless Technologies

WG50

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
Bluetooth	2.4 GHz	LE	100%[1]
WPT	13.56 MHz	Load only	N/A

Notes:

1. Duty Cycle referenced from §9.

WB50

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
Bluetooth	2.4 GHz	LE	100%[1]
WPT	13.56 MHz	N/A	100%

Notes:

1. Duty Cycle referenced from R-14956064-S1 §9.

WD50

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
WPT	13.56 MHz	N/A	100%

7. RF Exposure Conditions (Test Configurations)

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Device Configuration	Test Position	Antenna To Surface Separation	SAR Required	Note
Bluetooth	Extremity (Wrist)	0	WG50 Standalone	Back	N/A	Yes	
			WG50 Tx with WB50 Mounted	Back	N/A	Yes	
			WB50 Tx Mounted on WG50	Back	N/A	Yes	
			WG50 Tx With WD50 Mounted	Back	N/A	Yes	
WPT	Extremity (Wrist)	0	WB50 Tx Mounted on WG50	Back	N/A	Yes	1
			WD50 Tx Mounted on WG50	Back	N/A	Yes	1
Note 1: WPT is only supported on models WB50 (FCC ID: 2AJ2X-WB50) and WD50 (FCC ID: 2AJ2X-WD50). It is included here for Simultaneous Transmission analysis only.							

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.

The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEC/IEEE 62209-1528:2020, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

IEC/IEEE 62209-1528:2020

Table 2 – Dielectric properties of the tissue-equivalent medium

Frequency MHz	Real part of the complex relative permittivity, ε_r'	Conductivity, σ S/m	Penetration depth (E-field), δ mm
4	*55,0*	*0,75*	293,0
13	*55,0*	*0,75*	165,5
30	55,0	0,75	112,8
150	52,3	0,76	62,0
300	45,3	0,87	46,1
450	43,5	0,87	43,0
750	*41,9*	*0,89*	39,8
835	41,5	0,90	39,0
900	41,5	0,97	36,2
1 450	40,5	1,20	28,6
1 800	40,0	1,40	24,3
1 900	40,0	1,40	24,3
1 950	40,0	1,40	24,3
2 000	40,0	1,40	24,3
2 100	*39,8*	*1,49*	22,8
2 450	39,2	1,80	18,7
2 600	*39,0*	*1,96*	17,2
3 000	38,5	2,40	14,0
3 500	*37,9*	*2,91*	11,4
4 000	*37,4*	*3,43*	10,0
4 500	*36,8*	*3,94*	9,7
5 000	*36,2*	*4,45*	1,5
5 200	*36,0*	*4,66*	8,4
5 400	*35,8*	*4,86*	8,1
5 600	*35,5*	*5,07*	7,5
5 800	35,3	5,27	7,3
6 000	*35,1*	*5,48*	7,0
6 500	*34,5*	*6,07*	6,7
7 000	*33,9*	*6,65*	6,4
7 500	*33,3*	*7,24*	6,1
8 000	*32,7*	*7,84*	5,9
8 500	*32,1*	*8,46*	5,3
9 000	*31,6*	*9,08*	4,8
9 500	*31,0*	*9,71*	4,4
10 000	*30,4*	*10,40*	4,0

NOTE For convenience, permittivity and conductivity values are linearly interpolated for frequencies that are not a part of the original data from Drossos et al. [2]. They are shown in italics in Table 2. The italicized values are linearly interpolated (below 5800 MHz) or extrapolated (above 5800 MHz) from the non-italicized values that are immediately above and below these values.

Dielectric Property Measurements Results:

SAR Lab	Date	Tissue Type	Band (MHz)	Freq. (MHz)	Relative Permittivity (εr)			Conductivity (σ)		
					Measured	Target	Delta	Measured	Target	Delta
SAR 1A	2024-10-29	Head	13	13	53.8	55.0	-2.11%	0.73	0.75	-2.31%
				12	53.8	55.0	-2.11%	0.73	0.75	-2.32%
				14	53.8	55.0	-2.11%	0.73	0.75	-2.29%
SAR 1A	2024-11-12	Head	13	13	53.4	55.0	-2.85%	0.73	0.75	-2.85%
				12	53.4	55.0	-2.93%	0.73	0.75	-2.87%
				14	53.4	55.0	-2.87%	0.73	0.75	-2.84%
SAR 2A	2024-10-24	Head	2450	2450	39.6	39.2	0.89%	1.80	1.80	-0.06%
				2400	39.6	39.3	0.87%	1.76	1.75	0.25%
				2500	39.5	39.1	0.80%	1.83	1.85	-1.14%
SAR 2A	2024-10-28	Head	2450	2450	40.2	39.2	2.63%	1.75	1.80	-2.67%
				2400	40.3	39.3	2.60%	1.71	1.75	-2.15%
				2500	40.2	39.1	2.61%	1.79	1.85	-3.40%
SAR 2A	2024-11-11	Head	2450	2450	40.6	39.2	3.47%	1.77	1.80	-1.61%
				2400	40.6	39.3	3.37%	1.73	1.75	-1.29%
				2500	40.5	39.1	3.43%	1.81	1.85	-2.48%

8.2. System Check

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

System Performance Check Measurement Conditions:

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

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. Refer to Appendix B for the SAR System Check Plots.

SAR Lab	Date	Dipole Type & Serial Number	Dipole Cal. Due Date	Input Power (dBm)	Measured results for 1-g SAR				Measured results for 10-g SAR				Plot No.
					Meas. Zoom Scan	Normalize to 1 W	Target (Ref. Value)	Delta ±10%	Meas. Zoom Scan	Normalize to 1 W	Target (Ref. Value)	Delta ±10%	
SAR 1A	2024-10-29	CLA13 SN: 1017	2025-03-07	16.0	0.020	0.502	0.551	-8.82%	0.013	0.327	0.344	-5.07%	1
SAR 1A	2024-11-12	CLA13 SN: 1017	2025-03-07	16.0	0.021	0.527	0.551	-4.27%	0.013	0.327	0.344	-5.07%	-
SAR 2A	2024-10-24	D2450V2 SN: 963	2025-10-11	17.0	2.430	48.485	52.600	-7.82%	1.140	22.746	24.400	-6.78%	-
SAR 2A	2024-10-28	D2450V2 SN: 963	2025-10-11	17.0	2.387	47.627	52.600	-9.45%	1.120	22.347	24.400	-8.41%	2
SAR 2A	2024-11-11	D2450V2 SN: 963	2025-10-11	17.0	2.480	49.483	52.600	-5.93%	1.170	23.345	24.400	-4.33%	-

9. Conducted Output Power Measurements

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

9.1. Bluetooth

Maximum Output Power (Tune-up Limit) for Bluetooth

Band	Mode	Dat Rate	Channel	Frequency (MHz)	Tune-up PowerLimit (dBm)
					BLE Main Antenna
Bluetooth 2.4 GHz WG50	LE	1 Mbps / 2Mbps	37	2402	4.11
			17	2440	4.11
			39	2480	4.11
Bluetooth 2.4 GHz WB50	LE	1 Mbps / 2Mbps	37	2402	8.04
			17	2440	8.04
			39	2480	8.04

WG50 Bluetooth Measured Results

Band	Mode	Ch #	Freq. (MHz)	Chain 0 Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)
Bluetooth 2.4 GHz	LE GFSK 1 Mbps	37	2402	3.6	4.11	Yes
		17	2440	3.4	4.11	
		39	2480	3.2	4.11	

Note: Model WB50 (FCC ID: 2AJ2X-WB50) is covered by UL Report R14956064-S1. Output power data used for scaling purposes in §10.1 is referenced from R14956064-S1 §9.1.

Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
GFSK	DH5	100	100	100.00%	1.00

Note(s):

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

Duty Cycle plots

LE, GFSK, 1 Mbps

9.2. WPT

WPT is only supported on models WB50 (FCC ID: 2AJ2X-WB50) and WD50 (FCC ID: 2AJ2X-WD50). It is included here for Simultaneous Transmission analysis only. Refer to UL Report R14956064-S1 for Conducted Output Power data for model WB50.

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

- Reported SAR(W/kg) for Bluetooth and WPT = 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

10.1. Bluetooth

WG50 Standalone

RF Exposure Conditions	Mode	Device Configuration	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		10-g SAR (W/kg)		Plot No.
								Tune-up Limit	Meas.	Meas.	Scaled	
Extremity	LE GFSK 1 Mbps	WG50 Standalone	0	Back	17	2440	100%	4.11	3.4	0.028	**0.033**	1

WG50 with WB50

RF Exposure Conditions	Mode	Device Configuration	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		10-g SAR (W/kg)		Plot No.
								Tune-up Limit	Meas.	Meas.	Scaled	
Extremity	LE GFSK 1 Mbps	WG50 Tx with WB50 Mounted	0	Back	17	2440	100%	4.11	3.4	0.022	0.026	2
Extremity	LE GFSK 1 Mbps	WB50 Tx Mounted on WG50	0	Back	17	2440	100%	8.04	7.8	0.004	0.004	3

Note: Model WB50 (FCC ID: 2AJ2X-WB50) is covered by UL Report R14956064-S1. Output power data used for scaling purposes is referenced from R14956064-S1 §9.1.

WG50 with WD50

RF Exposure Conditions	Mode	Device Configuration	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		10-g SAR (W/kg)		Plot No.
								Tune-up Limit	Meas.	Meas.	Scaled	
Extremity	LE GFSK 1 Mbps	WG50 Tx with WD50 Mounted	0	Back	17	2440	100%	4.11	3.4	0.026	0.031	4

10.2. WPT

WG50 with WB50

RF Exposure Conditions	Mode	Device Configuration	Dist. (mm)	Test Position	Freq. (MHz)	Duty Cycle	Tolerance Scaling Factor (dBm)	10-g SAR (W/kg)		Plot No.
								Meas.	Scaled	
Extremity	WPT	WB50 Tx Mounted on WG50	0	Back	13.56	100%	2.0	0.000	0.000	5

Note: Conducted output power cannot be measured for WPT, therefore a 2 dB scaling factor shall be used to account for potential variations between samples. WPT is only supported on Model WB50 (FCC ID: 2AJ2X-WB50). It is included here for Simultaneous Transmission analysis only.

WG50 with WD50

RF Exposure Conditions	Mode	Device Configuration	Dist. (mm)	Test Position	Freq. (MHz)	Duty Cycle	Tolerance Scaling Factor (dBm)	10-g SAR (W/kg)		Plot No.
								Meas.	Scaled	
Extremity	WPT	WD50 Tx Mounted on WG50	0	Back	13.56	100%	2.0	0.000	0.000	6

Note: Conducted output power cannot be measured for WPT, therefore a 2 dB scaling factor shall be used to account for potential variations between samples. WPT is only supported on Model WD50 (FCC ID: 2AJ2X-WD50). It is included here for Simultaneous Transmission analysis only.

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.

Note(s):

Repeated measurement is not required since the original highest measured SAR is < 2 W/kg (10-g).

12. Simultaneous Transmission Conditions

RF Exposure Condition	Item	Capable Transmit Configurations				
Extremity	1*	DTS (WG50)	+	DTS (WB50)	+	DXX (WB50)
	2**	DTS (WG50)	+	DXX (WD50)		

Notes:
***** For a more accurate simultaneous transmission scenario of the WG50 + WB50 system, only the Device Configurations "WG50 Tx with WB50 Mounted" and "WB50 Tx Mounted on WG50" are considered.
** For a more accurate simultaneous transmission scenario of thw WG50 + WD50 system, only the Device Configurations "WG50 Tx with WD50 Mounted" and "WD50 Mounted on WG50" are considered.

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.

12.2. Sum of the SAR for BLE & WPT (WG50 with WB50)

RF Exposure conditions	Test Position	Standalone SAR (W/kg)			∑ 10-g SAR (W/kg)
		1	2	3	1+2+3
		BLE WG50	BLE WB50	WPT WB50 + WG50	
Extremity	Back	0.026	0.004	0.000	0.030

12.3. Sum of the SAR for BLE & WPT (WG50 with WD50)

RF Exposure conditions	Test Position	Standalone SAR (W/kg)		∑ 10-g SAR (W/kg)
		1	2	1+2
		BLE WG50	WPT WD50 + WG50	
Extremity	Back	0.033	0.000	**0.033**

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

END OF REPORT