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SAR EVALUATION REPORT

Applicant Name:
Sound Devices LLC
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Date of Testing:
09/15/23 – 09/20/23; 02/05/24
Test Site/Location:
Element Washington DC LLC,
Columbia, MD, USA
FCC Test Site: US1113
Document Serial No.:
1M2308290098-01-R1.2AKLX

FCC ID: **2AKLX-9808**

APPLICANT: **SOUND DEVICES, LLC**

DUT Type: Portable Wireless Microphone
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): A20-TX (9808)

Equipment Class	Band & Mode	Tx Frequency	SAR	
			1g Body-Worn (W/kg)	10g Extremity (W/kg)
TNT	Wireless Audio Antenna 8	169.0 - 216.0 MHz	< 0.1	< 0.1
TNT	Wireless Audio Antenna 1	470.0 - 548.0 MHz	0.62	0.37
TNT	Wireless Audio Antenna 2	548.0 - 663.0 MHz	0.73	0.44
TNT	Wireless Audio Antenna 5	902.0 - 959.85 MHz	0.57	0.35
TNT	Wireless Audio Antenna 7	1435.0 - 1525.0 MHz	0.80	0.45
DSS	Nexlink	2400.8 - 2481.6 MHz	0.10	< 0.1
DTS	Bluetooth Low Energy	2402.0 - 2480.0 MHz	< 0.1	< 0.1
Simultaneous SAR per KDB 690783 D01v01r03:			0.90	0.49

Note: This revised Test Report (S/N:1M2308290098-01-R1.2AKLX) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in section 3.1 of this report for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

RJ Ortanez
Executive Vice President

The SAR Tick is an initiative of the Mobile & Wireless Forum (MWF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MWF. Further details can be obtained by emailing: sartick@mwfai.info.

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
Wireless Audio Bands	Proprietary digital Modulation (COFDM)	169.0 - 216.0 MHz
		470.0 - 548.0 MHz
		548.0 - 663.0 MHz
		902.0 - 959.85 MHz
		1435.0 - 1525.0 MHz
2.4GHz Nexlink	Proprietary LoRa Based FHSS protocol	2400.8 - 2481.6 MHz
Bluetooth Low Energy (BLE)	Data	2402.0 - 2480.0 MHz

The Wireless Microphone Transmitter is intended for professional “Programme Making and Special Events” (PMSE) applications. The portable battery-powered transmitter is designed to be worn on the body, e.g., placed in a pocket, attached to a belt, or concealed in costuming.

The DUT is tested using software provided by the manufacturer to activate a testing signal transmitting from the DUT without any other auxiliary needed. Test channels and maximum output power were set to the highest possible output power level.

The transmitter is supplied with a set of ¼-wave monopole whip antennas that attach to the transmitter via standard SMA connector. The antennas are pre-cut to specific lengths for use in several different wireless microphone frequency bands that span the range 169 MHz to 1525 MHz. A second connector is provided for connecting the microphone (Audio Input). At the base of the unit, there is a USB connector for *in situ* Li-Ion battery charging, audio recording file transfers, transmitter pairing (with compatible receiver), and firmware updates.

The transmitter includes two other radio technologies for remote control of transmitter settings: a proprietary long-range 2.4 GHz back-link (*NexLink*); and Bluetooth LE. An internal 2.4 GHz PCB chip antenna is located at the base of the transmitter.

Power is supplied from three AA size batteries; either standard 1.5V or 3.7V Li-Ion re-chargeable cells can be used.

1.2 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

1.2.1 Wireless Audio Bands

Antenna #	Frequency Range		Modulated Average Output Power (in dBm)
8	169 - 216 MHz	Max allowed power	14.0
		Nominal	13.0
1	470 - 548 MHz	Max allowed power	20.0
		Nominal	19.0
2	548 - 608 MHz	Max allowed power	20.0
		Nominal	19.0
	608 - 663 MHz	Max allowed power	11.0
		Nominal	10.0
5	902-959.85 MHz	Max allowed power	17.0
		Nominal	16.0
7	1435 - 1525 MHz	Max allowed power	17.0
		Nominal	16.0

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1.2.2 2.4 GHz NexLink FHSS Maximum Output Power

Frequency Range		Modulated Average Output Power (in dBm)
2400.8 - 2481.6MHz	Max allowed power	6.5
	Nominal	5.5

1.2.3 2.4 GHz Bluetooth Low Energy Maximum Output Power

Frequency Range		Modulated Average Output Power (in dBm)
2402 MHz – 2480 MHz	Max allowed power	4.5
	Nominal	3.5

1.3 DUT Antenna Locations

A diagram showing the location of the device antennas can be found in Appendix F.

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. **Table 1-1**
Device Edges/Sides for SAR testing

Device Sides/Edges for SAR Testing						
Antenna	Back	Front	Top	Bottom	Right	Left
Wireless Audio Band	Yes	Yes	Yes	No	Yes	Yes
Bluetooth LE	Yes	Yes	No	Yes	Yes	Yes
Nexlink	Yes	Yes	No	Yes	Yes	Yes

The DUT was tested on all sides where the antenna was within 25 mm of that side. All measurements were conducted with the side of the device in direct contact with the phantom and at maximum power.

1.4 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Body	Extremity
1	Wireless Audio Band + 2.4 GHz FHSS Nexlink	Yes	Yes
2	Wireless Audio Band + 2.4 GHz Bluetooth LE	Yes	Yes

1. 2.4 GHz FHSS NexLink and 2.4 GHz Bluetooth LE cannot transmit simultaneously.

1.5 Guidance Applied

- IEEE 1528:2013
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04 (SAR Measurement 100 MHz to 6 GHz)
- FCC KDB Publication 865664 D02 RF Exposure Reporting v01r02
- October 2016 TCB Workshop Notes (Bluetooth)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)

1.6 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 9.

2 INTRODUCTION

The FCC and Innovation, Science, and Economic Development Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1).

Equation 2-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

3 DOSIMETRIC ASSESSMENT

3.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

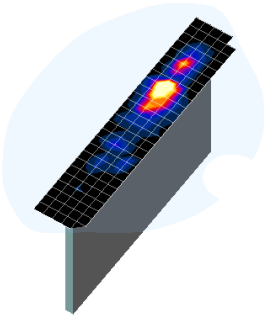

Figure 3-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 3-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 3-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 3-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 3-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*Δz_{zoom}(n-1)	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*Δz_{zoom}(n-1)	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*Δz_{zoom}(n-1)	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*Δz_{zoom}(n-1)	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*Δz_{zoom}(n-1)	≥ 22

*Also compliant to IEEE 1528-2013 Table 6

4 TEST CONFIGURATION POSITIONS

4.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02.
right while placed in this inclined position to the flat phantom.

4.1 Body-Worn Accessory Configurations

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented in section 9.2 of this report. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

Only one housing type is available for this model. However, a removeable belt clip is available from the manufacturer. Initial testing was completed without the belt clip attached to the device to ensure a conservative distance between the body of the phantom and the device as the belt clip increases distance between the body and the device. The worst-case measured SAR of the device was tested with the belt clip installed to show compliance for each mode and band.

4.2 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v06 should be applied to determine SAR test requirements.

4.3 SAR Test Positioning Based on Form Factor

This device has protruding battery door release buttons on the right and left side of the device. Two device orientations were considered to evaluate the right and left side for body-worn and extremity SAR based on possible usage conditions and worst-case exposure scenarios. For the ¼ wave monopole whip antennas the device was orientated toward the phantom with the top of the device tilted toward the phantom as this produces the most conservative measurement for these modes and bands. For the Bluetooth LE and 2.4 GHz NexLink antenna incorporated into the device. The bottom of the device was tilted towards the phantom as this produces the most conservative measurement for these modes and bands. For the ¼ wave monopole whip antenna #8 the antenna is 430 mm in length to simulate expected use cases the antenna was tapped to the bottom of the phantom as it is a likely use case when the device is concealed in clothing or a pocket. Please see Appendix F for photos of the device during testing.

5 RF EXPOSURE LIMITS

5.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 5-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

6 FCC MEASUREMENT PROCEDURES

6.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

7 RF CONDUCTED POWERS

7.1 Wireless Audio Band

Table 7-1
Wireless Audio Band Maximum Average RF Power

Operating Mode	Channel Bandwidth	Antenna	Frequency [MHz]	Avg Conducted Power [dBm]
Propiety Digital Modulation (COFDM)	200 kHz	Ant 8	169.10	13.02
			192.50	12.98
			215.90	12.76
		Ant 1	470.10	18.86
			509.00	18.95
			547.90	18.83
		Ant 2	548.10	18.68
			578.00	18.59
			607.90	18.58
			615.00	9.86
			655.00	9.98
			660.00	9.97
	520 kHz	Ant 5	902.40	15.86
			915.00	15.90
			927.60	15.89
	200 kHz		941.60	15.86
			951.90	15.85
			952.95	15.92
			953.10	15.92
			956.15	15.91
			956.55	15.83
			959.75	15.83
		Ant 7	1435.10	16.41
			1480.00	16.34
			1524.90	16.57

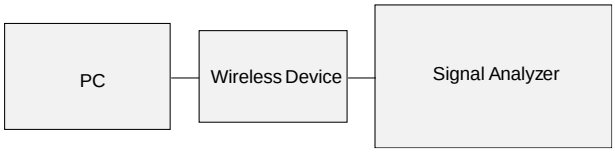

Figure 7-1
Power Measurement Setup

7.2 NexLink FHSS

Table 7-2
NexLink FHSS Maximum Average RF Power

Frequency [MHz]	Channel No.	Data Rate (kbps)	Avg Conducted Power [dBm]
2400.8	0	1.09	4.67
2440.8	100	1.09	5.51
2481.6	202	1.09	5.50

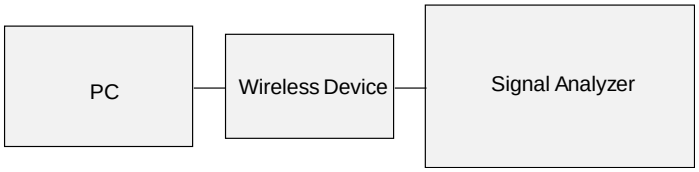

Figure 7-2
Power Measurement Setup

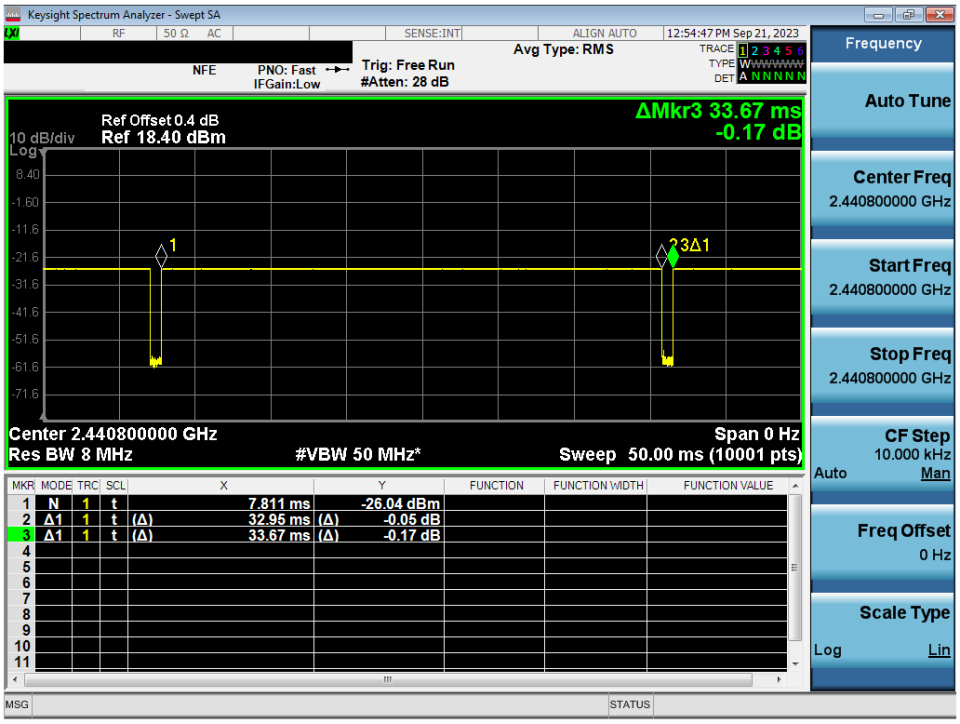

Figure 7-3
NexLink Transmission Plot

Equation 7-1
NexLink Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{32.95ms}{33.67\ ms} * 100\% = 97.86\%$$

7.3 Bluetooth Low Energy Conducted Powers

Table 7-3
Bluetooth Low Energy Maximum Average RF Power

Frequency [MHz]	Channel No.	Bluetooth Mode	Data Rate [Mbps]	Avg Conducted Power [dBm]
2402	0	LE	1	4.46
2440	19	LE	1	4.45
2480	39	LE	1	3.99

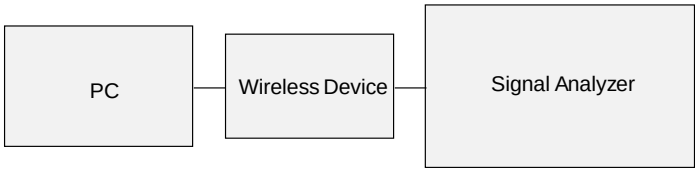

Figure 7-4
Power Measurement Setup

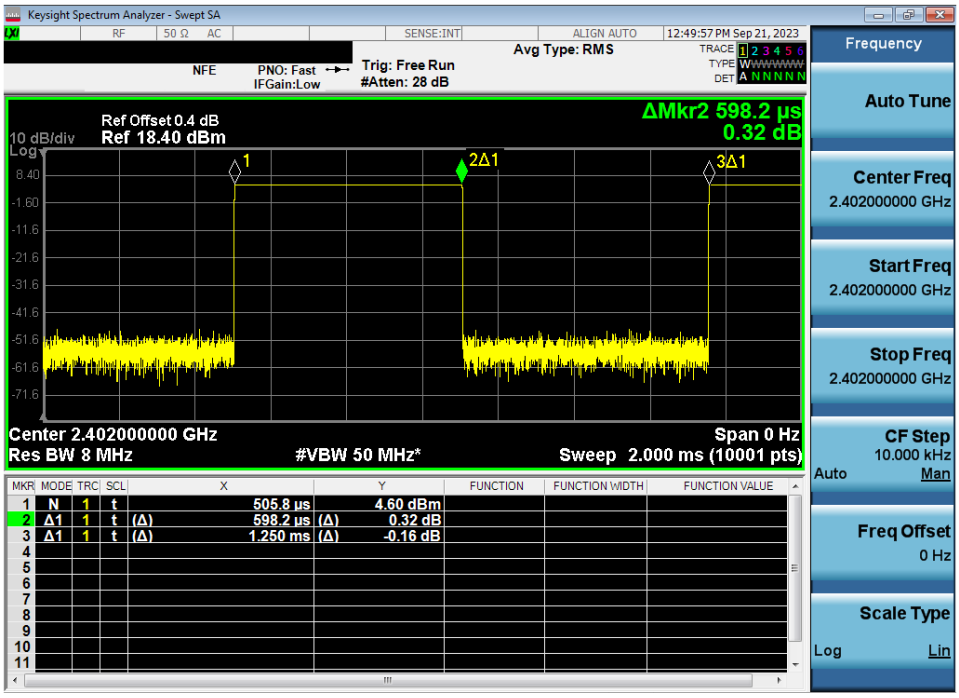

Figure 7-5
Bluetooth Transmission Plot

Equation 7-2
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{0.5892\ ms}{1.250\ ms} * 100\% = 47.86\%$$

8 SYSTEM VERIFICATION

8.1 Tissue Verification

Table 8-1
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (°C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
09/18/2023	150 Head	19.0	150	0.724	51.525	0.760	52.300	-4.75%	-1.48%
			175	0.746	50.212	0.778	51.133	-4.21%	-1.80%
			200	0.767	48.886	0.797	49.967	-3.69%	-2.16%
09/18/2023	300 Head	19.0	200	0.767	48.886	0.797	49.967	-3.69%	-2.16%
			220	0.785	47.880	0.811	49.033	-3.31%	-2.35%
			240	0.803	47.013	0.826	48.100	-2.78%	-2.26%
			260	0.822	46.166	0.841	47.167	-2.23%	-2.12%
			280	0.840	45.426	0.855	46.233	-1.84%	-1.75%
			300	0.856	44.719	0.870	45.300	-1.66%	-1.28%
09/19/2023	450 Head	24.9	450	0.835	43.742	0.870	43.500	-4.03%	0.56%
			500	0.850	43.538	0.873	43.233	-2.66%	0.70%
			550	0.865	43.294	0.877	42.967	-1.32%	0.76%
02/05/2024	450 Head	19.7	450	0.847	44.996	0.870	43.500	-2.64%	3.44%
			500	0.861	44.722	0.873	43.233	-1.37%	3.44%
			550	0.875	44.492	0.877	42.967	-0.23%	3.55%
09/19/2023	600 Head	24.9	550	0.865	43.294	0.877	42.967	-1.32%	0.76%
			600	0.881	43.133	0.880	42.700	0.10%	1.01%
			650	0.897	42.944	0.883	42.433	1.56%	1.20%
			700	0.912	42.819	0.887	42.167	2.84%	1.55%
02/05/2024	600 Head	19.7	550	0.875	44.492	0.877	42.967	-0.23%	3.55%
			600	0.890	44.262	0.880	42.700	1.14%	3.66%
			650	0.906	44.084	0.883	42.433	2.60%	3.89%
			700	0.921	43.910	0.887	42.167	3.83%	4.13%
09/18/2023	900 Head	20.0	880	0.922	41.780	0.950	41.500	-2.95%	0.67%
			900	0.930	41.737	0.970	41.500	-4.12%	0.57%
			915	0.936	41.710	0.980	41.500	-4.49%	0.51%
			920	0.938	41.698	0.982	41.491	-4.48%	0.50%
			950	0.950	41.606	0.991	41.413	-4.14%	0.47%
			1000	0.970	41.463	1.013	41.325	-4.24%	0.33%
			1050	0.990	41.347	1.034	41.238	-4.26%	0.26%
09/15/2023	1450 Head	20.4	1350	1.186	41.700	1.165	40.712	1.80%	2.43%
			1370	1.196	41.663	1.175	40.676	1.74%	2.43%
			1400	1.209	41.613	1.190	40.624	1.61%	2.44%
			1420	1.218	41.582	1.200	40.588	1.47%	2.45%
			1450	1.231	41.535	1.215	40.535	1.33%	2.47%
			1500	1.256	41.479	1.240	40.447	1.29%	2.55%
			1520	1.266	41.455	1.250	40.412	1.30%	2.58%
			1530	1.271	41.438	1.255	40.394	1.31%	2.58%
			1600	1.307	41.323	1.290	40.271	1.32%	2.61%
09/20/2023	2450 Head	21.8	2400	1.745	39.515	1.756	39.289	-0.63%	0.58%
			2450	1.782	39.419	1.800	39.200	-1.00%	0.56%
			2480	1.805	39.383	1.833	39.162	-1.53%	0.56%
			2500	1.819	39.365	1.855	39.136	-1.94%	0.59%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2. The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

8.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in the SAR System Validation Appendix E.

Table 8-2
System Verification Results

System Verification TARGET & MEASURED																	
SAR System	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp. (C)	Liquid Temp. (C)	Input Power (W)	Source SN	Probe SN	DAE	Measured SAR 1g (W/kg)	1W Target SAR 1g (W/kg)	1W Normalized SAR 1g (W/kg)	Deviation 1g (%)	Measured SAR 10g (W/kg)	1W Target SAR 10g (W/kg)	1W Normalized SAR 10g (W/kg)	Deviation 10g (%)
C	150	Head	09/18/2023	20.0	19.0	0.50	4022	3914	728	1.970	3.750	3.940	5.07%	1.290	2.470	2.580	4.45%
C	300	Head	09/18/2023	20.0	19.0	0.25	1025	3914	728	0.690	2.860	2.760	-3.50%	0.465	1.930	1.860	-3.63%
C	450	Head	09/19/2023	20.7	24.0	0.20	1104	3914	728	0.946	4.590	4.730	3.05%	0.641	3.100	3.205	3.39%
C	450	Head	02/05/2024	20.6	19.7	0.20	1104	3914	728	0.953	4.590	4.765	3.81%	0.650	3.100	3.250	4.84%
C	600	Head	09/19/2023	20.7	24.0	0.20	1013	3914	728	1.320	6.380	6.600	3.45%	0.880	4.200	4.400	4.76%
C	600	Head	02/05/2024	20.6	19.7	0.20	1013	3914	728	1.280	6.380	6.400	0.31%	0.864	4.200	4.320	2.86%
E	900	Head	09/18/2023	20.0	20.0	0.20	189	7406	1677	2.070	11.100	10.350	-6.76%	1.330	7.110	6.650	-6.47%
C	1450	Head	09/21/2023	22.0	21.4	0.10	1025	3914	728	3.110	29.200	31.100	6.51%	1.730	16.000	17.300	8.12%
C	2450	Head	09/20/2023	24.6	21.8	0.10	719	7661	728	5.720	55.000	57.200	4.00%	2.660	25.700	26.600	3.50%

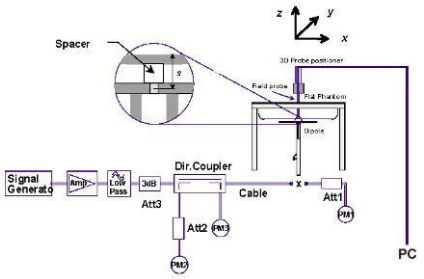

Figure 8-1
System Verification Setup Diagram

Figure 8-2
System Verification Setup Photo

9 SAR DATA SUMMARY

9.1 Standalone Body-Worn/Extremity SAR Data

Table 9-1
Wireless Audio Antenna 8 Body-Worn/Extremity SAR

MEASUREMENT RESULTS																		
FREQUENCY		Side	Spacing	Antenna Config.	Accesory	Device Serial Number	Modulation Bandwidth [KHz]	Modulation	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Duty Cycle (%)	SAR (1g)	Scaling Factor	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
Ch.													(W/kg)		(W/kg)	(W/kg)	(W/kg)	
169.10	Low	back	0 mm	8	None	37028	200	COFDM	14.0	13.02	-0.02	100	0.043	1.253	0.054	0.017	0.021	
169.10	Low	front	0 mm	8	None	37028	200	COFDM	14.0	13.02	0.02	100	0.036	1.253	0.045	0.019	0.024	
169.10	Low	top	0 mm	8	None	37028	200	COFDM	14.0	13.02	-0.04	100	0.017	1.253	0.021	0.006	0.008	
169.10	Low	right	0 mm	8	None	37028	200	COFDM	14.0	13.02	0.01	100	0.045	1.253	0.056	0.016	0.020	
169.10	Low	left	0 mm	8	None	37028	200	COFDM	14.0	13.02	0.01	100	0.053	1.253	0.066	0.020	0.025	A1
169.10	Low	left	0 mm	8	Belt Clip	37028	200	COFDM	14.0	13.02	-0.03	100	0.052	1.253	0.065	0.017	0.021	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body/Extremity 1.6 W/kg (mW/g), 4.0 W/kg (mW/g) averaged over 1 gram/ 10 gram								

Note: 1) Light green entries indicate an additional check on the worst-case exposure condition for body-worn accessory.

Table 9-2
Wireless Audio Antenna 1 Body-Worn/Extremity SAR

MEASUREMENT RESULTS																		
FREQUENCY		Side	Spacing	Antenna Config.	Accessory	Device Serial Number	Modulation Bandwidth [KHz]	Modulation	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Duty Cycle (%)	SAR (1g)	Scaling Factor	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz													(W/kg)		(W/kg)	(W/kg)	(W/kg)	
509.00	Mid	back	0 mm	1	None	37028	200	COFDM	20.0	18.95	0.01	100	0.409	1.274	0.521	0.255	0.325	
509.00	Mid	front	0 mm	1	None	37028	200	COFDM	20.0	18.95	-0.03	100	0.378	1.274	0.482	0.242	0.308	
509.00	Mid	top	0 mm	1	None	37028	200	COFDM	20.0	18.95	-0.16	100	0.095	1.274	0.121	0.023	0.029	
509.00	Mid	right	0 mm	1	None	37028	200	COFDM	20.0	18.95	0.01	100	0.162	1.274	0.206	0.076	0.097	
470.10	Low	left	0 mm	1	None	37028	200	COFDM	20.0	18.86	0.10	100	0.464	1.300	0.603	0.280	0.364	
509.00	Mid	left	0 mm	1	None	37028	200	COFDM	20.0	18.95	-0.01	100	0.486	1.274	0.619	0.289	0.368	A2
509.00	Mid	left	0 mm	1	Belt Clip	37028	200	COFDM	20.0	18.95	-0.03	100	0.385	1.274	0.490	0.251	0.320	
547.90	High	left	0 mm	1	None	37028	200	COFDM	20.0	18.83	0.01	100	0.399	1.309	0.522	0.235	0.308	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body/Extremity 1.6 W/kg (mW/g), 4.0 W/kg (mW/g) averaged over 1 gram/ 10 gram								

Note: 1) Light green entries indicate an additional check on the worst-case exposure condition for body-worn accessory.

Table 9-3
Wireless Audio Antenna 2 Body-Worn/Extremity SAR

MEASUREMENT RESULTS																		
FREQUENCY		Side	Spacing	Antenna Config.	Accessory	Device Serial Number	Modulation Bandwidth [KHz]	Modulation	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Duty Cycle (%)	SAR (1g)	Scaling Factor	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz													(W/kg)		(W/kg)	(W/kg)	(W/kg)	
655.00	Mid	back	0 mm	2	None	37028	200	COFDM	11.0	9.98	-0.08	100	0.051	1.265	0.065	0.031	0.039	
655.00	Mid	front	0 mm	2	None	37028	200	COFDM	11.0	9.98	0.02	100	0.042	1.265	0.053	0.025	0.032	
655.00	Mid	top	0 mm	2	None	37028	200	COFDM	11.0	9.98	-0.07	100	0.016	1.265	0.020	0.003	0.004	
655.00	Mid	right	0 mm	2	None	37028	200	COFDM	11.0	9.98	-0.01	100	0.023	1.265	0.029	0.010	0.013	
655.00	Mid	left	0 mm	2	None	37028	200	COFDM	11.0	9.98	-0.01	100	0.035	1.265	0.044	0.020	0.025	
548.10	Low	back	0 mm	2	None	37028	200	COFDM	20.0	18.68	0.00	100	0.542	1.355	0.734	0.328	0.444	A3
548.10	Low	back	0 mm	2	Belt Clip	37028	200	COFDM	20.0	18.68	-0.02	100	0.441	1.355	0.598	0.287	0.389	
548.10	Low	front	0 mm	2	None	37028	200	COFDM	20.0	18.68	-0.01	100	0.372	1.355	0.504	0.236	0.320	
548.10	Low	top	0 mm	2	None	37028	200	COFDM	20.0	18.68	-0.18	100	0.123	1.355	0.167	0.030	0.041	
548.10	Low	right	0 mm	2	None	37028	200	COFDM	20.0	18.68	0.12	100	0.140	1.355	0.190	0.075	0.102	
548.10	Low	left	0 mm	2	None	37028	200	COFDM	20.0	18.68	-0.11	100	0.326	1.355	0.442	0.189	0.256	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body/Extremity 1.6 W/kg (mW/g), 4.0 W/kg (mW/g) averaged over 1 gram/ 10 gram									

Note: 1) Light green entries indicate an additional check on the worst-case exposure condition for body-worn accessory.

Table 9-4
Wireless Audio Antenna 5 Body-Worn/Extremity SAR

MEASUREMENT RESULTS																		
FREQUENCY		Side	Spacing	Antenna Config.	Accessory	Device Serial Number	Modulation Bandwidth [KHz]	Modulation	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Duty Cycle (%)	SAR (1g)	Scaling Factor	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz													(W/kg)		(W/kg)	(W/kg)	(W/kg)	
915.00	Mid	back	0 mm	5	None	37026	520	COFDM	17.0	15.90	-0.03	100	0.441	1.288	0.568	0.268	0.345	A4
915.00	Mid	front	0 mm	5	None	37026	520	COFDM	17.0	15.90	-0.05	100	0.416	1.288	0.536	0.257	0.331	
915.00	Mid	top	0 mm	5	None	37026	520	COFDM	17.0	15.90	-0.04	100	0.053	1.288	0.068	0.014	0.018	
915.00	Mid	right	0 mm	5	None	37026	520	COFDM	17.0	15.90	0.11	100	0.070	1.288	0.090	0.045	0.058	
915.00	Mid	left	0 mm	5	None	37026	520	COFDM	17.0	15.90	-0.02	100	0.277	1.288	0.357	0.159	0.205	
953.10	Mid	back	0 mm	5	None	37026	200	COFDM	17.0	15.92	0.00	100	0.443	1.282	0.568	0.267	0.342	A5
953.10	Mid	back	0 mm	5	Belt Clip	37026	200	COFDM	17.0	15.92	-0.04	100	0.330	1.282	0.423	0.202	0.259	
953.10	Mid	front	0 mm	5	None	37026	200	COFDM	17.0	15.92	-0.02	100	0.412	1.282	0.528	0.252	0.323	
953.10	Mid	top	0 mm	5	None	37026	200	COFDM	17.0	15.92	-0.02	100	0.062	1.282	0.079	0.014	0.018	
953.10	Mid	right	0 mm	5	None	37026	200	COFDM	17.0	15.92	0.00	100	0.067	1.282	0.086	0.043	0.055	
953.10	Mid	left	0 mm	5	None	37026	200	COFDM	17.0	15.92	-0.13	100	0.305	1.282	0.391	0.183	0.235	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body/Extremity 1.6 W/kg (mW/g), 4.0 W/kg (mW/g) averaged over 1 gram/ 10 gram									

Note: 1) Light green entries indicate an additional check on the worst-case exposure condition for body-worn accessory.

Table 9-5
Wireless Audio Antenna 7 Body-Worn/Extremity SAR

MEASUREMENT RESULTS																		
FREQUENCY		Side	Spacing	Antenna Config.	Accessory	Device Serial Number	Modulation Bandwidth [KHz]	Modulation	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Duty Cycle (%)	SAR (1g)	Scaling Factor	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz													(W/kg)		(W/kg)	(W/kg)	(W/kg)	
1435.10	Low	back	0 mm	7	None	37028	200	COFDM	17.0	16.41	-0.01	100	0.615	1.146	0.705	0.337	0.386	
1480.00	Mid	back	0 mm	7	None	37028	200	COFDM	17.0	16.34	0.02	100	0.654	1.164	0.761	0.369	0.430	
1524.90	High	back	0 mm	7	None	37028	200	COFDM	17.0	16.57	0.03	100	0.722	1.104	**0.797**	0.406	**0.448**	A6
1524.90	High	back	0 mm	7	Belt Clip	37028	200	COFDM	17.0	16.57	-0.09	100	0.695	1.104	0.767	0.394	0.435	
1524.90	High	front	0 mm	7	None	37028	200	COFDM	17.0	16.57	0.14	100	0.516	1.104	0.570	0.297	0.328	
1524.90	High	top	0 mm	7	None	37028	200	COFDM	17.0	16.57	0.03	100	0.025	1.104	0.028	0.009	0.010	
1524.90	High	right	0 mm	7	None	37028	200	COFDM	17.0	16.57	0.14	100	0.019	1.104	0.021	0.010	0.011	
1524.90	High	left	0 mm	7	None	37028	200	COFDM	17.0	16.57	-0.02	100	0.611	1.104	0.675	0.341	0.376	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body/Extremity 1.6 W/kg (mW/g), 4.0 W/kg (mW/g) averaged over 1 gram/ 10 gram									

Note: 1) Light green entries indicate an additional check on the worst-case exposure condition for body-worn accessory.

Table 9-6
NexLink Body-Worn/Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Side	Spacing	Mode	Service	Accessory	Device Serial Number	Data Rate (Kbps)	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Maximum Duty Cycle (%)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.													(W/kg)			(W/kg)	(W/kg)	(W/kg)	
2440.80	100	back	0 mm	NexLink	FHSS	None	37028	1.09	6.5	5.51	-0.16	100.00	97.86	0.078	1.256	1.022	**0.100**	0.035	**0.045**	A7
2440.80	100	back	0 mm	NexLink	FHSS	Belt Clip	37028	1.09	6.5	5.51	-0.18	100.00	97.86	0.028	1.256	1.022	0.036	0.014	0.018	
2440.80	100	front	0 mm	NexLink	FHSS	None	37028	1.09	6.5	5.51	-0.06	100.00	97.86	0.041	1.256	1.022	0.053	0.017	0.022	
2440.80	100	bottom	0 mm	NexLink	FHSS	None	37028	1.09	6.5	5.51	-0.05	100.00	97.86	0.032	1.256	1.022	0.041	0.011	0.014	
2440.80	100	right	0 mm	NexLink	FHSS	None	37028	1.09	6.5	5.51	-0.09	100.00	97.86	0.019	1.256	1.022	0.024	0.008	0.010	
2440.80	100	left	0 mm	NexLink	FHSS	None	37028	1.09	6.5	5.51	0.01	100.00	97.86	0.008	1.256	1.022	0.010	0.004	0.005	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body/Extremity 1.6 W/kg (mW/g), 4.0 W/kg (mW/g) averaged over 1 gram/ 10 gram									

Note: 1) Light green entries indicate an additional check on the worst-case exposure condition for body-worn accessory.

Table 9-7
DSS Body-Worn/Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Side	Spacing	Mode	Service	Accessory	Device Serial Number	Data Rate (Mbps)	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Maximum Duty Cycle (%)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.													(W/kg)			(W/kg)	(W/kg)	(W/kg)	
2402.00	0	back	0 mm	Bluetooth LE	DSSS	None	37028	1	4.5	4.46	-0.13	100.00	47.86	0.038	1.009	2.089	**0.080**	0.016	**0.034**	A8
2402.00	0	back	0 mm	Bluetooth LE	DSSS	Belt Clip	37028	1	4.5	4.46	0.01	100.00	47.86	0.011	1.009	2.089	0.023	0.005	0.011	
2402.00	0	front	0 mm	Bluetooth LE	DSSS	None	37028	1	4.5	4.46	0.00	100.00	47.86	0.018	1.009	2.089	0.038	0.006	0.013	
2402.00	0	bottom	0 mm	Bluetooth LE	DSSS	None	37028	1	4.5	4.46	0.02	100.00	47.86	0.005	1.009	2.089	0.011	0.000	0.000	
2402.00	0	right	0 mm	Bluetooth LE	DSSS	None	37028	1	4.5	4.46	0.00	100.00	47.86	0.000	1.009	2.089	0.000	0.000	0.000	
2402.00	0	left	0 mm	Bluetooth LE	DSSS	None	37028	1	4.5	4.46	0.00	100.00	47.86	0.000	1.009	2.089	0.000	0.000	0.000	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body/Extremity 1.6 W/kg (mW/g), 4.0 W/kg (mW/g) averaged over 1 gram/ 10 gram									

Note: 1) Light green entries indicate an additional check on the worst-case exposure condition for body-worn accessory.

9.2 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical, and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. The device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 0 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance. A body-worn distance of 0 mm was also used for testing with the belt clip accessory for the worst-case of each mode/band.
7. Per FCC KDB Publication 865664 D01v01r04, variability SAR tests were not required since measured SAR results for all frequency bands were less than 0.8 W/kg. Please see Section 11 for variability analysis.
8. Unless otherwise noted, when 10g SAR measurement is considered, a factor of 2.5 is applied to the 1g thresholds for the equivalent test cases.
9. Per FCC KDB Publication 447498 D01v06, the metallic body-worn accessories (belt clip) was tested in conjunction with the host device to demonstrate compliance. The belt clip was evaluated as a body-worn accessory evaluated for 1 g body-worn and 10 g extremity SAR for the worst-case of each wireless technology and frequency band at 0 mm from the phantom.

Bluetooth Notes

1. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 100% transmission duty factor to determine compliance. See Section 7 for the time domain plot and calculation for the duty factor of the device.

10 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

10.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as Bluetooth devices which may simultaneously transmit with the licensed transmitter.

10.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg for 1 g SAR and ≤ 4.0 W/kg for 10 g SAR. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g or 10g SAR.

10.3 Body/Extremity SAR Simultaneous Transmission Analysis

Table 10-1
Simultaneous Transmission Scenario with 2.4 GHz NexLink Body-Worn

Configuration	Mode	SAR (W/kg)	2.4 GHz Nexlink (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn SAR	Wireless Audio Antenna 8	0.066	0.100	0.166
	Wireless Audio Antenna 1	0.619	0.100	0.719
	Wireless Audio Antenna 2	0.734	0.100	0.834
	Wireless Audio Antenna 5	0.568	0.100	0.668
	Wireless Audio Antenna 7	0.797	0.100	**0.897**

Table 10-2
Simultaneous Transmission Scenario with Bluetooth Low Energy Body-Worn

Configuration	Mode	SAR (W/kg)	2.4 GHz Bluetooth Low Energy SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn SAR	Wireless Audio Antenna 8	0.066	0.080	0.146
	Wireless Audio Antenna 1	0.619	0.080	0.699
	Wireless Audio Antenna 2	0.734	0.080	0.814
	Wireless Audio Antenna 5	0.568	0.080	0.648
	Wireless Audio Antenna 7	0.797	0.080	0.877

Table 10-3
Simultaneous Transmission Scenario with 2.4 GHz NexLink Extremity

Configuration	Mode	SAR (W/kg)	2.4 GHz Nexlink (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Extremity SAR	Wireless Audio Antenna 8	0.025	0.045	0.070
	Wireless Audio Antenna 1	0.368	0.045	0.413
	Wireless Audio Antenna 2	0.444	0.045	0.489
	Wireless Audio Antenna 5	0.345	0.045	0.390
	Wireless Audio Antenna 7	0.448	0.045	**0.493**

Table 10-4
Simultaneous Transmission Scenario with Bluetooth Low Energy Extremity

Configuration	Mode	SAR (W/kg)	2.4 GHz Bluetooth Low Energy SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Extremity SAR	Wireless Audio Antenna 8	0.025	0.034	0.059
	Wireless Audio Antenna 1	0.368	0.034	0.402
	Wireless Audio Antenna 2	0.444	0.034	0.478
	Wireless Audio Antenna 5	0.345	0.034	0.379
	Wireless Audio Antenna 7	0.448	0.034	0.482

10.4 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 .

11 SAR MEASUREMENT VARIABILITY

11.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, all measured 1 g SAR values were <0.8 W/kg and all measured 10 g SAR values were <2.0 W/kg. Therefore, no SAR measurement variability analysis was required.

11.2 Measurement Uncertainty

The measured 1 g SAR was <1.5 W/kg and measured 10 g SAR was <3.75 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

12 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4404B	Spectrum Analyzer	N/A	N/A	N/A	MY45113242
Agilent	N5182A	MXG Vector Signal Generator	11/30/2022	Annual	11/30/2023	MY47420603
Agilent	8753ES	S-Parameter Vector Network Analyzer	2/8/2023	Annual	2/8/2024	US39170122
Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Anritsu	MA2411B	Pulse Power Sensor	10/20/2022	Annual	10/20/2023	1339018
Mini-Circuits	PWR-4GHS	USB Power Sensor	11/11/2022	Annual	11/11/2023	11710030062
Control Company	6410	Platinum High-Accuracy Thermometer	10/31/2022	Biennial	10/31/2023	221844011
Control Company	6410	Platinum High-Accuracy Thermometer	10/31/2022	Biennial	10/31/2023	221855005
Control Company	4040	Therm./ Clock/ Humidity Monitor	3/27/2023	Biennial	3/27/2025	230208036
Mitutoyo	500-196-30	CD-6"ASX 6Inch Digital Caliper	2/16/2022	Triennial	2/16/2025	A20238413
Keysight Technologies	N6705B	DC Power Analyzer	5/5/2021	Triennial	5/5/2024	MY53004059
Keysight Technologies	N9020A	MXA Signal Analyzer	3/15/2023	Annual	3/15/2024	US46470561
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2050
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2111
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE5011-1	Torque Wrench	12/21/2021	Biennial	12/21/2023	82475
SPEAG	DAK-3.5	Dielectric Assessment Kit	12/15/2022	Annual	12/15/2023	1278
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1379
SPEAG	CLA150	Confined Loop Antenna	10/20/2022	Annual	10/20/2023	4022
SPEAG	D300V3	300 MHz SAR Dipole	10/27/2021	Triennial	10/27/2024	1025
SPEAG	D450V3	450 MHz SAR Dipole	4/14/2022	Biennial	4/14/2024	1104
SPEAG	D600V3	600 MHz SAR Dipole	9/14/2022	Biennial	9/14/2024	1013
SPEAG	D900V2	SAR Dipole	6/29/2023	Annual	6/29/2024	189
SPEAG	D1450V2	1450 MHz SAR Dipole	1/14/2021	Triennial	1/14/2024	1025
SPEAG	D2450V2	2450 MHz SAR Dipole	8/18/2021	Triennial	8/18/2024	719
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/11/2023	Annual	5/11/2024	728
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/10/2023	Annual	7/10/2024	1677
SPEAG	EX3DV4	SAR Probe	7/7/2023	Annual	7/7/2024	7406
SPEAG	EX3DV4	SAR Probe	5/19/2023	Annual	5/19/2024	3914
SPEAG	EX3DV4	SAR Probe	6/14/2023	Annual	6/14/2024	7661

Note: 1) All equipment was used solely within its respective calibration period. 2) CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

13 MEASUREMENT UNCERTAINTIES

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	7	N	1	1	1	7.0	7.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	E.2.3	2	R	1.732	1	1	1.2	1.2	∞
Linearity	E.2.4	0.3	N	1	1	1	0.3	0.3	∞
System Detection Limits	E.2.4	0.25	R	1.732	1	1	0.1	0.1	∞
Modulation Response	E.2.5	4.8	R	1.732	1	1	2.8	2.8	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	R	1.732	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	3	R	1.732	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	3	R	1.732	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.732	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E.6.3	6.7	R	1.732	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	4	R	1.732	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	3.12	N	1	1	1	3.1	3.1	35
Device Holder Uncertainty	E.4.1	1.67	N	1	1	1	1.7	1.7	5
Output Power Variation - SAR drift measurement	E.2.9	5	R	1.732	1	1	2.9	2.9	∞
SAR Scaling	E.6.5	0	R	1.732	1	1	0.0	0.0	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	E.3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E.3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E.3.4	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E.3.4	0.6	R	1.732	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				12.2	12.0	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.4	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2013

14 CONCLUSION

14.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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