Test Report Serial Number:	45461798 R1.0
Test Report Date:	23 February 2023
Project Number:	1619

SAR Test Report - New Application

Applicant:

GARMIN.

Maximum Reported 10g SAR			
Extremity (wrist)	Wifi (DTS)	0.33	W/kg
	BT/BLE (DSS)	<0.1	
General Pop. Limit:		4.00	

Garmin International Inc.
Olathe, KS, 66062
USA

FCC ID:	IC Registration Number
IPH-A04596	
Product Model Number / HVIN	Product Name / PMN
A04596	A04596

In Accordance With:

FCC 47 CFR §2.1093
Radiofrequency Radiation Exposure Evaluation: Portable Devices

Approved By:

Ben Hewson, President
Celltech Labs Inc.
21-364 Lougheed Rd.
Kelowna, BC, V1X 7R8
Canada

Test Lab Certificate: 2470.01

IC Registration 3874A

FCC Registration: CA3874

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1.0 DOCUMENT CONTROL

Revision History			
Samples Tested By:	Ben Hewson/Trevor Whillock	**Date(s) of Evaluation:**	15-16 December 2022 & 4-12 January 2023
Report Prepared By:	Ben Hewson	**Report Reviewed By:**	Art Voss

Report Revision	Description of Revision	Revised Section	Revised By	Revision Date
0.1	Draft	n/a	Ben Hewson	13 Feb 2023
1.0	Initial Release	n/a	Ben Hewson	23 Feb 2023

2.0 CLIENT AND DEVICE INFORMATION

Client Information		
Applicant Name	**Garmin International Inc.**	
Applicant Address	1200 East 151 St	
	Olathe, KS, 66062	
	USA	
DUT Information		
Device Identifier(s):	**FCC ID:**	**IPH-A04596**
	ISED ID:	
Device Model(s) / HVIN:	A04596	
EUT Name:	A04596	
Test Sample Serial No.:	3431589962 - Conducted, 3431589964 - OTA	
Device Type:	Extremity Worn Digital Device	
Equipment Class	Digital Transmission System (DTS)	
	Spread Spectrum Transmission System (DSS)	
	Low Power Communication Device (DXX)	
	Global Navigation Satellite System (GNSS) Receivers	
	NFC - Low Power Communication Device Transmitter (DXX)	
Transmit Frequency Range:	ANT (DXX): 2402-2480MHz	
	BT (DTS, DSS): 2402-2480MHz	
	WiFi (DTS): 2412-2462MHz	
Manuf. Max. Rated Output Power:	ANT (DXX):1.6mW (2.1dBm)	
	BT BR (DSS): 12.97mW (11.13dBm)	
	BT 2EDR (DTS): 10.5mW (10.23dBm)	
	BT 3EDR (DTS): 10.3mW (10.12dBm)	
	BT LE1 (DTS): 1.5mW (1.65dBm)	
	BT LE2 (DTS): 1.6mW (1.95dBm)	
	802.11b (DTS): 0.04W (18.25dBm)	
	802.11g (DTS): 0.05W (18.24dBm)	
	802.11n (DTS): 0.04W (15.91dBm)	
Antenna Type and Gain:	2.4GHz: -3.21 dBi PIFA	
Modulation:	ANT: GFSK:	
	BT BR: GFSK	
	BT 2EDR: π/4-DQPSK	
	BT 3EDR: 8DPSK	
	BLE: GMSK	
	WiFi: CCK, DSSS, OFDM, MCS	
DUT Power Source:	5V USB, Internal Li-Ion Battery	
DUT Dimensions [LxWxH]	L x W x H: 49mm x 45mm x 11mm	
Deviation(s) from standard/procedure:	None	
Modification of DUT:	None	

3.0 SCOPE OF EVALUATION

This Certification Report was prepared on behalf of:

Garmin International Inc.

,(the '*Applicant*"), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 (the '*Rules*'). The scope of this investigation was limited to only the equipment, devices and accessories (the '*Equipment*') supplied by the *Applicant*. The tests and measurements performed on this *Equipment* were only those set forth in the applicable *Rules* and/or the Test and Measurement Standards they reference. The *Rules* applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable *Rules* were applied to the measurement results obtained during this evaluation and ,unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the *Equipment* tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

As per FCC 47 CFR Part §2.1091 and §2.1093, an RF Exposure evaluation report is required for this *Equipment* and the results of the RF Exposure evaluation appear in this report.

The A04596 FCC ID: IPH-A04596, is a wrist-worn transceiver that is capable of operating in the 2.4GHz WiFi, ANT/Bluetooth frequency bands and has an additional NFC feature that operates at a fixed transmit frequency of 13.56MHz. The device is not capable of simultaneous transmission between transmitters. The device is intended for General Population Use. The product operates from an internal proprietary Li-ion rechargeable battery which can be connected to a compliant USB interface port, AC or DC adapter for charging. Test samples provided by the manufacturer were capable of transmitting at select frequencies and modulations preset by the manufacturer. An additional antenna modification was prepared for one sample allowing the ability to connect test equipment for antenna port conducted power analysis.

4.0 NORMATIVE REFERENCES

Normative References*	
ANSI / ISO 17025	General Requirements for competence of testing and calibration laboratories
FCC CFR Title 47 Part 2	Code of Federal Regulations
Title 47:	Telecommunication
Part 2.1093:	Radiofrequency Radiation Exposure Evaluation: Portable Devices
IEC International Standard /IEEE International Committee on Electromagnetic Safety	
IEC/IEEE 62209-1528	Measurement procudeure for the assessment of sepcific absorption rate of human expoure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528; Human models, insturmentation, and procedures (Frequency range of 4 MHz to 10 GHz)
FCC KDB	
KDB 865664 D01v01r04	SAR Measurement Requirements for 100MHz to 6GHz
FCC KDB	
KDB 447498 D01v06	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
FCC KDB	
KDB 248227 D01v02r02	SAR Guidance for IEEE 802.11 (WiFi) Transmitters
* When the issue number or issue date is omitted, the latest version is assumed.	

5.0 STATEMENT OF COMPLIANCE

This measurement report demonstrates that samples of the product model(s) were evaluated for Specific Absorption Rate (SAR) on the date(s) shown, in accordance with the Measurement Procedures cited and were found to comply with the Standard(s) Applied based on the Exposure Limits of the Use Group indicated for which the product is intended to be used.

Applicant:	Model / HVIN:	
Garmin International Inc.	A04596	
Standard(s) Applied:	**Measurement Procedure(s):**	
FCC 47 CFR §2.1093	FCC KDB 865664, FCC KDB 447498, FCC KDB 248227 IEC/IEEE Standard 62209-1528	
Reason For Issue:	**Use Group:**	**Limits Applied:**
[x] New Certification	[x] General Population / Uncontrolled	[ ] 1.6W/kg - 1g Volume
[ ] Class I Permissive Change		[ ] 8.0W/kg - 1g Volume
[ ] Class II Permissive Change	[ ] Occupational / Controlled	[x] 4.0W/kg - 10g Volume
Reason for Change:		**Date(s) Evaluated:**
		15-16 December 2022 & 4-12 January 2023

The results of this investigation are based solely on the test sample(s) provided by the applicant which was not adjusted, modified or altered in any manner whatsoever except as required to carry out specific tests or measurements. A description of the device, operating configuration, detailed summary of the test results, methodologies and procedures used during this evaluation, the equipment used and the various provisions of the rules are included in this test report.

I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.	Trevor Whillock Test Lab Engineer Celltech Labs Inc. 10 February 2023 Date

6.0 SAR MEASUREMENT SYSTEM

SAR Measurement System

Celltech Labs Inc. SAR measurement facility employs a Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY6 measurement system is comprised of the measurement server, a robot controller, a computer, a near-field probe, a probe alignment sensor, an Elliptical Planar Phantom (ELI) phantom and a specific anthropomorphic mannequin (SAM) phantom for Head and/or Body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller and a teach pendant (Joystick) to control the robot's servo motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical form the DAE to digital electronic signal and transfers data to the DASY6 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter, a command decoder and a control logic unit. Transmission to the DASY6 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot utilizes a controller with built in VME-bus computer.

DASY 6 SAR System with SAM Phantom

DASY 6 Measurement Controller

7.0 RF CONDUCTED POWER MEASUREMENT

Table 7.0 Conducted Power Measurements – 2.4GHz WiFi

A04596-Conducted Power Measurements									
Channel	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Delta (dB)	SAR Test Channel (Y/N)	Mode	BW (MHz)	Modulation	
6	2437	18.21			-	WLAN 2.4G	20	DSSS-1Mbps	802.11b
		18.14			-			DSSS-2Mbps	
		18.25			-			DSSS-5.5Mbps	
		18.04			-			DSSS-11Mbps	
1	2412	17.74	18.25	-0.51	Y			DSSS-5.5Mbps	
6	2437	18.25	18.25	0.00	Y				
11	2462	18.14	18.25	-0.11	Y				
1	2412	12.23	18.24	-6.01	-	WLAN 2.4G	20	OFDM-12Mbps	802.11g
6	2437	18.24	18.24	0.00					
11	2462	13.77	18.24	-4.47	-				
1	2412	14.34	15.91	-1.57	-	WLAN 2.4G	20	MCS-0	802.11n
6	2437	15.91	15.91	0.00	-				
11	2462	13.68	15.91	-2.23	-				

Table 7.1 Conducted Power Measurements – BT

A04596- Conducted Power Measurements								
Mode	Modulation	Channel	Frequency (MHz)	Measured Power (dBm)	Measured Power (mW)	Rated Power (mW)	Delta (mW)	SAR test Channel
ANT	GFSK	0	2402.00	-1.06	0.8	1.6	0.82	-
		39	2440.00	2.10	1.6	1.6	-0.02	-
		79	2480.00	-1.22	0.8	1.6	0.84	
BT BR	GFSK	0	2402.00	11.04	12.70	12.97	0.27	Y
		38	2441.00	11.11	12.90	12.97	0.07	Y
		78	2480.00	11.13	12.97	12.97	0.00	Y
BT 2EDR	π/4 -DQPSK	3	2402.00	10.11	10.30	10.50	0.20	-
		38	2441.00	10.21	10.50	10.50	0.00	-
		78	2480.00	10.23	10.50	10.50	0.00	-
BT 3EDR	8DPSK	3	2402.00	10.11	10.30	10.30	0.00	-
		38	2441.00	10.11	10.30	10.30	0.00	-
		78	2480.00	10.12	10.30	10.30	0.00	-
BT 3EDR	8DPSK	3	2402.00	10.11	10.30	10.30	0.00	-
		38	2441.00	10.11	10.30	10.30	0.00	-
		78	2480.00	10.12	10.30	10.30	0.00	-
BT LE1	GMSK	37	2402.00	-1.88	0.7	1.5	0.82	-
		17	2440.00	1.65	1.5	1.5	0.04	-
		39	2480.00	-1.50	0.7	1.5	0.79	-
BT LE2	GMSK	37	2402.00	1.95	1.6	1.6	0.00	-
		17	2440.00	1.75	1.5	1.6	0.10	-
		39	2480.00	-2.00	0.6	1.6	1.00	-

The rated power and tolerance are stated for typical transmission modes and data rates. Some modes and data rates may produce lower than rated conducted power levels. Power measurements taken across the various channels, modes and data rates did not produce levels in excess of the Rated Power plus Tolerance. SAR was evaluated using the power level setting and duty cycle specified by the manufacturer to be the max output power and produce the most conservative SAR. SAR was evaluated at the *maximum average* tune up tolerance. See section 2.0 Client and Device Information for details. The *reported* SAR was not scaled down.

8.0 NUMBER OF TEST CHANNELS (N_C)

WiFi SAR Evaluation:

SAR was evaluated in DSSS mode with a sample rate of 5.5 Mbps at a 100% duty cycle. The power level setting selected was specified by the manufacturer to be the max output power and produce the most conservative SAR.

As per FCC KDB 248227, the required 802.11 test channels are Ch 1, Ch 6 and Ch 11.
When applicable, SAR test reduction methods may be utilized.

802.11b DSSS SAR test reduction is determined according to the following:

a) When the *reported* SAR of the highest measured maximum output power channel is ≤ to 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

b) When the *reported* SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest output power channel. When any *reported* SAR is > 1.2 W/Kg, SAR is required for the third channel.

While 1-g SAR thresholds are specified in the procedures for SAR test reduction and exclusion, these thresholds should be multiplied by 2.5 when 10-g extremity SAR is considered.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

a) When KDB Publication 248227 SAR test exclusion applies to the OFDM configuration.

b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

When applying this formula to EU Extremity limits the adjusted SAR is ≤ 1.5W/kg, and for Body limits is ≤ 3.0W/kg.

See 13.1 for details.

BT/BLE/ANT SAR Test Evaluation:

Bluetooth was evaluated for SAR at a transmit duty cycle of 100 % in the worst-case configuration from the WiFi test evaluation.
The duty cycle cannot be altered in test mode or by the user.

General SAR Test Reduction Considerations:

As per KDB 447498D01 4.4.1,

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:

a) ≤ 0.8W/kg or 2.0W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100Mhz

BLE/ANT was not evaluated for SAR.

Per FCC KDB 447498 4.3.1 the BLE/ANT transmitter meets the standalone SAR test exclusion criteria. See section 11.0 for details.

NOTE: This device is not capable of simultaneous transmission between the BT/BLE/ANT and WiFi transmitters.
Due to the nature of this device, WiFi and Bluetooth were evaluated for standalone SAR only.

NFC:

The RFID transmitter is a low power communication device transmitter and does not require standalone SAR evaluation.
Simultaneous transmission evaluation with it and the 802.11b/g/n is not required

9.0 ACCESSORIES EVALUATED

Table 9.0 Accessories Evaluated

Accessory List				
Test Report ID Number	**Manufacturer's Part Number**	**Description**	**SAR Evaluated**	**SAR Tested**
B1	010-01988-04	Silicone Band	**Y**	**Y**
B2	010-12740-02	Metal Band	**Y**	**Y**

10.0 SAR MEASUREMENT SUMMARY

Table 10.0: Measured Results

Measured 10g SAR Results - EXTREMITY Configuration																
Date	Plot ID	Test Frequency (*MHz*)	DUT Configuration					Accessories	Spacing		Measured SAR (*W/kg*)	SAR Drift (*dB*)	Delta Power *dB*	Crest Factor n	Fluid Sensitivity n	*reported* SAR (*W/kg*)
			Pos	Mode	BW	Mod	BR		DUT (*mm*)	Antenna (*mm*)						
12/15/2022	E1	2412	Extremity	802.11b	20	DSSS	5.5	B1	0	1	0.252	-0.600	-0.510	1.000	1.000	0.325
12/16/2022	E2	2437	Extremity	802.11b	20	DSSS	5.5	B1	0	1	0.246	-0.260	0.000	1.000	1.000	0.261
12/16/2022	E3	2462	Extremity	802.11b	20	DSSS	5.5	B1	0	1	0.164	-0.200	-0.110	1.000	1.000	0.176
12/16/2022	E4	2412	Extremity	802.11b	20	DSSS	5.5	B2	0	1	0.244	-0.130	-0.510	1.000	1.000	0.283
1/4/2023	E5	2402	Extremity	BT Classic	1	BT-GFSK	-	B1	0	1	0.076	0.070	-0.090	1.000	1.000	0.077
1/4/2023	E6	2440	Extremity	BT Classic	1	BT-GFSK	-	B1	0	1	0.075	0.060	-0.020	1.000	1.000	0.075
1/4/2023	E7	2480	Extremity	BT Classic	1	BT-GFSK	-	B1	0	1	0.074	0.140	0.000	1.000	1.000	0.074
Applicable SAR Limit								Use Group					Limit			
FCC CFR 2.1093			Health Canada Safety Code 6					General Population/User Unaware					4 W/kg			

11.0 SCALING OF MAXIMUM MEASURE SAR

Table 11.0 SAR Scaling – Extremity

Scaling of Maximum Measured SAR (10g)					
Measured Parameters		Configuration			
		Extremity	Extremity		
Plot ID		E1	E5		
Maximum Measured SAR_M		0.252	0.076		(W/kg)
Frequency		2412	2402		(MHz)
Drift	Power Drift	-0.600	0.070 (1)		(dB)
Conducted Power		17.740	11.040		(dBm)
DC	Transmit Duty Cycle	100.000	100.0		(%)
Fluid Deviation from Target					
Δe	Permitivity	-7.33%	-7.27%		
Δσ	Conductivity	3.18%	2.84%		

Note(1): Power Drift is Positive, Drift Adjustment not Required.

Fluid Sensitivity Calculation (10g)			IEC/IEEE 62209-1528 7.8.2		
Delta SAR = Ce * Δe + Cσ * Δσ					(8)
$Ce = (0.003456*f^3) - (0.03531*f^2) + (0.07675*f) - 0.186$					(11)
$Cσ = (0.004479*f^3) - (0.01586*f^2) - (0.1972*f) + 0.7717$					(12)
f	Frequency (GHz)	2.412	2.402		
Ce		-0.158	-0.157		
Cσ		0.267	0.269		
Ce * Δe		0.012	0.011		
Cσ * Δσ		0.008	0.008		
ΔSAR		0.020 (3)	0.019 (3)		(%)

Note(3): Delta SAR is Positive, SAR Adjustment for Fluid Sensitivity is not Required, in accordance with ISED Notice 2012-DRS0529

Manufacturer's Tuneup Tolerance				
Measured Conducted Power	17.740	11.040		(dBm)
Rated Conducted Power	18.250	11.130		(dBm)
ΔP	-0.510	-0.090		(dB)

Note(4): SAR was Evaluated at the Maximum Tuneup Tolerance. SAR Adjustment is not Required.

Crest Factor				
Transmit Duty Cycle (DC)	100.000	100.0		(%)
CF (1/DC)	1.000 (5)	1.00 ###		

Note(5): Crest Factor = 1 (100% Duty Cycle), Crest Factor Adjustment not Required.

SAR Adjustment for Fluid Sensitivity				
$SAR_1 = SAR_M$ X [ΔSAR]	0.252	0.076		(W/kg)
SAR Adjustment for Tuneup Tolerance				
$SAR_2 = SAR_1$ + [ΔP]	0.283	0.077		(W/kg)
SAR Adjustment for Drift				
$SAR_3 = SAR_2$ + [Drift]	0.325	0.077		(W/kg)
SAR Adjustment for Crest Factor				
$SAR_4 = SAR_3$ x [CF]	0.325	0.077		(W/kg)
***reported* 10g SAR**				
SAR_4	**0.33**	**0.08**		(W/kg)

The SAR test exclusion threshold for the BLE/ANT transmitter as per FCC KDB 447498 4.3.1 is as follows:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] X [√f(GHz)] ≤ 7.5 for 10-g SAR
[1.9)/(5)] X [√2.441] = 0.496 ≤ 7.5

Where:
max. power of channel, including tune-up tolerance, mW = 1.6 mW
min. test separation distance, mm = 5mm
f(GHz) = 2.402 GHz

Therefore; the BLE/ANT Transmitter meets the SAR test exclusion criteria.

NOTE: This device is not capable of simultaneous transmission between the BT/BLE/ANT and WiFi transmitters.
Due to the nature of this device, WiFi and Bluetooth were evaluated for standalone SAR only.

The NFC transmitter is a low power communication device transmitter and does not require standalone SAR evaluation. Simultaneous transmission evaluation with it and the 802.11b/g/n or BT 802.15 is not required. When applying this formula to EU Extremity limits the adjusted SAR is ≤ 1.5W/kg, and for Body limits is ≤ 3.0W/kg.

NOTES to Table 11.0
(1) Scaling of the Maximum Measured SAR is based on the highest, 100% duty cycle, Face, Body and/or Head SAR measured of ALL test channels, configurations and accessories used during THIS evaluation. The Measured Fluid Deviation parameters apply only to deviation of the tissue equivalent fluids used at the frequencies which produced the highest measured SAR. The Measured Conducted Power applies to the Conducted Power measured at the frequencies producing the highest Face and Body SAR. The Measured Drift is the SAR drift associated with that specific SAR measurement. The Reported SAR is the accumulation of all SAR Adjustments from the applicable Steps 1 through 4. The Plot ID is for indentification of the SAR Measurement Plots in Annex A of this report. NOTE: Some of the scaling factors in Steps 1 through 4 may not apply and are identified by light gray text.
Step 1
Per IEC\IEEE 62209-1528 and FCC KDB 865664. Scaling required only when Measured Fluid Deviation is greater than 5%. If the Measured Fluid Deviation is greater than 5%, Table 9.1 will be shown and will indicate the SAR scaling factor in percent (%). SAR is MULTIPLIED by this scaling factor only when the scaling factor is positive (+).
Step 2
Per KDB 447498. Scaling required only when the difference (Delta) between the Measured Conducted Power and the Manufacturer's Rated Conducted Power is (-) Negative. The absolute value of Delta is ADDED to the SAR.
Step 3
Per IEC\IEEE 62209-1528. Scaling required only when Measured Drift is (-) Negative. The absolute value of Measured Drift is added to Reported or Simultaneous Reported SAR.
Step 4
Per KDB 447498 4.3.2. The SAR, either measured or calculated, of ANY and ALL simultaneous transmitters must be added together and includes all contributors.
Step 5
The Reported SAR is the Maximum Final Adjusted Cumulative SAR from the applicable Steps 1 through 4 and are reported on Page 1 of this report.

12.0 SAR EXPOSURE LIMITS

Table 12.0 Exposure Limits

SAR RF EXPOSURE LIMITS			
FCC 47 CFR§2.1093	**Health Canada Safety Code 6**	**General Population / Uncontrolled Exposure(4)**	**Occupational / Controlled Exposure(5)**
Spatial Average(1) (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak(2) (Head and Trunk averaged over any 1 g of tissue)		1.6 W/kg	8.0 W/kg
Spatial Peak(3) (Hands/Wrists/Feet/Ankles averaged over 10 g)		**4.0 W/kg**	20.0 W/kg
(1) The Spatial Average value of the SAR averaged over the whole body.			
(2) 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.			
(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.			
(4) Uncontrolled environments are defined as locations where there is potential exposure to individuals who have no knowledge or control of their potential exposure.			
(5) Controlled environments are defined as locations where there is potential exposure to individuals who have knowledge of their potential exposure and can exercise control over their exposure.			

13.0 DETAILS OF SAR EVALUATION

13.0 Day Log

DAY LOG								
Date	Ambient Temp (°C)	Fluid Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Fluid Dielectric	SPC	Test	Task
15 Dec 2022	23.6	23.7	19%	102.8	X	X	X	2450H Fluids&SPC, SAR Testing
16 Dec 2022	22.9	20.5	18%	102.9			X	2450H SAR Testing
18 Dec 2022	22.5	21.6	17%	102.2			X	2450H SAR Testing
4 Jan 2023	25.4	23.6	18%	102.0	X	X	X	2450H Fluids&SPC, SAR Testing
12 Jan 2023	24.7	23.1	23%	102.0	X	X	X	2450H Fluids&SPC, SAR Testing

*Per IEC/IEEE 62209-1528, test series was started within 24 hours of Fluid Parameter Measurement

13.1 DUT Setup and Configuration

DUT Setup and Configuration	
1	The device was evaluated for Extremity (wrist worn), from a flat phantom filled with head tissue-equivalent medium. The DUT was evaluated for SAR in accordance with the procedures as described in FCC KDB 447498, 248227, 865664 and IEC/IEEE 62209-1528, ACMA Radiocommunications and ICNIRP.
2	2.4GHz 802.11g/n OFDM SAR Test Exclusion As Per KDB 248227 D01v02r02 - 5.2.2, b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2W/kg When applying this formula to EU Extremity limits the adjusted SAR is ≤ 1.5W/kg, and for Body limits is ≤ 3.0W/kg. Maximum 802.11g/n OFDM specified power(POFDM)= 18.24 dBm (66.68mW) Maximum 802.11b DSSS specified power (PDSSS)= 18.25 dBm (36.83mW) Ratio OFDM/DSSS power = -0.01 dBm (99.9%) Highest reported SAR (SARMAX)= 0.33W/kg POFDM/PDSSS X SARMAX = 0.33 W/kg ≤ 3.0 W/kg (Extremity) and ≤ 1.5 W/kg (Body) and SAR test exclusion applies.
3	The Device was capable of transmitting at various modulations, data rates and duty cycles. The Conducted Power was highest when measured in DSSS Mode-5.5 Mbps at 100% Duty cycle than any other configuration in the 2.4GHz Band. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer.
4	Bluetooth was evaluated for SAR in BT BR (GFSK) mode with a transmit duty cycle of 100% in the worst-case configuration from the WiFi test evaluation.The Duty cycle could not be altered in test mode or by the user. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer.
5	Each SAR evaluation was performed with a fully charged battery.

13.2 DUT Positioning

DUT Positioning
Positioning
The DUT Positioner was securely fastened to the Phantom Platform. Registration marks were placed on the DUT and the Positioner to ensure consistent positioning of the DUT for each test evaluation.
FACE Configuration
Devices that are designed to be worn on the wrist and may operate with in speaker mode for voice communication, with the device positioned next to the mouth. When next-to-mouth SAR evaluation is required, the device is positioned at 10mm from a flat phantom filled with head tissue-equivalent medium.
BODY Configuration
The DUT was securely clamped into the device holder with the surface of the DUT being 2mm from bottom of the phantom in the Body configuration.
HEAD Configuration
This device is not intended to be held to the ear and was not tested in the HEAD configuration.
Limb Worn Configuration
The DUT was positioned with the back side directly against the phantom surface with the strap opened to allow direct contact or 0mm of the DUT and watch band to the phantom surface.

13.3 General Procedures and Report

General Procedures and Reporting
General Procedures
The fluid dielectric parameters of the Active Tissue Simulating Liquid (TSL) were measured as described in this Section, recorded and entered into the DASY Measurement Server. Active meaning the TSL used during the SAR evaluation of the DUT. The temperature of the Active TSL was measured and recorded prior to performing a System Performance Check (SPC). An SPC was performed with the Active TSL prior to the start of the test series. The temperature of the Active TSL was measured throughout the day and the Active TSL temperature was maintained to ± 0.5°C. The Active TSL temperature was maintained to within ±2.0°C throughout the test series. The liquid parameters shall be measured within 24 hours before the start of a test series and if it takes longer than 48 hours, the liquid parameters shall also be measured at the end of the test series. An Area Scan exceeding the length and width of the DUT projection was performed and the locations of all maximas within 2dB of the Peak SAR recorded. A Zoom Scan centered over the Peak SAR location(s) was performed and the 1g and 10g SAR values recorded. The resolutions of the Area Scan and Zoom Scan are described in the Scan Resolution table(s) in this Section. A Power Reference Measurement was taken at the phantom reference point immediately prior to the Area Scan. A Power Drift measurement was taken at the phantom reference point immediately following the Zoom Scan to determine the power drift. A Z-Scan from the *Maximum Distance to Phantom Surface* to the fluid surface was performed following the power drift measurement.
Reporting
The 1g SAR, 10g SAR and power drift measurements are recorded in the SAR Measurement Summary tables in the SAR Measurement Summary Section of this report. The SAR values shown in the 100% DC (Duty Cycle) column are the SAR values reported by the SAR Measurement Server with the DUT operating at 100% transmit duty cycle. These tables also include other information such as transmit channel and frequency, modulation, accessories tested and DUT-phantom separation distance. In the Scaling of Maximum Measured SAR Section of this report, the highest measured SAR in the BODY configuration, within the entire scope of this assessment, are, when applicable, scaled for Fluid Sensitivity, Manufacturer's Tune-Up Tolerance, Simultaneous Transmission and Drift. With the exception of Duty Cycle correction/compensation, SAR values are ONLY scaled up, not down. The final results of this scaling is the *reported SAR* which appears on the Cover Page of this report.

13.4 Fluid Dielectric and Systems Performance Check

Fluid Dielectric and Systems Performance Check
Fluid Dielectric Measurement Procedure
The fluid dielectric parameters of the Tissue Simulating Liquid (TSL) are measured using the Open-Ended Coax Method connected to an Agilent 8753ET Network Analyzer connected to a measurement server running Aprel Dielectric Property Measurement System. A frequency range of ± 100MHz for frequencies > 300MHz and ± 50MHz for frequencies ≤ 300MHz with frequency step size of 10MHz is used. The center frequency is centered around the SAR measurement probe's calibration point for that TSL frequency range. A calibration of the setup is performed using a short-open-deionized water (at 23°C in a 300ml beaker) method. A sample of the TSL is placed in a 300ml beaker and the open-ended coax is submerged approximately 8mm below the fluid surface in the approximate center of the beaker. A check of the setup is made to ensure no air is trapped under the open-ended coax. The sample of TSL is measured and compared to the FCC KDB 865664 targets for HEAD or BODY for the entire fluid measurement range. Fluid adjustment are made if the dielectric parameters are > 5% in range that the DUT is to be tested. If the adjustments fail to bring the parameters to ≤ 5% but are < 10%, the SAR Fluid Sensitivity as per IEC\IEE 62209-1528 and FCC KDB 865664 are applied to the highest measured SAR. A TSL with dielectric parameters > 10% in the DUT test frequency range are not used.
Systems Performance Check
The fluid dielectric parameters of the Active TSL are entered into the DASY Measurement Server at each of the 10MHz step size intervals. Active meaning the TSL used during the SAR evaluation of the DUT. The DASY Measurement System will automatically interpolate the dielectric parameters for DUT test frequencies that fall between the 10MHz step intervals. A Systems Performance Check (SPC) is performed in accordance with IEC\IEEE 62209-1528 "System Check" and FCC KDB 865664 "System Verification". A validation source, dipole or Confined Loop Antenna (CLA), is placed under the geometric center of the phantom and separated from the phantom in accordance to the validation source's Calibration Certificate data. A CW signal set to the frequency of the validate source's and SAR measurement probe's calibration frequency with a forward power set to the validation source's Calibration Certificate data power setting is applied to the validation source. An Area Scan is centered over the projection of the validation source's feed point and an Area Scan is taken. A Zoom Scan centered over the Peak SAR measurement of the Area Scan and the 1g and 10g SAR is measured. The measured 1g and 10g SAR is compared to the 1g and 10g SAR measurements from the validation source's Calibration Certificate. When required, the measured SAR is normalized to 1.0W and compared to the normalized SAR indicated on the validation source's Calibration Certificate. The SPC is considered valid when the measured and normalized SAR is ≤ 10% of the measured and normalize SAR of the validation source's Calibration Certificate. The fluid dielectric parameters of the Active TSL and SPC are repeated when the Active TSL has been in use for greater than 84 hours or if the Active TSL temperature has exceed ± 1°C of the initial fluid analysis.

13.5 Scan Resolution 100MHz to 2GHz

Scan Resolution 100MHz to 2GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	**4 ± 1 mm**
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	**5° ± 1°**
Area Scan Spatial Resolution ΔX, ΔY	**15 mm**
Zoom Scan Spatial Resolution ΔX, ΔY	**7.5 mm**
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	**5 mm**
Zoom Scan Volume X, Y, Z	**30 mm**
Phantom	**ELI**
Fluid Depth	**150 ± 5 mm**
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

13.6 Scan Resolution 2GHz to 3GHz

Scan Resolution 2GHz to 3GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	**4 ± 1 mm**
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	**5° ± 1°**
Area Scan Spatial Resolution ΔX, ΔY	**12 mm**
Zoom Scan Spatial Resolution ΔX, ΔY	**5 mm**
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	**5 mm**
Zoom Scan Volume X, Y, Z	**30 mm**
Phantom	**ELI**
Fluid Depth	**150 ± 5 mm**
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

13.7 Scan Resolution 5GHz to 6GHz

Scan Resolution 5GHz to 6GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	**4 ± 1 mm**
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	**5° ± 1°**
Area Scan Spatial Resolution ΔX, ΔY	**10 mm**
Zoom Scan Spatial Resolution ΔX, ΔY	**4 mm**
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	**2 mm**
Zoom Scan Volume X, Y, Z	**22 mm**
Phantom	**ELI**
Fluid Depth	**100 ± 5 mm**
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

14.0 MEASUREMENT UNCERTAINTIES

Table 14.0 Measurement Uncertainty

Measurement uncertainty table is not required per KDB 865664 D01 v01r04 section 2.8.2 page 12. SAR measurement uncertainty analysis is required in SAR reports only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR.21 The equivalent ratio (1.5/1.6) should be applied to extremity and occupational exposure conditions. The highest reported SAR value is less than 1.5W/kg. Therefore, he measurement uncertainty table is not required.

15.0 FLUID DIELECTRIC PARAMETERS

Table 15.0 Fluid Dielectric Parameters 2450MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Tue 15/Dec/2022 04:40:03
Freq Frequency(GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
2.4000	39.29	1.76	36.24	1.80
2.4100	39.27	1.76	36.37	1.81
2.4200	39.25	1.77	36.45	1.85
2.4300	39.24	1.78	36.22	1.83
2.4400	39.22	1.79	36.17	1.82
2.4500	39.20	1.80	36.13	1.85
2.4600	39.19	1.81	35.83	1.86
2.4700	39.17	1.82	35.89	1.89
2.4800	39.16	1.83	35.94	1.92

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date: 15-Dec-2022		Fluid Temp: 23.7		Frequency:	2450MHz	Tissue:	Head	ΔSAR	ΔSAR	SAR Correction Factor (1)	
Freq (MHz)		Test ε	Test σ (S/m)	Target ε	Target σ (S/m)	Deviation Permittivity	Deviation Conductivity	1g	10g	1g	10g
2400.0000		36.2400	1.8000	39.2900	1.76	-7.76%	2.27%	0.029	0.018	1.000	1.000
2402.0000	*	36.2660	1.8020	39.2860	1.76	-7.69%	2.39%	0.029	0.019	1.000	1.000
2410.0000		36.3700	1.8100	39.2700	1.76	-7.38%	2.84%	0.031	0.019	1.000	1.000
2412.0000	*	36.3860	1.8180	39.2660	1.76	-7.33%	3.18%	0.032	0.020	1.000	1.000
2420.0000		36.4500	1.8500	39.2500	1.77	-7.13%	4.52%	0.038	0.023	1.000	1.000
2430.0000		36.2200	1.8300	39.2400	1.78	-7.70%	2.81%	0.031	0.020	1.000	1.000
2437.0000	*	36.1850	1.8230	39.2260	1.79	-7.75%	2.01%	0.027	0.018	1.000	1.000
2440.0000	*	36.1700	1.8200	39.2200	1.79	-7.78%	1.68%	0.026	0.017	1.000	1.000
2450.0000		36.1300	1.8500	39.2000	1.80	-7.83%	2.78%	0.031	0.020	1.000	1.000
2460.0000		35.8300	1.8600	39.1900	1.81	-8.57%	2.76%	0.032	0.021	1.000	1.000
2462.0000	*	35.8420	1.8660	39.1860	1.81	-8.53%	2.98%	0.033	0.021	1.000	1.000
2470.0000		35.8900	1.8900	39.1700	1.82	-8.37%	3.85%	0.037	0.023	1.000	1.000
2480.0000	*	35.9400	1.9200	39.1600	1.83	-8.22%	4.92%	0.042	0.026	1.000	1.000

*Channel Frequency Tested

Table 15.1 Fluid Dielectric Parameters 2450MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Wed 04/Jan/2023 15:57:42
Freq Frequency(GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
2.4000	39.29	1.76	36.44	1.81
2.4100	39.27	1.76	36.39	1.81
2.4200	39.25	1.77	36.32	1.83
2.4300	39.24	1.78	36.13	1.83
2.4400	39.22	1.79	36.34	1.86
2.4500	39.20	1.80	36.31	1.88
2.4600	39.19	1.81	36.25	1.88
2.4700	39.17	1.82	36.32	1.88
2.4800	39.16	1.83	36.34	1.88

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date: 4-Jan-2023		Fluid Temp: 23.6		Frequency: 2450MHz		Tissue:	Head	ΔSAR	ΔSAR	SAR Correction Factor (1)	
Freq (MHz)		Test ε	Test σ (S/m)	Target ε	Target σ (S/m)	Deviation Permittivity	Deviation Conductivity	1g	10g	1g	10g
2400.0000		36.4400	1.8100	39.2900	1.76	-7.25%	2.84%	0.030	0.019	1.000	1.000
2402.0000	*	36.4300	1.8100	39.2860	1.76	-7.27%	2.84%	0.030	0.019	1.000	1.000
2410.0000		36.3900	1.8100	39.2700	1.76	-7.33%	2.84%	0.030	0.019	1.000	1.000
2412.0000	*	36.3760	1.8140	39.2660	1.76	-7.36%	2.95%	0.031	0.019	1.000	1.000
2420.0000		36.3200	1.8300	39.2500	1.77	-7.46%	3.39%	0.033	0.021	1.000	1.000
2430.0000		36.1300	1.8300	39.2400	1.78	-7.93%	2.81%	0.031	0.020	1.000	1.000
2437.0000	*	36.2770	1.8510	39.2260	1.79	-7.52%	3.58%	0.034	0.021	1.000	1.000
2440.0000	*	36.3400	1.8600	39.2200	1.79	-7.34%	3.91%	0.035	0.022	1.000	1.000
2450.0000		36.3100	1.8800	39.2000	1.80	-7.37%	4.44%	0.038	0.023	1.000	1.000
2460.0000		36.2500	1.8800	39.1900	1.81	-7.50%	3.87%	0.035	0.022	1.000	1.000
2462.0000	*	36.2640	1.8800	39.1860	1.81	-7.46%	3.75%	0.035	0.022	1.000	1.000
2470.0000		36.3200	1.8800	39.1700	1.82	-7.28%	3.30%	0.032	0.020	1.000	1.000
2480.0000	*	36.3400	1.8800	39.1600	1.83	-7.20%	2.73%	0.029	0.018	1.000	1.000

*Channel Frequency Tested

Table 15.2 Fluid Dielectric Parameters 2450MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Wed 12/Jan/2023 10:14:03
Freq Frequency(GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
2.4000	39.29	1.76	36.56	1.76
2.4100	39.27	1.76	36.45	1.77
2.4200	39.25	1.77	36.40	1.80
2.4300	39.24	1.78	36.38	1.84
2.4400	39.22	1.79	36.38	1.80
2.4500	39.20	1.80	36.38	1.83
2.4600	39.19	1.81	36.40	1.84
2.4700	39.17	1.82	36.46	1.87
2.4800	39.16	1.83	36.40	1.87

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date: 12-Jan-2023		Fluid Temp: 23.8		Frequency: 2450MHz		Tissue: Head		ΔSAR	ΔSAR	SAR Correction Factor (1)	
Freq (MHz)		Test ε	Test σ (S/m)	Target ε	Target σ (S/m)	Deviation Permittivity	Deviation Conductivity	1g	10g	1g	10g
2400.0000		36.5600	1.7600	39.2900	1.76	-6.95%	0.00%	0.016	0.011	1.000	1.000
2402.0000	*	36.5380	1.7620	39.2860	1.76	-6.99%	0.11%	0.016	0.011	1.000	1.000
2410.0000		36.4500	1.7700	39.2700	1.76	-7.18%	0.57%	0.019	0.013	1.000	1.000
2412.0000	*	36.4400	1.7760	39.2660	1.76	-7.20%	0.79%	0.020	0.013	1.000	1.000
2420.0000		36.4000	1.8000	39.2500	1.77	-7.26%	1.69%	0.025	0.016	1.000	1.000
2430.0000		36.3800	1.8400	39.2400	1.78	-7.29%	3.37%	0.033	0.020	1.000	1.000
2437.0000	*	36.3800	1.8120	39.2260	1.79	-7.26%	1.40%	0.023	0.015	1.000	1.000
2440.0000	*	36.3800	1.8000	39.2200	1.79	-7.24%	0.56%	0.019	0.013	1.000	1.000
2450.0000		36.3800	1.8300	39.2000	1.80	-7.19%	1.67%	0.024	0.016	1.000	1.000
2460.0000		36.4000	1.8400	39.1900	1.81	-7.12%	1.66%	0.024	0.016	1.000	1.000
2462.0000	*	36.4120	1.8460	39.1860	1.81	-7.08%	1.88%	0.025	0.016	1.000	1.000
2470.0000		36.4600	1.8700	39.1700	1.82	-6.92%	2.75%	0.029	0.018	1.000	1.000
2480.0000	*	36.4000	1.8700	39.1600	1.83	-7.05%	2.19%	0.026	0.017	1.000	1.000

*Channel Frequency Tested

16.0 SYSTEM VERIFICATION TEST RESULTS

Table 16.0 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
15 Dec 2022		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.7	24	19%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
36.13	39.20	-7.83%	1.85	1.80	2.78%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
12.60	13.18	-4.40%	5.70	6.01	-5.08%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
50.40	52.72	-4.40%	22.80	24.02	-5.06%

Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEC\IEEE 62209-1528, FCC KDB 846224.

The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.

The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value.

The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.

Table 16.1 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
4 Jan 2023		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.6	25	18%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
36.31	39.20	-7.37%	1.88	1.80	4.44%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
14.00	13.18	6.22%	6.38	6.01	6.24%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
56.00	52.72	6.22%	25.52	24.02	6.27%

Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEC\IEEE 62209-1528, FCC KDB 846224.

The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.

The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value.

The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.

Table 16.2 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
12 Jan 2023		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.1	25	23%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
36.38	39.20	-7.19%	1.83	1.80	1.67%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
13.00	13.18	-1.37%	5.88	6.01	-2.08%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
52.00	52.72	-1.36%	23.52	24.02	-2.06%

Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEC\IEEE 62209-1528, FCC KDB 846224.

The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.

The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value.

The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.

17.0 SYSTEM VALIDATION SUMMARY

Table 17.0 System Validation Summary

SAR Validation SummaryChart							
Validation Date	Validation Source	Source S/N	Validation Frequency	Tissue	Linearity	Isotropy	Extrapolation
3-May-22	D2450V2	825	2450	Head	✓	✓	✓

18.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 18.0 Measurement System Specifications

Measurement System Specification	
Specifications	
Positioner	Stäubli Unimation Corp. Robot Model: TX90XL
Repeatability	+/- 0.035 mm
No. of axis	6.0
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor	Intel(R) Core(TM) i7-7700
Clock Speed	3.60 GHz
Operating System	Windows 10 Professional
Data Converter	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASY6, V 6.4.0.12171 / DASY52 V10.2(1504)
	Postprocessing Software: SEMCAD X, V14.6.12(7470)
Connecting Lines	Optical downlink for data and status info., Optical uplink for commands and clock
DASY Measurement Server	
Function	Real-time data evaluation for field measurements and surface detection
Hardware	Intel ULV Celeron CPU 400 MHz; 128 MB chip disk; 128 MB RAM
Connections	COM1, COM2, DAE, Robot, Ethernet, Service Interface
E-Field Probe	
Model	EX3DV4
Serial No.	3600
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Phantom	
Type	ELI Elliptical Planar Phantom
Shell Material	Fiberglass
Thickness	2mm +/- .2mm
Volume	> 30 Liter

Table 18.1

Measurement System Specification (Continued)

Probe Specification

Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents (e.g. DGBE)
Calibration:	ISO/IEC 17025
Frequency:	4 MHz - 10 GHz; Linearity: ± 0.2 dB (30 MHz - 10 GHz)
Directivity:	± 0.1 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis)
Dynamic Range:	10 μW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically <1 mW/g)
Dimensions:	Overall length: 337 mm; (tip: 20 mm) Tip diameter: 2.5 mm; Tip (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application:	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better than 30%

EX3DV4 E-Field Probe

Phantom Specification

The ELI V5.0 phantom is an elliptical planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC\IEEE 62209-1528.

ELI Phantom

Phantom Specification

The SAM V4.0 phantom is a flat planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC\IEEE 62209-1528.

SAM Phantom

Phantom Specification

The MFP V5.1C phantom is a flat planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEC\IEEE 62209-1528.

MFP Phantom

Device Positioner Specification

The DASY device positioner has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65^{O}. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

Device Positioner

19.0 TEST EQUIPMENT LIST

Table 19.0 Equipment List and Calibration

Test Equipment List				
DESCRIPTION	ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION DUE
Schmid & Partner DASY 6 System	-	-	-	-
-DASY Measurement Server	00158	1078	CNR	CNR
-Robot	00046	599396-01	CNR	CNR
-DAE4	00019	353	14-Apr-22	14-Apr-23
-EX3DV4 E-Field Probe	00213	3600	20-Apr-22	20-Apr-23
-D2450V2 Validation Dipole	00219	825	24-Apr-21	24-Apr-24
MFP Phantom	00355	1177/2	CNR	CNR
HP 85070C Dielectric Probe Kit	00033	none	CNR	CNR
HP 8753ET Network Analyzer	00134	US39170292	6-Jan-21	6-Jan-24
Rohde & Schwarz SMR20 Signal Generator	00006	100104	11-Aug-20	11-Aug-23
Amplifier Research 10W1000C Power Amplifier	00041	27887	CNR	CNR
Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
Narda Directional Coupler 3020A	00064	-	CNR	CNR
Kangaroo VWR Humidity/Thermometer	00334	192385455	5-Aug-19	5-Jan-23
Digital Multi Meter DMR-1800	00250	TE182	23-Jun-20	23-Jun-23
Bipolar Power Supply 6299A	00086	1144A02155	CNR	CNR
DC-18G 10W 30db Attenuator	00102	-	COU	COU
R&S FSP40 Spectrum Analyzer	00241	100500	9-Aug-21	9-Aug-24
HP 8566B Spectrum Analyzer	00051	2747A055100	29-Jun-20	29-Jun-23
RF Cable-SMA	00311	-	CNR	CNR
HP Calibration Kit	00145	-	CNR	CNR

CNR = Calibration Not Required

COU = Calibrate on Use

Note: Per KDB 865664, Dipoles are evaluated annually for return loss and impedance. The dipole's SAR target can only be assessed by the SAR equipment manufacturer and remains the target until the dipole is recalibrated by the manufacturer. The dipole's SAR is evaluated and compared to this target during each and every System Verification which is performed prior to and/or during each DUT SAR evaluation. The results of these verifications are shown in Section 16.0

20.0 FLUID COMPOSITION

Table 20.0 Fluid Composition 2450MHz HEAD TSL

Tissue Simulating Liquid (TSL) Composition				2450MHz Head
Component by Percent Weight				
Water	Glycol	Salt(1)	HEC(2)	Bacteriacide(3)
52.0	48.0	0.0	0.0	0.0

(1) Non-Iodinized
(2) **H**ydroxy**E**thyl-**C**ellulose: Sigma-Aldrich P/N 54290-500g
(3) Dow Chemical Dowicil 75 Antimicrobial Perservative

END OF REPORT

APPENDIX A – SYSTEM VERIFICATION PLOTS

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:825
Procedure Name: SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 36.13; ρ = 1000 kg/m^3
Phantom section: Left Section

Date/Time: 12/15/2022 6:42:11 PM

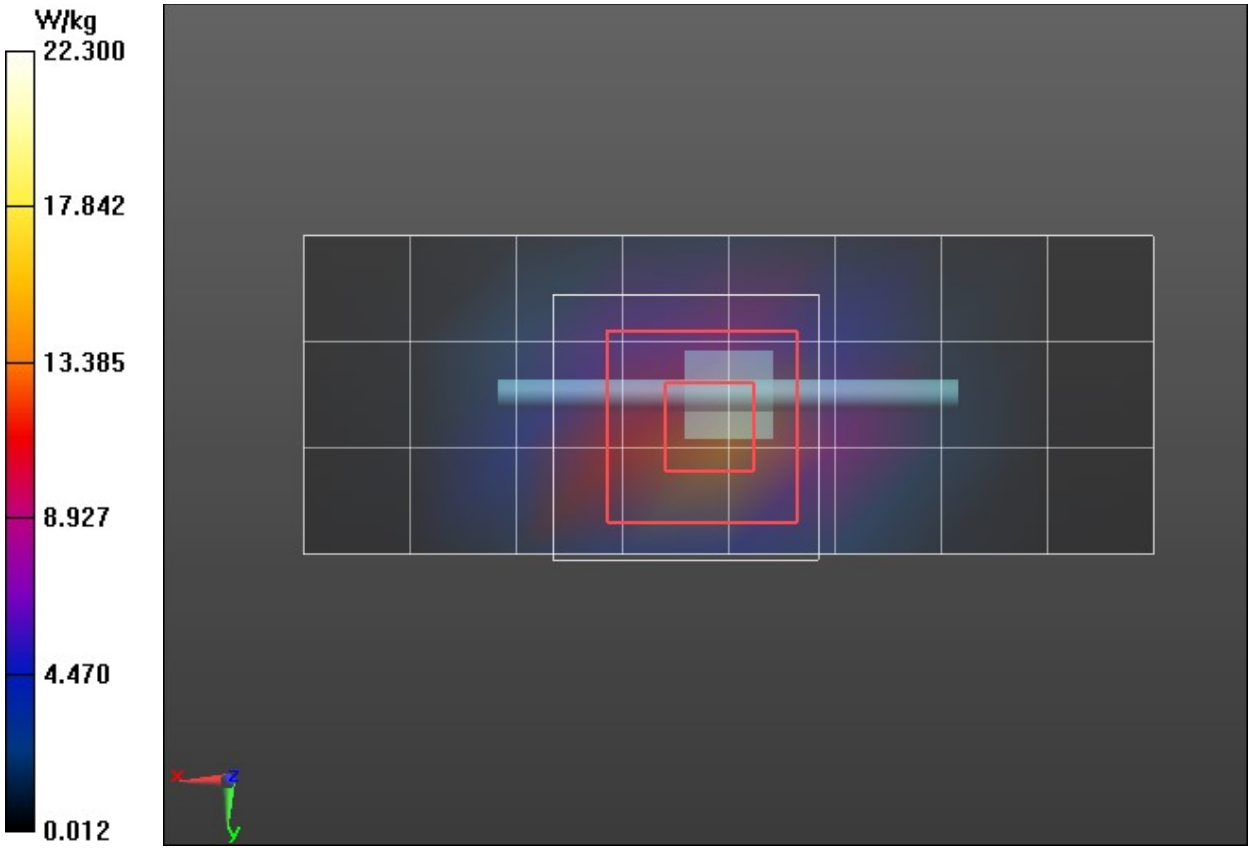
DASY5 Configuration:

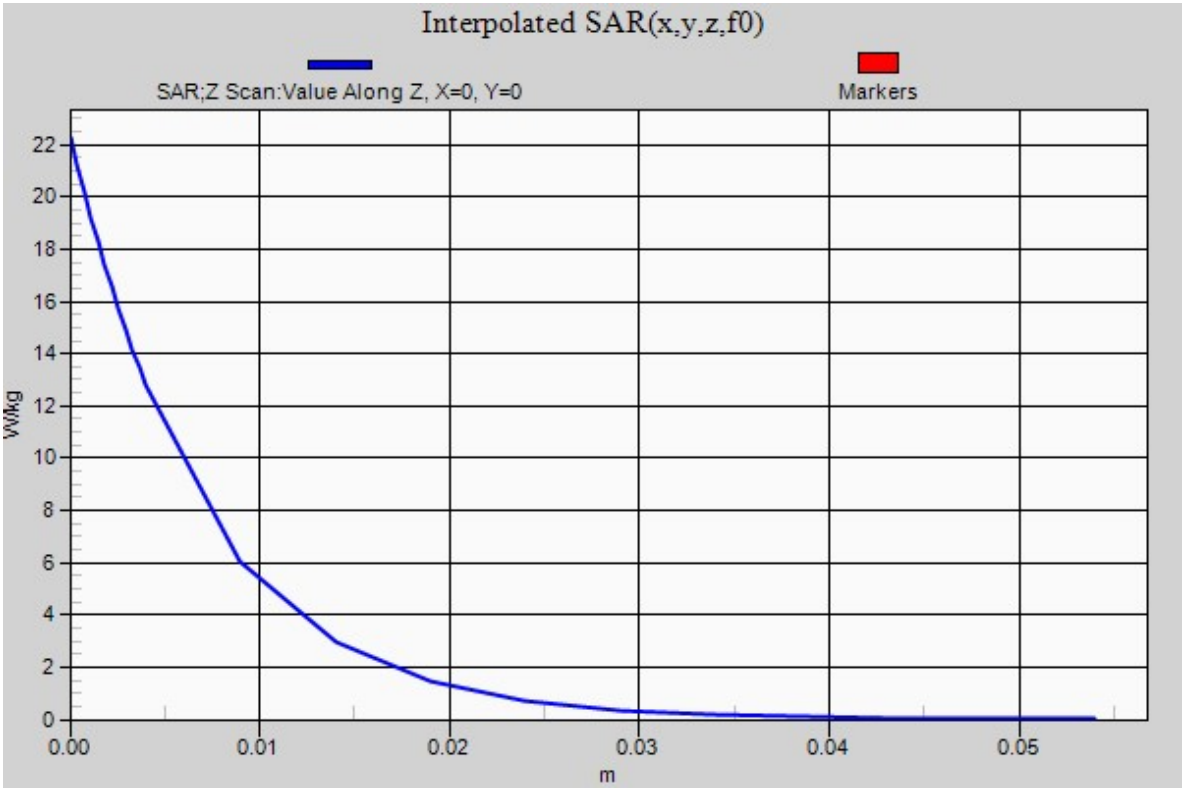
- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2450 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 00355
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2/Area Scan (9x4x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 13.4 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 83.16 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.7 W/kg
Smallest distance from peaks to all points 3 dB below = 10.4 mm
Ratio of SAR at M2 to SAR at M1 = 46.3%
Maximum value of SAR (measured) = 14.1 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2/Z Scan (1x1x22): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 6.885 (6.712, 6.948) [mm]
Maximum value of SAR (interpolated) = 22.3 W/kg





DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:825
Procedure Name: SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2 2

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.88 S/m; ε_r = 36.31; ρ = 1000 kg/m^3
Phantom section: Left Section

Date/Time: 1/4/2023 4:48:04 PM

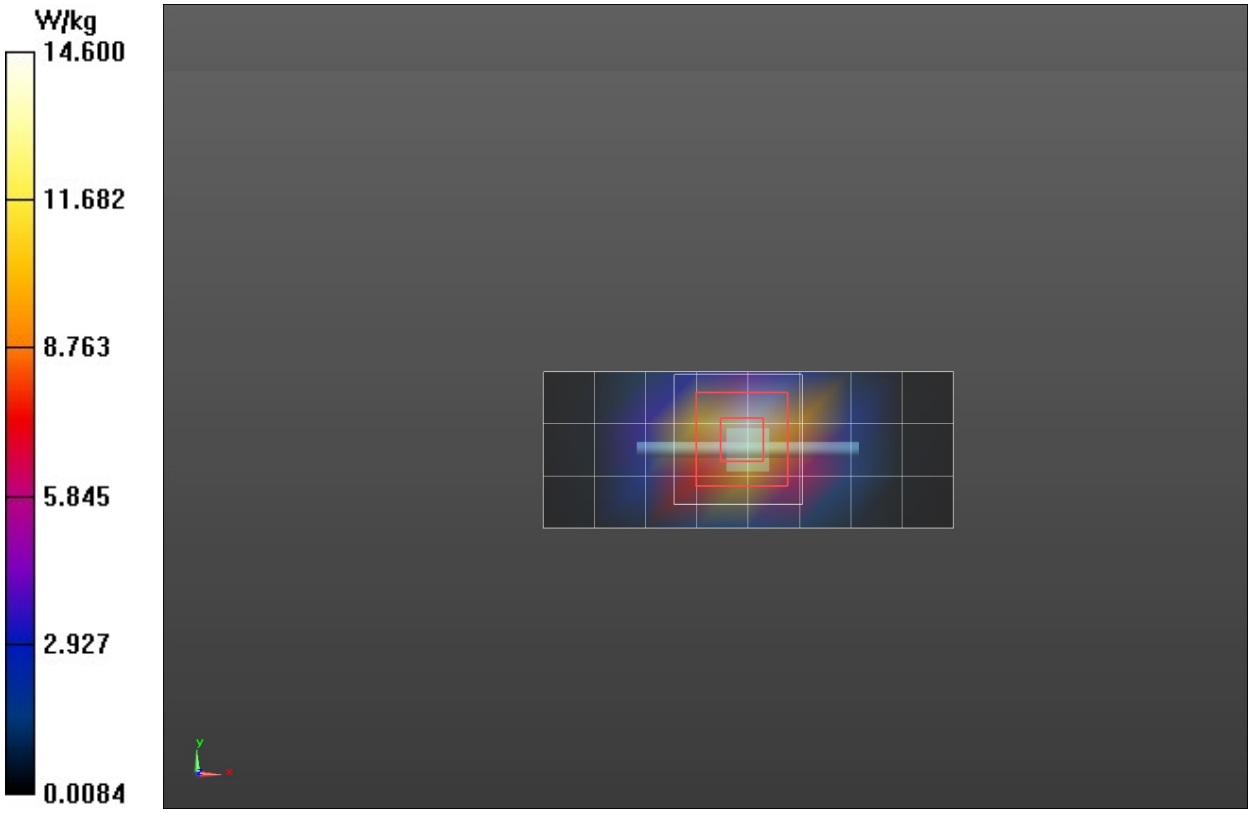
DASY5 Configuration:

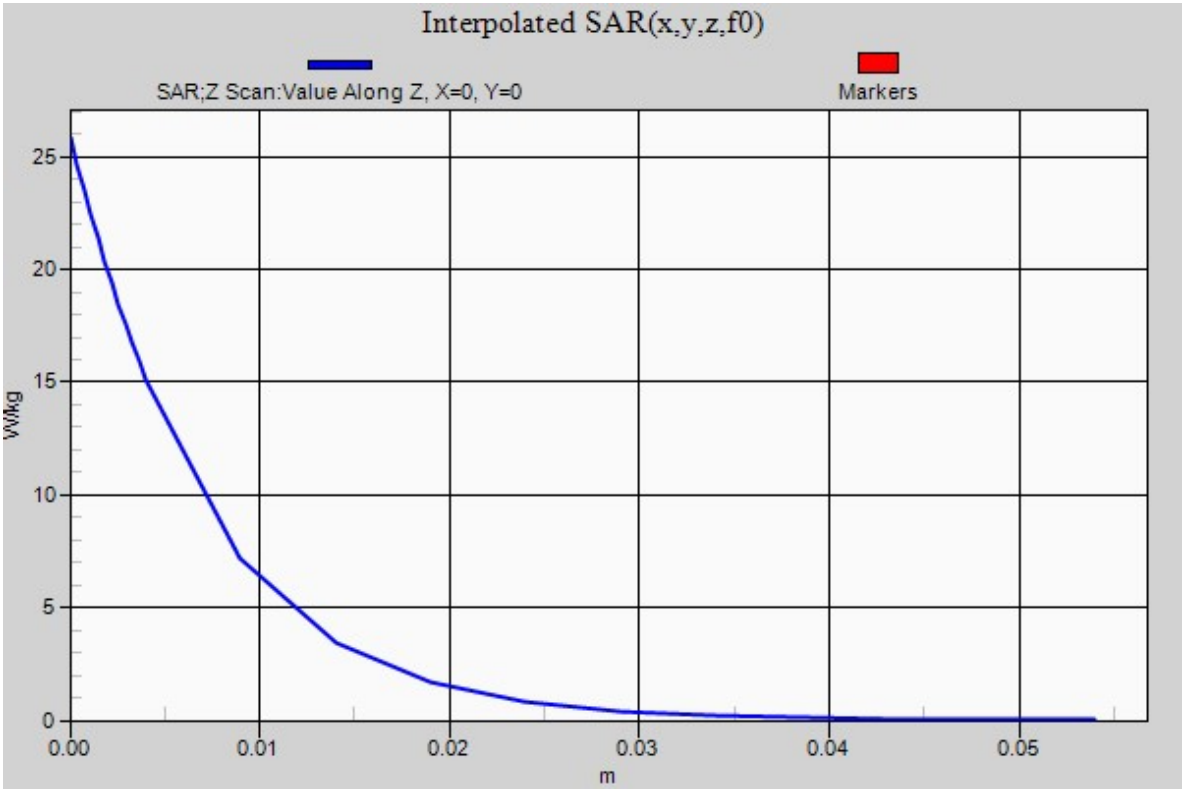
- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2450 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 00355
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2 2/Area Scan (9x4x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 14.6 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.07 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 30.6 W/kg
SAR(1 g) = 14 W/kg; SAR(10 g) = 6.38 W/kg
Smallest distance from peaks to all points 3 dB below = 10.8 mm
Ratio of SAR at M2 to SAR at M1 = 46.8%
Maximum value of SAR (measured) = 15.8 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2 2 2/Z Scan (1x1x22): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 6.919 (6.667, 7.038) [mm]
Maximum value of SAR (interpolated) = 25.8 W/kg


W/kg
14.600
11.682
8.763
5.845
2.927
0.0084


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
25
20
15
10
5
0
0.00
0.01
0.02
0.03
0.04
0.05
m

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:825
Procedure Name: SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.83 S/m; ε_r = 36.38; ρ = 1000 kg/m^3
Phantom section: Left Section

Date/Time: 1/12/2023 6:30:32 PM

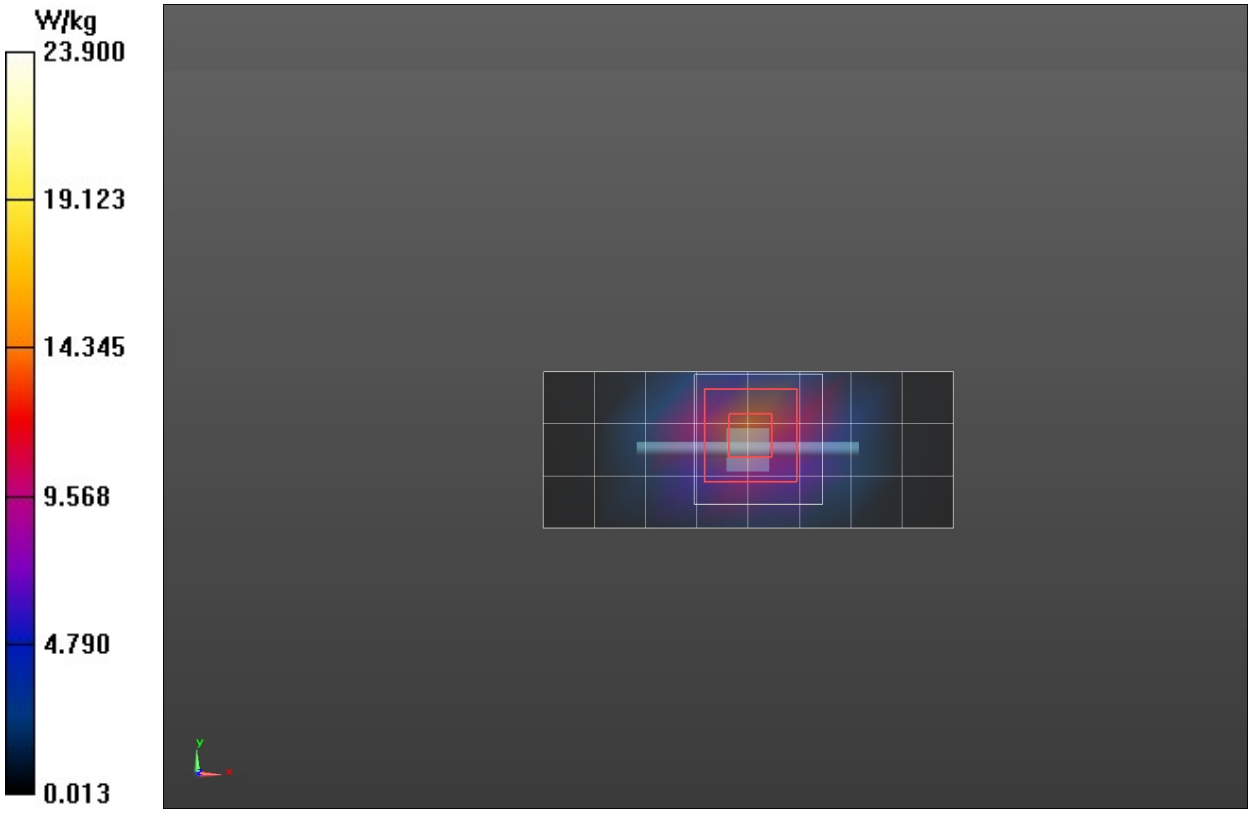
DASY5 Configuration:

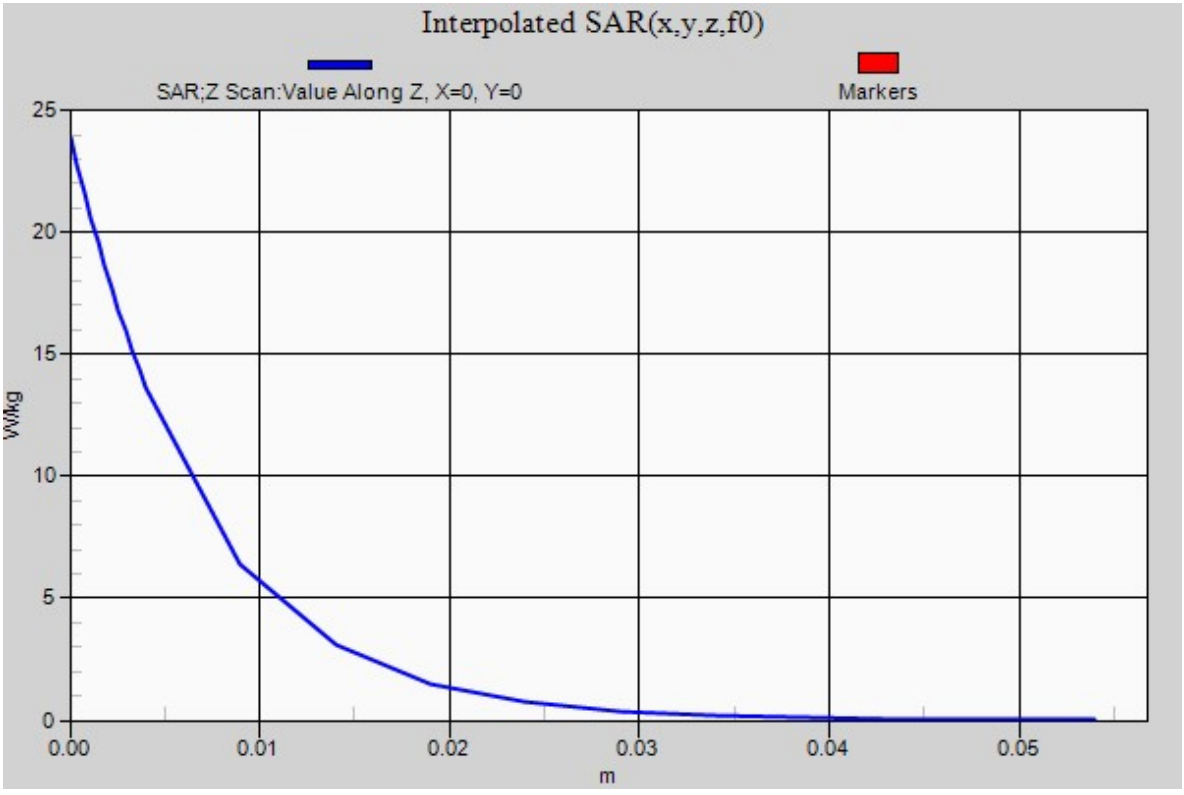
- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2450 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 00355
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2/Area Scan (9x4x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 14.0 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.50 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 28.7 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 5.88 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 46.1%
Maximum value of SAR (measured) = 14.6 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg_ 2/Z Scan (1x1x22): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 6.826 (6.611, 6.925) [mm]
Maximum value of SAR (interpolated) = 23.9 W/kg


W/kg
23.900
19.123
14.345
9.568
4.790
0.013


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
25
20
15
10
5
0
0.00
0.01
0.02
0.03
0.04
0.05
m

APPENDIX B – MEASUREMENT PLOTS OF MAXIMUM MEASURED SAR

Plot E1

DUT: A04596; Type: Extremity Worn Transmitter; Serial: 3431589964
Procedure Name: E1-A04596,Extremity-Back Side, 2412 MHz, Silcone Band-WIFI, DSSS-5.5Mbps

Communication System: UID 0, CW (0); Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.818 S/m; ε_r = 36.386; ρ = 1000 kg/m^3
Phantom section: Left Section

Date/Time: 12/15/2022 8:17:28 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2412 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 00355
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

2450H/E1-A04596,Extremity-Back Side, 2412 MHz, Silcone Band-WIFI, DSSS-5.5Mbps/Area Scan (8x8x1):
Measurement grid: dx=12mm, dy=12mm

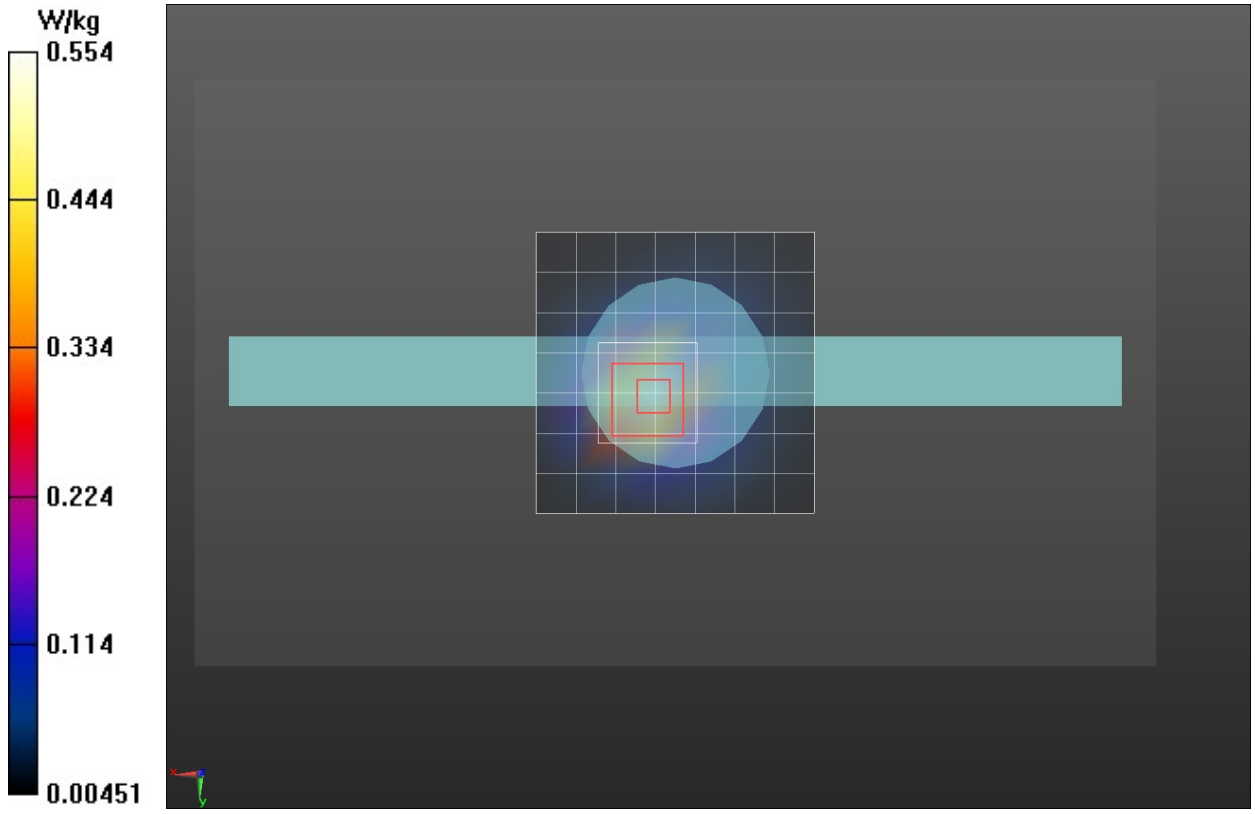
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.688 W/kg

2450H/E1-A04596,Extremity-Back Side, 2412 MHz, Silcone Band-WIFI, DSSS-5.5Mbps/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.71 V/m; Power Drift = -0.60 dB
Peak SAR (extrapolated) = 0.990 W/kg
SAR(1 g) = 0.536 W/kg; SAR(10 g) = 0.252 W/kg
Smallest distance from peaks to all points 3 dB below = 9.2 mm
Ratio of SAR at M2 to SAR at M1 = 55.4%

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.605 W/kg

2450H/E1-A04596,Extremity-Back Side, 2412 MHz, Silcone Band-WIFI, DSSS-5.5Mbps/Z Scan (1x1x17):
Measurement grid: dx=20mm, dy=20mm, dz=20mm

Info: Interpolated medium parameters used for SAR evaluation.
Penetration depth = n/a (n/a, 7.335) [mm]
Maximum value of SAR (interpolated) = 0.554 W/kg



Plot E5

DUT: A04596; Type: Extremity Worn Transmitter; Serial: 3431589964
Procedure Name: E5-A04596,Extremity-Back Side,ch-0 2402 MHz, B1,BT, GFSK

Communication System: UID 0, CW (0); Frequency: 2402 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2402 MHz; σ = 1.81 S/m; ε_r = 36.43; ρ = 1000 kg/m^3
Phantom section: Left Section

Date/Time: 1/4/2023 8:38:12 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2402 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 00355
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

2450H-1619- A04596 /E5-A04596,Extremity-Back Side,ch-0 2402 MHz, B1,BT, GFSK/Area Scan (6x6x1):
Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.150 W/kg

2450H-1619- A04596 /E5-A04596,Extremity-Back Side,ch-0 2402 MHz, B1,BT, GFSK/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.28 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.311 W/kg
SAR(1 g) = 0.162 W/kg; SAR(10 g) = 0.076 W/kg
Smallest distance from peaks to all points 3 dB below = 9.8 mm
Ratio of SAR at M2 to SAR at M1 = 55.6%

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.190 W/kg

2450H-1619- A04596 /E5-A04596,Extremity-Back Side,ch-0 2402 MHz, B1,BT, GFSK/Z Scan (1x1x17): Measurement grid: dx=20mm, dy=20mm, dz=20mm

Info: Interpolated medium parameters used for SAR evaluation.
Penetration depth = n/a (n/a, 7.686) [mm]
Maximum value of SAR (interpolated) = 0.271 W/kg