Test Report Serial Number:	45461740 R1.0
Test Report Date:	9 June 2022
Project Number:	1585

SAR Test Report - New Application

Applicant:

Garmin International Inc.
1200 East 151 St.
Olathe, KS, 66062
USA

Maximum *reported* SAR		
Body (1g):	0.34	W/kg
Simultaneous (1g):	0.34	
General Pop. Limit:	1.60	
Extremity (10g):	0.08	
General Pop. Limit:	4.00	

FCC ID:	IC Registration Number
IPH-04450	
Product Model Number / HVIN	Product Name / PMN
A04450	A04450

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 REVISION HISTORY

Revision History				
Samples Tested By:	Ben Hewson	**Date(s) of Evaluation:**		22 March - 3 April, 2022
Report Prepared By:	Art Voss	**Report Reviewed By:**		Art Voss
Report Revision	**Description of Revision**	**Revised Section**	**Revised By**	**Revision Date**
0.1	Draft	n/a	Art Voss	8 June 2022
1.0	Initial Release	n/a	Art Voss	9 June 2022

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-04450**
	ISED ID:	
Device Model(s) / HVIN:	A04450	
Device Marketing Name / PMN:	A04450	
Test Sample Serial No.:	Conducted: 3401137001 OTA: 3401137013 / 3401136969	
Device Type:	Low Power Digital Device Transmitter	
FCC Equipment Class:	Digital Transmission System (DTS), Part 15 Spread Spectrum Transmitter (DSS), Unlicensed National Information Infrastructure TX (NII)	
Transmit Frequency Range:	WiFi (DTS): 2412-2462MHz	
	BT/BLE (DSS, DTS, DSS): 2402-2480MHz	
	U-NII-1: 5180 - 5240, U-NII-3: 5745-5825	

Client Information	
Manuf. Max. Rated Output Power:	BT BR (DXX): 1.91dBm
	BT 2EDR (DSS): 3dBm
	BT 3EDR (DSS): 0dBm
	BT LE (DTS): 0dBm
	802.11b (DTS): 15.3dBm
	802.11g (DTS): 14.6dBm
	802.11n (DTS): 13.2dBm
	U-NII-1/802.11a (NII): 12.04dBm
	U-NII-1/802.11n (NII): 11.14Bm
	U-NII-1/802.11n40 (NII): 3.0dBm
	U-NII-1/802.11ac80 (NII): 0dBm
	U-NII-3/802.11a (NII): 12.78dBm
	U-NII-3/802.11n (NII): 12.55dBm
	U-NII-3/802.11n40 (NII): 12.78dBm
	U-NII-3/802.11ac80 (NII): 12.55dBm
Antenna Type and Gain:*	2450MHz: 2dBi PIFA, 5GHz: 7dBi PIFA
Modulation:	WiFi: DSSS, OFDM, CCK, MCS0-7
	BT BR: GFSK
	BT 2EDR: Pi/4-DQPSK
	Bt 3EDR: 8DPSK
	BLE: GMSK
DUT Power Source:	4.35 VDC Internal Li-Ion Battery
DUT Dimensions [LxWxH]	L x W x H: 245mm x 154mm x 21mm
Deviation(s) from standard/procedure:	None
Modification of DUT:	None

* Information on antenna gain provided by applicant.

3.0 SCOPE OF EVALUATION

This Certification Report was prepared on behalf of:

Garmin International Inc.

The A04450 is a Low Power Digital Transmitter that may be mounted or handheld, with a Wi-Fi transceiver that is capable of operating in the 2.4GHz WiFi/ BT and 5GHz U-NII frequency bands. The device is capable of operating simultaneously on the BT and U-NII bands. 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.

Application:

This is an application for a new device certification.

Scope:

The scope of this evaluation limited to the evaluation of SAR for intended and non-intended applications. It will include evaluation of the 2.4 GHz WiFi/BT and U-NII transmitters for all required RF exposure configurations including Extremity and Body Configuration as the device may be operational while in hand or on person (lap).

The Test Plan developed for this evaluation is based on the required test channels and configurations which produced the highest worst case SAR and where applicable, SAR test reduction and/or SAR test exclusion may be utilized. The DUT was evaluated for SAR at the maximum tune up tolerance and conducted output power level, preset by the manufacturer and in accordance with the procedures described in IEC/IEEE 62209-1528, FCC KDB 447498 and FCC KDB 248227.

4.0 NORMATIVE REFERENCES

Normative References*	
ANSI / ISO 17025:2005	General Requirements for competence of testing and calibration laboratories
FCC CFR Title 47 Part 2 Title 47: Part 2.1093:	Code of Federal Regulations Telecommunication Radiofrequency Radiation Exposure Evaluation: Portable Devices
IEEE International Committee on Electromagnetic Safety IEEE 1528-2013:	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEC International Standard IEC 62209-2 2010	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 2
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

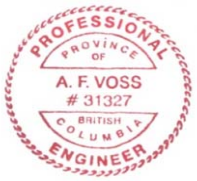
This measurement report demonstrates that samples of the product model(s) were evaluated for Specific Absorption Rate (SAR) on the date(s) shown, in accordance with the Measurement Procedures cited and were found to comply with the Standard(s) Applied based on the Exposure Limits of the Use Group indicated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

Applicant:	Model / HVIN:	
Garmin International Inc.	A04450	
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, IEC 62209-2	
Reason For Issue:	**Use Group:**	**Limits Applied:**
[x] New Certification	[x] General Population / Uncontrolled	[x] 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:**
		February 28, 2022

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.

Art Voss, P.Eng.
Technical Manager
Celltech Labs Inc.
8 June 2022
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

DASY 6 Measurement Controller

7.0 RF CONDUCTED POWER MEASUREMENT

Table 7.1 Conducted Power Measurements, WiFi

Conducted Power Measurements													
Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dB)	SAR Test Channel (Y/-)	Duty Cycle (%)	Crest Factor (1/DC)
WLAN 2.4G	802.11b	20	6	2437	CCK	1	14.97	15.30	0.034	-0.33	-	-	-
			6	2437	CCK	2	14.99	15.30	0.034	-0.31	-	-	-
			6	2437	DSSS	5.5	**15.30**	**15.30**	**0.034**	**0.00**	**Y**	**83.7**	**1.2**
			6	2437		11	15.07	15.30	0.034	-0.23	-	-	-
			1	2412		5.5	15.01	15.30	0.034	-0.29	-	-	-
			2	2417			14.90	15.30	0.034	-0.40	-	-	-
			3	2422			15.09	15.30	0.034	-0.21	-	-	-
			4	2427			14.92	15.30	0.034	-0.38	-	-	-
			5	2432			14.99	15.30	0.034	-0.31	-	-	-
			6	2437			15.30	15.30	0.034	0.00	-	-	-
			7	2442			15.21	15.30	0.034	-0.09	-	-	-
			8	2447			15.14	15.30	0.034	-0.16	-	-	-
			9	2452			15.19	15.30	0.034	-0.11	-	-	-
			10	2457			15.15	15.30	0.034	-0.15	-	-	-
			11	2462			15.21	15.30	0.034	-0.09	-	-	-
			12	2467			15.14	15.30	0.034	-0.16	-	-	-
			13	2472			15.24	15.30	0.034	-0.06	-	-	-
	802.11g	20	6	2437	OFDM	6	14.60	14.60	0.029	0.00	-	-	-
						9	14.57	14.60	0.029	-0.03	-	-	-
						12	14.46	14.60	0.029	-0.14	-	-	-
						18	14.48	14.60	0.029	-0.12	-	-	-
						24	12.51	14.60	0.029	-2.09	-	-	-
						36	12.80	14.60	0.029	-1.80	-	-	-
						48	11.53	14.60	0.029	-3.07	-	-	-
						54	11.58	14.60	0.029	-3.02	-	-	-
	802.11n	20	6	2437	MCS0	-	13.20	13.20	0.021	0.00	-	-	-
					MCS1		13.66	13.20	0.021	0.46	-	-	-
					MCS4		11.65	13.20	0.021	-1.55	-	-	-
					MCS7		10.81	13.20	0.021	-2.39	-	-	-

Table 7.2 Conducted Power Measurements, BT, BLE

Conducted Power Measurements													
Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dB)	SAR Test Channel (Y/-)	Duty Cycle (%)	Crest Factor (1/DC)
BT	BR	1	2	2402	GFSK	-	**1.91**	**1.91**	**0.002**	**0.00**	**Y**	**60.7**	**1.64**
			41	2441			1.13	1.91	0.002	-0.78	-	-	-
			80	2480			0.01	1.91	0.002	-1.90	-	-	-
	2EDR	1	2	2402	Pi/4-DQPSK	-	-1.78	3.00	0.002	-4.78	-	-	-
			41	2441			-1.21	3.00	0.002	-4.21	-	-	-
			80	2480			-2.08	3.00	0.002	-5.08	-	-	-
	3EDR	1	2	2402	8DPSK	-	-1.31	0.00	0.001	-1.31	-	-	-
			41	2441			-1.11	0.00	0.001	-1.11	-	-	-
			80	2480			-2.06	0.00	0.001	-2.06	-	-	-
	LE	1	37	2402	GFSK	-	0.51	0.00	0.001	0.51	-	-	-
			17	2440			0.85	0.00	0.001	0.85	-	-	-
			39	2480			0.10	0.00	0.001	0.10	-	-	-

Table 7.3 Conducted Power Measurements, U-NII

Conducted Power Measurements													
Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Modulation	Bit Rate (Mbps)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dB)	SAR Test Channel (Y/-)	Duty Cycle (%)	Crest Factor (1/DC)
U-NII-1	802.11a	20	36	5180	OFDM	6	11.29	12.04	0.016	-0.75	-	-	-
						9	11.84	12.04	0.016	-0.20	-	-	-
						24	11.71	12.04	0.016	-0.33	-	-	-
						54	**12.04**	**12.04**	**0.016**	**0.00**	**Y**	**66.2**	**1.51**
			40	5200		54	11.97	12.04	0.016	-0.07	-	-	-
			44	5220			11.84	12.04	0.016	-0.2	-	-	-
			48	5240			11.38	12.04	0.016	-0.66	-	-	-
	802.11n	20	36	5180	MCS0	-	10.45	11.14	0.013	-0.69	-	-	-
					MCS3		10.42	11.14	0.013	-0.72	-	-	-
					MCS7		11.04	11.14	0.013	-0.10	-	-	-
			40	5200	MCS7		**11.14**	**11.14**	**0.013**	**0.00**	**Y**	**50.5**	**1.98**
			44	5220			11.01	11.14	0.013	-0.13	-	-	-
			48	5240			11.01	11.14	0.013	-0.13	-	-	-
	802.11n40	40	38	5190	MCS7	-	11.65	3.00	0.002	8.65	-	-	-
			46	5230			**11.68**	**3.00**	**0.002**	**8.68**	**Y**	**43**	**2.32**
	802.11ac80	80	42	5210	MCS7	-	**11.65**	**0.00**	**0.001**	**11.65**	**Y**	**38.6**	**2.6**
U-NII-3	802.11a	20	149	5745	OFDM	6	12.40	12.78	0.019	-0.38	-	-	-
						9	12.46	12.78	0.019	-0.32	-	-	-
						24	12.34	12.78	0.019	-0.44	-	-	-
						54	**12.76**	**12.78**	**0.019**	**-0.02**	**Y**	**66.2**	**1.51**
			153	5765		54	12.47	12.78	0.019	-0.31	-	-	-
			157	5785			12.47	12.78	0.019	-0.31	-	-	-
			161	5805			12.55	12.78	0.019	-0.23	-	-	-
			165	5825			12.68	12.78	0.019	-0.1	-	-	-
	802.11n	20	149	5745	MCS0	-	11.76	12.55	0.018	-0.79	-	-	-
					MCS3		12.24	12.55	0.018	-0.31	-	-	-
					MCS7		12.50	12.55	0.018	-0.05	-	-	-
			153	5765	MCS7		12.23	12.55	0.018	-0.32	-	-	-
			157	5785			**12.53**	**12.55**	**0.018**	**-0.02**	**-**	**50.5**	**1.98**
			161	5805			12.44	12.55	0.018	-0.11	-	-	-
			165	5825			12.47	12.55	0.018	-0.08	-	-	-
	802.11n40	40	151	5755	MCS7	-	**12.06**	**12.78**	**0.019**	**-0.72**	**Y**	**43**	**2.32**
			159	5795			9.80	12.78	0.019	-2.98	-	-	-
	802.11ac80	80	155	5775	MCS7	-	**11.92**	**12.55**	**0.018**	**-0.63**	**Y**	**38.6**	**2.6**

Note: The rated power on the 802.11n-40 and 802.11ac-80 channels in the U-NII-1 band were reduced to meet Restricted Band requirements after the above conducted measurements were assessed.

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 specified by the manufacture 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 (*Nc*)

Table 8.1 Number of Test Channels

The intended use of the device is to be mounted on a vehicle' dashboard; however, the device could transmit while held in hand or on person. As such the device was evaluated for both Body and Extremity use.

Wi-FI SAR Evaluation:

SAR was evaluated in DSSS mode at the maximum 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 Ch1, Ch 6 and Ch 11; The highest conducted output power was found on Channel 6. As a result, this channel was selected for initial SAR evaluation.

SAR test reduction methodology was applied to reduce the total number of required test channels from the SAR test evaluation.

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.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

a) When KDB Publication 447498 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.

The initial test configuration for 2.4 GHz and 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. An initial test position was established for Both UNII1 and UNII 3 bands.

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

NOTE: The Bluetooth transmitter is capable of simultaneous transmission with the 5GHz WiFi Transmitter. The Bluetooth SAR was evaluated for simultaneous SAR.

As per KDB 447498 D04V01, where appropriate SAR test exclusion based on antenna test separation distances may be applied.

$$P_{\text{th}}\,(\text{mW}) = ERP_{20\,\text{cm}}\,(\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases} \quad \text{(B. 1)}$$

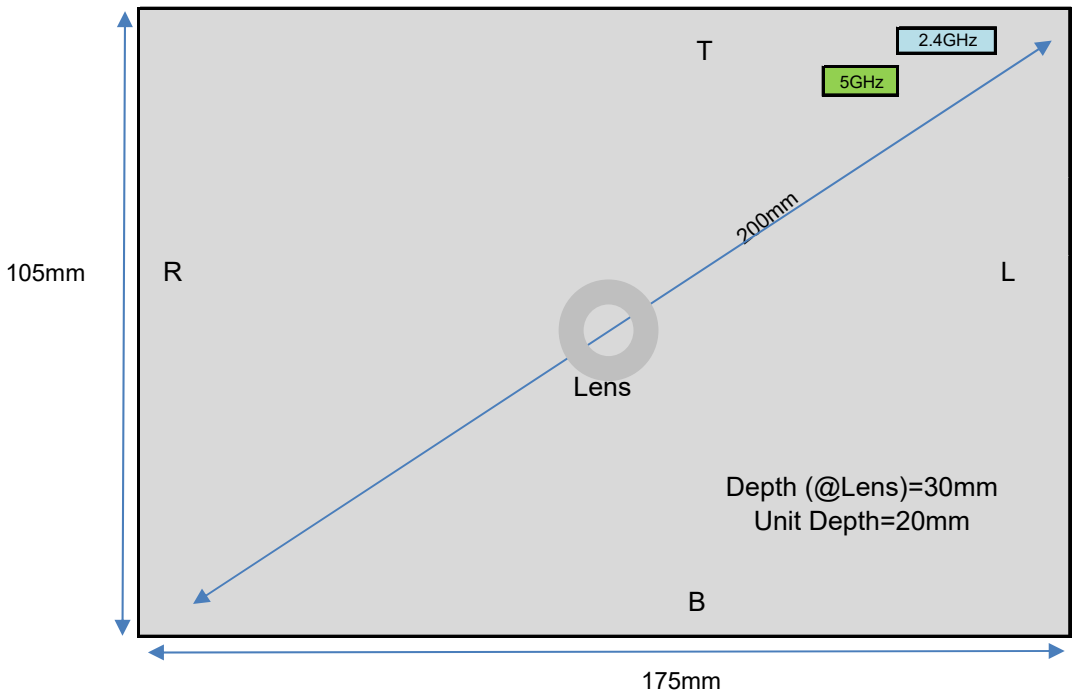
$$P_{\text{th}}\,(\text{mW}) = \begin{cases} ERP_{20\,\text{cm}}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\,\text{cm}} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases} \quad \text{(B. 2)}$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,\text{cm}}\sqrt{f}}\right)$$

Table 8.2 Antenna Distances

Topographic View
Back Side



Antenna	Top Edge (mm)	Left Edge (mm)	Bottom Edge (mm)	Right Edge (mm)	Depth (mm)
WLAN/BT	11.0	165.0	95.0	20.0	8.0
5GHz	14.0	160.0	90.0	25.0	8.0

Table 8.3 Body SAR test Exclusion Workchart

SAR Test Exclusion Analysis Antenna Separation to DUT Surfaces					
BODY Configuration (1g)		Band			
		BT/BLE ANT	2.4GHz WiFi	5GHz WLAN U-NII-1	5GHz WLAN U-NII-3
Exposure Position	Frequency (MHz)	2480	2462	5240	5825
	Power (mW)	2.00	34.00	19.00	19.00
	Antenna Gain (dBi)	2.00	2.00	7.00	7.00
	Antenna Gain (dBd)	-0.15	-0.15	4.85	4.85
	Total ERP (mW)	1.93	32.85	58.04	58.04
Back Side	Separation Distance (mm)	7.00	7.00	7.00	7.00
	Exclusion Threshold (Pth)(mW)	5.16	5.19	2.99	2.77
	Testing Required	No	Yes	Yes	Yes

~ Pth(mW) = ERP_{20cm}(mW) = 2040f for 0.3GHz ≤ f < 1.5GHz
~ Pth(mW) = ERP_{20cm}(mW) = 3060 for 1.5GHz ≤ f ≤ 6GHz
~ Pth(mW) = ERP_{20cm}(mW) * (d / 20cm)^{X} where x = -log10(60 / ERP_{20cm} √f) for d ≤ 20cm
~ Pth(mW) = ERP_{20cm}(mW)) for 20cm < d ≤ 40cm
~ Total ERP = Power + Gain(dBd)
~ Gain(dBd) = Gain(dBi) - 2.15

Table 8.4 Extremity SAR test Exclusion Workchart

SAR Test Exclusion Analysis Antenna Separation to DUT Surfaces					
EXTREMITY Configuration (10g)		Band			
		BT/BLE ANT	2.4GHz WiFi	5GHz WLAN U-NII-1	5GHz WLAN U-NII-3
Exposure Position	Frequency (MHz)	2480	2462	5240	5825
	Power (mW)	2.00	34.00	19.00	19.00
	Antenna Gain (dBi)	2.00	2.00	7.00	7.00
	Antenna Gain (dBd)	-0.15	-0.15	4.85	4.85
	Total ERP (mW)	1.93	32.85	58.04	58.04
Top Edge	Separation Distance (mm)	11.00	11.00	14.00	14.00
	Exclusion Threshold (Pth)(mW)	30.50	30.64	31.35	29.49
	Testing Required	No	Yes	Yes	Yes
Bottom Edge	Separation Distance (mm)	95.00	95.00	90.00	90.00
	Exclusion Threshold (Pth)(mW)	1852.80	1854.98	1468.15	1441.45
	Testing Required	No	No	No	No
Right Edge	Separation Distance (mm)	165.00	165.00	160.00	160.00
	Exclusion Threshold (Pth)(mW)	5303.02	5304.63	4823.09	4798.42
	Testing Required	No	No	No	No
Left Edge	Separation Distance (mm)	20.00	20.00	25.00	25.00
	Exclusion Threshold (Pth)(mW)	95.25	95.60	103.93	99.08
	Testing Required	No	No	No	No

~ Pth(mW) = ERP_{20cm}(mW) = 2040f for 0.3GHz ≤ f < 1.5GHz
~ Pth(mW) = ERP_{20cm}(mW) = 3060 for 1.5GHz ≤ f ≤ 6GHz
~ Pth(mW) = ERP_{20cm}(mW) * (d / 20cm)^{X} where x = -log10(60 / ERP_{20cm} √f) for d ≤ 20cm
~ Pth(mW) = ERP_{20cm}(mW)) for 20cm < d ≤ 40cm
~ Pth(mW) = ERP_{20cm}(mW) X 2.5 for 10g Extremity
~ Total ERP = Power + Gain(dBd)
~ Gain(dBd) = Gain(dBi) - 2.15

9.0 ACCESSORIES EVALUATED

Table 9.1 Manufacturer's Accessory List

There are no manufacturer's accessories available when used in a portable application.

10.0 SAR MEASUREMENT SUMMARY

Table 10.1: Measured Results – BODY

Measured 1g SAR Results - BODY Configuration																
Date	Plot ID	Test Frequency (*MHz*)	DUT Configuration					Accessories				DUT Spacing		Measured	SAR Drift (*dB*)
			Pos	Mode	BW	Mod	BR	Antenna ID	Battery ID	Body ID	Audio ID	DUT (*mm*)	Antenna (*mm*)	SAR (*W/kg*)	
22 Mar 2022	B1	2437	Back Touch	802.11b	20MHz	DSSS	5.5mbps	n/a	n/a	n/a	n/a	0	0	0.071	-0.460
2 Apr 2022	B10	5180	Back Touch	802.11a	20MHz	OFDM	54mbps	n/a	n/a	n/a	n/a	0	0	0.223	0.290
2 Apr 2022	B14	5200	Back Touch	802.11n	20MHz	MCS-7	-	n/a	n/a	n/a	n/a	0	0	0.182	0.780
3 Apr 2022	B20	5230	Back Touch	802.11n	40MHz	MCS-7	-	n/a	n/a	n/a	n/a	0	0	0.165	0.190
3 Apr 2022	B21	5210	Back Touch	802.11ac	80MHz	MCS-7	-	n/a	n/a	n/a	n/a	0	0	0.116	0.880
30 Mar 2022	B33	5785	w/c - Back	802.11n	20MHz	OFDM	54mbps	n/a	n/a	n/a	n/a	0	0	0.130	-0.140
30 Mar 2022	B37	5755	w/c - Back	802.11n	40MHz	MCS-7	-	n/a	n/a	n/a	n/a	0	0	0.084	1.390
Applicable SAR Limit								Use Group						Limit	
FCC CFR 2.1093			Health Canada Safety Code 6					General Population/User Unaware						1.6 W/kg	

Table 10.2: Measured Results – Extremity

Measured 10g SAR Results - EXTREMITY Configuration																
Date	Plot ID	Test Frequency (*MHz*)	DUT Configuration					Accessories				DUT Spacing		Measured	SAR Drift (*dB*)
			Pos	Mode	BW	Mod	BR	Antenna ID	Battery ID	Body ID	Audio ID	DUT (*mm*)	Antenna (*mm*)	SAR (*W/kg*)	
22 Mar 2022	E2	2437	Left Edge	802.11b	20MHz	DSSS	5.5mbps	n/a	n/a	n/a	n/a	0	0	0.016	0.430
22 Mar 2022	E4	2437	Top Edge	802.11b	20MHz	DSSS	5.5mbps	n/a	n/a	n/a	n/a	0	0	0.071	0.840
22 Mar 2022	E5	2402	Top Edge	BT	-	GFSK	-	n/a	n/a	n/a	n/a	0	0	0.000	4.920
2 Apr 2022	E11	5180	Left Edge	802.11a	20MHz	OFDM	54mbps	n/a	n/a	n/a	n/a	0	0	0.000	4.720
2 Apr 2022	E12	5180	Top Edge	802.11a	20MHz	OFDM	54mbps	n/a	n/a	n/a	n/a	0	0	0.048	2.660
29 Mar 2022	E31	5745	Left Edge	802.11a	20MHz	OFDM	54mbps	n/a	n/a	n/a	n/a	0	0	0.007	0.790
30 Mar 2022	E36	5745	Top Edge-R	802.11a	20MHz	OFDM	54mbps	n/a	n/a	n/a	n/a	0	0	0.037	1.990
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 11.1 SAR Scaling 1g

Scaling of Maximum Measured SAR (1g)					
Measured Parameters		Configuration			
		Body			
Plot ID		B10			
Maximum Measured SAR_M		0.223			(W/kg)
Frequency		5180			(MHz)
Drift	Power Drift	0.290 (1)			(dB)
Conducted Power		12.040			(dBm)
DC	Transmit Duty Cycle	66.200			(%)
Fluid Deviation from Target					
Δe	Permitivity	-6.91%	-3.34%	-3.34%	
Δσ	Conductivity	1.94%	7.26%	7.26%	

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

Fluid Sensitivity Calculation (1g)			IEC 62209-2 Annex F		
Delta SAR = Ce * Δe + Cσ * Δσ					(F.1)
Ce = (-0.0007854*f^3) + (0.009402*f^2) - (0.02742*f) - 0.2026					(F.2)
Cσ = (0.009804*f^3) - (0.08661*f^2) + (0.02981*f) + 0.7829					(F.3)
f	Frequency (GHz)	5.18			
Ce		-0.256			
Cσ		-0.053			
Ce * Δe		0.018			
Cσ * Δσ		-0.001			
ΔSAR		0.017 (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	12.040			(dBm)
Rated Conducted Power	12.040			(dBm)
ΔP	0.000 (4)			(dB)

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

Crest Factor				
Transmit Duty Cycle (DC)	66.200			(%)
CF (1/DC)	1.511			

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

Table 11.1 SAR Scaling 1g (Cont.)

Scaling of Maximum Measured SAR (1g)					
Measured Parameters		Configuration			
		Body			
Plot ID		B10			
Maximum Measured SAR_M		0.223			(W/kg)
Frequency		5180			(MHz)
Drift	Power Drift	0.290 (1)			(dB)
Conducted Power		12.040			(dBm)
DC	Transmit Duty Cycle	66.200			(%)
SAR Adjustment for Fluid Sensitivity					
$SAR_1 = SAR_M$ X [ΔSAR]		0.223			(W/kg)
SAR Adjustment for Tuneup Tolerance					
$SAR_2 = SAR_1$ + [ΔP]		0.223			(W/kg)
SAR Adjustment for Drift					
$SAR_3 = SAR_2$ + [Drift]		0.223			(W/kg)
SAR Adjustment for Crest Factor					
$SAR_4 = SAR_3$ x [CF]		0.337			(W/kg)
reported 1g SAR					
SAR_4		**0.34**			(W/kg)

Table 11.2 SAR Scaling 10g

Scaling of Maximum Measured SAR (10g)					
Measured Parameters		Configuration			
		Extremity	Extremity	Extremity	
Plot ID		E4	E5	E12	
Maximum Measured SAR_M		0.071	0.000	0.048	(W/kg)
Frequency		2437	2402	5180	(MHz)
Drift	Power Drift	0.840 (1)	4.920 (1)	2.660 (1)	(dB)
Conducted Power		15.300	1.910	12.040	(dBm)
DC	Transmit Duty Cycle	83.700	60.7	66.2	(%)
Fluid Deviation from Target					
Δe	Permitivity	-6.77%	-6.54%	-6.91%	
Δσ	Conductivity	2.41%	2.73%	1.94%	

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

Fluid Sensitivity Calculation (10g)			IEC 62209-2 Annex F		
Delta SAR = Ce * Δe + Cσ * Δσ					(F.1)
$Ce = (0.003456*f^3) - (0.03531*f^2) + (0.07675*f) - 0.186$					(F.4)
$C\sigma = (0.004479*f^3) - (0.01586*f^2) - (0.1972*f) + 0.7717$					(F.5)
f	Frequency (GHz)	2.437	2.402	5.18	
Ce		-0.159	-0.157	-0.256	
Cσ		0.262	0.269	-0.053	
Ce * Δe		0.011	0.010	0.018	
Cσ * Δσ		0.006	0.007	-0.001	
ΔSAR		0.017 (3)	0.018 (3)	0.017 (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	15.300	1.910	12.040	(dBm)
Rated Conducted Power	15.300	1.910	12.040	(dBm)
ΔP	0.000 (4)	0.000 (4)	0.000 (4)	(dB)

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

Crest Factor				
Transmit Duty Cycle (DC)	83.700	60.7	66.2	(%)
CF (1/DC)	1.195	1.65	1.51	

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

Table 11.2 SAR Scaling 10g (Cont.)

Scaling of Maximum Measured SAR (10g)					
Measured Parameters		Configuration			
		Extremity	Extremity	Extremity	
Plot ID		E4	E5	E12	
Maximum Measured SAR_M		0.071	0.000	0.048	(W/kg)
Frequency		2437	2402	5180	(MHz)
Drift	Power Drift	0.840 (1)	4.920 (1)	2.660 (1)	(dB)
Conducted Power		15.300	1.910	12.040	(dBm)
DC	Transmit Duty Cycle	83.700	60.7	66.2	(%)
SAR Adjustment for Fluid Sensitivity					
$SAR_1 = SAR_M$ X [ΔSAR]		0.071	0.000	0.048	(W/kg)
SAR Adjustment for Tuneup Tolerance					
$SAR_2 = SAR_1$ + [ΔP]		0.071	0.000	0.048	(W/kg)
SAR Adjustment for Drift					
$SAR_3 = SAR_2$ + [Drift]		0.071	0.000	0.048	(W/kg)
SAR Adjustment for Crest Factor					
$SAR_4 = SAR_3$ x [CF]		0.084	0.000	0.072	(W/kg)
reported 10g SAR					
SAR_4		**0.08**	**0.00**	**0.07**	(W/kg)

NOTES to Table
Scaling of the Maximum Measured SAR is based on the highest 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, Body and/or Head 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 the Annexes of this report. NOTE: Some of the scaling factors in Steps 1 through 4may not apply and are identified by grayed fields.
Step 1
Per IEC/IEEE 62209-1528, FCC KDB 865664, ISED RSS-102 and ISED Notice 2012-DRS0529 . Scaling required only when Measured Fluid Deviation is greater than 5%. If the Measured Fluid Deviation is greater than 5%, Table 10.1 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 IEC/IEEE 62209-1528, FCC KDB 865664 and ISED RSS-102. 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, FCC KDB 865664 and ISED RSS-102. Scaling required only when Measured Drift is (-) Negative. The absolute value of Measured Drift is added to Reported.
Step 4
Per IEC/IEEE 62209-1528, FCC KDB 865664 and ISED RSS-102. When the transmit Duty Cyle (DC) is less than 100%, the *reported* SAR must be scaled to 100% by the Crest Factor (CF). CF = 1/DC where DC is in decimal.
Step 5
The Reported SAR is the Maximum Final Adjusted SAR from the applicable Steps 1 through 4and are reported on Page 1 of this report.

11.3 Simultaneous Transmission SAR Analysis

Only the Bluetooth and U-NII transmitters are capable of simultaneous transmission. Since the Body configuration resulted in the highest measured SAR, only the Body configuration SAR will be considered.

From Table 11.1 and Table 11.2 above, the *reported* Standalone SAR are as follows:
Bluetooth (SAR_{BT}): 0.00W/kg
WiFi (SAR_{WiFiII}): 0.34W/kg

Simultaneous SAR (SAR_{TOT}) = SAR_{BT} + SAR_{WiFi} = 0.00 + 0.34 = **0.34W/kg**

12.0 SAR EXPOSURE LIMITS

Table 12.1 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

13.1 Day Log

DAY LOG								
Date	Ambient Temp (°C)	Fluid Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Fluid Dielectric	SPC	Test	Task
Mar 21 2022	26.7	24.8	20%	102.5	X	X		2450H
Mar 22 2022	25.6	24.2	21%	102.6			X	2450H
Mar 28 2022	23.0	20.7	31%	100.6	X	X	X	5250H/5750H
Mar 29 2022	22.6	20.3	27%	101.7			X	5750H
Mar 30 2022	21.5	20.7	27%	101.4			X	5750H
April 2 2022	21.4	20.0	25%	101.0			X	5250H
April 3 2022	21.8	20.6	22%	101.2			X	5250H

13.2 DUT Setup and Configuration

DUT Setup and Configuration
Overview
The A04450 was evaluated for Body and Extremity SAR at the maximum conducted output power level, preset by the manufacturer, with a fully charged battery in unmodulated continuous transmit operation (Maximum duty cycle), as provided by the manufacturer with a unit set up and pre-installed with Compliance Test Mode.

13.3 DUT Positioning

DUT Positioning
Positioning
The DUT Positioner was securely fastened to the Phantom Platform to ensure consistent positioning of the DUT for each test evaluation.
FACE Configuration
This device is not capable of voice communication and was not tested in the FACE configuration.
BODY Configuration
There are no Body-Worn and Audio Accessories for this device and was not evaluated for BODY configuration.
HEAD Configuration
This device is not intended to be held to the ear and was not tested in the HEAD configuration.
EXTREMITY Configuration
The DUT, was securely clamped into the device holder with the surface of the DUT normally in contact with the body (hand) in direct contact with the bottom of the phantom, or 0mm separation from the DUT to the phantom resembling that for which it was intended to be used.

13.4 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 SAR column are the SAR values reported by the SAR Measurement Server with the DUT operating at maximum 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.

13.5 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 62201-1 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 IEEE 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.

13.6 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	

13.7 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	

13.8 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 14.1 Measurement Uncertainty

UNCERTAINTY BUDGET FOR DEVICE EVALUATION (IEEE 1528-2013 Table 9)									
Source of Uncertainty	**IEEE 1528 Section**	**Toler ±%**	**Prob Dist**	**Div**	**c_i**	**c_i**	**Stand Unct ±%**	**Stand Unct ±%**	**V_i or V_{eff}**
Measurement System					(1g)	(10g)	(1g)	(10g)	
EX3DV4 Probe Calibration** (*k*=1)	E.2.1	6.7	N	1	1	1	**6.7**	**6.7**	∞
Axial Isotropy** (*k*=1)	E.2.2	0.6	R	√3	0.7	0.7	**0.2**	**0.2**	∞
Hemispherical Isotropy** (*k*=1)	E.2.2	3.2	R	√3	0.7	0.7	**1.3**	**1.3**	∞
Boundary Effect*	E.2.3	1.0	R	√3	1	1	0.6	0.6	∞
Linearity** (*k*=1)	E.2.4	**0.5**	R	√3	1	1	**0.3**	**0.3**	∞
System Detection Limits*	E.2.4	1.0	R	√3	1	1	0.6	0.6	∞
Modulation Response** (*k*=1)	E.2.5	**8.3**	R	√3	1	1	**4.8**	**4.8**	∞
Readout Electronics*	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time*	E.2.7	0.8	R	√3	1	1	0.5	0.5	∞
Integration Time*	E.2.8	2.6	R	√3	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	**0.0**	R	√3	1	1	0.0	0.0	**10**
RF Ambient Conditions - Reflection	E.6.1	**0.0**	R	√3	1	1	0.0	0.0	**10**
Probe Positioner Mechanical Tolerance*	E.6.2	0.0	R	√3	1	1	0.0	0.0	∞
Probe Positioning wrt Phantom Shell*	E.6.3	0.4	R	√3	1	1	0.2	0.2	∞
Post-processing*	E.5	2.0	R	√3	1	1	1.2	1.2	∞
Test Sample Related									
Test Sample Positioning	E.4.2	**2.2**	N	1	1	1	2.2	2.2	**5**
Device Holder Uncertainty*	E.4.1	3.6	N	1	1	1	3.6	3.6	∞
SAR Drift Measurement(2)	E.2.9	0.0	R	√3	1	1	0.0	0.0	∞
SAR Power Scaling(3)	E.6.5	0.0	R	√3	1	1	0.0	0.0	∞
Phantom and Tissue Parameters									
Phantom Uncertainty*	E.3.1	6.1	R	√3	1	1	3.5	3.5	∞
SAR Correction Uncertainty	E.3.2	**1.6**	N	1	1	0.84	1.6	1.3	∞
Liquid Conductivity (measurement)	E.3.3	**5.0**	N	1	0.78	0.71	3.9	3.6	**10**
Liquid Permittivity (measurement)	E.3.3	**5.0**	N	1	0.23	0.26	1.2	1.3	**10**
Liquid Conductivity (Temperature)	E.3.2	**0.4**	R	√3	0.78	0.71	0.2	0.2	**10**
Liquid Permittivity Temperature)	E.3.2	**0.2**	R	√3	0.23	0.26	0.0	0.0	**10**
Effective Degrees of Freedom(1)								**V_{eff} =**	**1141**
Combined Standard Uncertainty			**RSS**				**11.1**	**11.0**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**22.2**	**21.9**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003									

(1) The Effective Degrees of Freedom is > 30

Therefore a coverage factor of k=2 represents an approximate confidence level of 95%.

(2) The SAR Value is compensated for Drift

(3) SAR Power Scaling not Required

* Provided by SPEAG for DASY4

Table 14.2 Calculation of Degrees of Freedom

Calculation of the Degrees and Effective Degrees of Freedom	
$v_i = n - 1$	$v_{eff} = \frac{u_c^4}{\frac{m}{\sum_{i=1} \frac{c_i^4 u_i^4}{v_i}}}$

15.0 FLUID DIELECTRIC PARAMETERS

Table 15.1 Fluid Dielectric Parameters 5250MHz HEAD TSL

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Aprel Laboratory
Test Result for UIM Dielectric Parameter
Sat 02/Apr/2022 11:04:54
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
5.1500	36.04	4.60	33.59	4.61
5.1600	36.03	4.61	33.54	4.67
5.1700	36.02	4.62	33.19	4.64
5.1800	36.01	4.63	33.52	4.72
5.1900	36.00	4.64	33.50	4.74
5.2000	35.99	4.65	33.41	4.78
5.2100	35.97	4.67	33.34	4.70
5.2200	35.96	4.68	33.57	4.79
5.2300	35.95	4.69	33.52	4.75
5.2400	35.94	4.70	33.54	4.74
5.2500	35.93	4.71	33.58	4.84
5.2600	35.92	4.72	33.35	4.87
5.2700	35.91	4.73	33.43	4.80
5.2800	35.89	4.74	33.46	4.84
5.2900	35.88	4.75	33.33	4.84
5.3000	35.87	4.76	33.61	4.91
5.3100	35.86	4.77	33.82	4.94
5.3200	35.85	4.78	33.55	4.89
5.3300	35.84	4.79	33.44	4.88
5.3400	35.83	4.80	33.33	4.92
5.3500	35.81	4.81	33.00	4.91

FLUID DIELECTRIC PARAMETERS

Date:	2 Apr 2022	Fluid Temp:	20	Frequency:	5250MHz	Tissue:	Head

Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
5150.0000		33.5900	4.6100	36.0400	4.60	-6.80%	0.22%
5160.0000		33.5400	4.6700	36.0300	4.61	-6.91%	1.30%
5170.0000		33.1900	4.6400	36.0200	4.62	-7.86%	0.43%
5180.0000	*	33.5200	4.7200	36.0100	4.63	-6.91%	1.94%
5190.0000		33.5000	4.7400	36.0000	4.64	-6.94%	2.16%
5200.0000	*	33.4100	4.7800	35.9900	4.65	-7.17%	2.80%
5210.0000	*	33.3400	4.7000	35.9700	4.67	-7.31%	0.64%
5220.0000		33.5700	4.7900	35.9600	4.68	-6.65%	2.35%
5230.0000	*	33.5200	4.7500	35.9500	4.69	-6.76%	1.28%
5240.0000		33.5400	4.7400	35.9400	4.70	-6.68%	0.85%
5250.0000		33.5800	4.8400	35.9300	4.71	-6.54%	2.76%
5260.0000		33.3500	4.8700	35.9200	4.72	-7.15%	3.18%
5270.0000		33.4300	4.8000	35.9100	4.73	-6.91%	1.48%
5280.0000		33.4600	4.8400	35.8900	4.74	-6.77%	2.11%
5290.0000		33.3300	4.8400	35.8800	4.75	-7.11%	1.89%
5300.0000		33.6100	4.9100	35.8700	4.76	-6.30%	3.15%
5310.0000		33.8200	4.9400	35.8600	4.77	-5.69%	3.56%
5320.0000		33.5500	4.8900	35.8500	4.78	-6.42%	2.30%
5330.0000		33.4400	4.8800	35.8400	4.79	-6.70%	1.88%
5340.0000		33.3300	4.9200	35.8300	4.80	-6.98%	2.50%
5350.0000		33.0000	4.9100	35.8100	4.81	-7.85%	2.08%

*Channel Frequency Tested

Table 15.3 Fluid Dielectric Parameters 5750MHz HEAD TSL

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Aprel Laboratory
Test Result for UIM Dielectric Parameter
Mon 28/Mar/2022 11:28:33
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
5.6500	35.47	5.12	32.53	5.35
5.6600	35.46	5.13	32.47	5.36
5.6700	35.45	5.14	32.43	5.27
5.6800	35.44	5.15	32.59	5.35
5.6900	35.43	5.16	32.32	5.30
5.7000	35.41	5.17	32.43	5.40
5.7100	35.40	5.18	32.25	5.37
5.7200	35.39	5.19	32.40	5.46
5.7300	35.38	5.20	32.58	5.41
5.7400	35.37	5.21	32.06	5.41
5.7500	35.36	5.22	32.45	5.45
5.7600	35.35	5.23	32.26	5.44
5.7700	35.33	5.24	32.30	5.50
5.7800	35.32	5.25	32.45	5.46
5.7900	35.31	5.26	32.43	5.47
5.8000	35.30	5.27	32.27	5.44
5.8100	35.29	5.28	32.12	5.49
5.8200	35.28	5.29	31.89	5.41
5.8300	35.27	5.30	32.35	5.44
5.8400	35.25	5.31	32.32	5.50
5.8500	35.24	5.32	31.92	5.49

FLUID DIELECTRIC PARAMETERS

Date:	28 Mar 2022	Fluid Temp:	23.5	Frequency:	5750MHz	Tissue:	Head

Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
5650.0000		32.5300	5.3500	35.4700	5.12	-8.29%	4.49%
5660.0000		32.4700	5.3600	35.4600	5.13	-8.43%	4.48%
5670.0000		32.4300	5.2700	35.4500	5.14	-8.52%	2.53%
5680.0000		32.5900	5.3500	35.4400	5.15	-8.04%	3.88%
5690.0000		32.3200	5.3000	35.4300	5.16	-8.78%	2.71%
5700.0000		32.4300	5.4000	35.4100	5.17	-8.42%	4.45%
5710.0000		32.2500	5.3700	35.4000	5.18	-8.90%	3.67%
5720.0000		32.4000	5.4600	35.3900	5.19	-8.45%	5.20%
5730.0000		32.5800	5.4100	35.3800	5.20	-7.91%	4.04%
5740.0000		32.0600	5.4100	35.3700	5.21	-9.36%	3.84%
5745.0000	*	32.2550	5.4300	35.3650	5.22	-8.79%	4.12%
5750.0000		32.4500	5.4500	35.3600	5.22	-8.23%	4.41%
5755.0000	*	32.3550	5.4450	35.3550	5.23	-8.49%	4.21%
5760.0000		32.2600	5.4400	35.3500	5.23	-8.74%	4.02%
5770.0000		32.3000	5.5000	35.3300	5.24	-8.58%	4.96%
5775.0000	*	32.3750	5.4800	35.3250	5.25	-8.35%	4.48%
5780.0000		32.4500	5.4600	35.3200	5.25	-8.13%	4.00%
5785.0000	*	32.4400	5.4650	35.3150	5.26	-8.14%	4.00%
5790.0000		32.4300	5.4700	35.3100	5.26	-8.16%	3.99%
5800.0000		32.2700	5.4400	35.3000	5.27	-8.58%	3.23%
5810.0000		32.1200	5.4900	35.2900	5.28	-8.98%	3.98%
5820.0000		31.8900	5.4100	35.2800	5.29	-9.61%	2.27%
5830.0000		32.3500	5.4400	35.2700	5.30	-8.28%	2.64%
5840.0000		32.3200	5.5000	35.2500	5.31	-8.31%	3.58%
5850.0000		31.9200	5.4900	35.2400	5.32	-9.42%	3.20%

*Channel Frequency Tested

Table 15.4 Fluid Dielectric Parameters 2450MHz HEAD TSL

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Aprel Laboratory
Test Result for UIM Dielectric Parameter
Mon 21/Mar/2022 15:20:35
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
2.3500	39.38	1.71	36.44	1.78
2.3600	39.36	1.72	36.65	1.79
2.3700	39.34	1.73	36.71	1.83
2.3800	39.32	1.74	36.74	1.80
2.3900	39.31	1.75	36.82	1.80
2.4000	39.29	1.76	36.73	1.81
2.4100	39.27	1.76	36.67	1.80
2.4200	39.25	1.77	36.68	1.81
2.4300	39.24	1.78	36.57	1.83
2.4400	39.22	1.79	36.57	1.83
2.4500	39.20	1.80	36.51	1.84
2.4600	39.19	1.81	36.54	1.86
2.4700	39.17	1.82	36.48	1.90
2.4800	39.16	1.83	36.61	1.87
2.4900	39.15	1.84	36.55	1.92
2.5000	39.14	1.85	36.60	1.93
2.5100	39.12	1.87	36.58	1.93
2.5200	39.11	1.88	36.40	1.94
2.5300	39.10	1.89	36.43	1.94
2.5400	39.09	1.90	36.38	1.93
2.5500	39.07	1.91	36.28	1.93

FLUID DIELECTRIC PARAMETERS

Date:	21 Mar 2022	Fluid Temp:	24.8	Frequency:	2450MHz	Tissue:	Head

Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
2350.0000		36.4400	1.7800	39.3800	1.71	-7.47%	4.09%
2360.0000		36.6500	1.7900	39.3600	1.72	-6.89%	4.07%
2370.0000		36.7100	1.8300	39.3400	1.73	-6.69%	5.78%
2380.0000		36.7400	1.8000	39.3200	1.74	-6.56%	3.45%
2390.0000		36.8200	1.8000	39.3100	1.75	-6.33%	2.86%
2400.0000		36.7300	1.8100	39.2900	1.76	-6.52%	2.84%
2402.0000	*	36.7180	1.8080	39.2860	1.76	-6.54%	2.73%
2410.0000		36.6700	1.8000	39.2700	1.76	-6.62%	2.27%
2420.0000		36.6800	1.8100	39.2500	1.77	-6.55%	2.26%
2430.0000		36.5700	1.8300	39.2400	1.78	-6.80%	2.81%
2437.0000	*	36.5700	1.8300	39.2260	1.79	-6.77%	2.41%
2440.0000		36.5700	1.8300	39.2200	1.79	-6.76%	2.23%
2450.0000		36.5100	1.8400	39.2000	1.80	-6.86%	2.22%
2460.0000		36.5400	1.8600	39.1900	1.81	-6.76%	2.76%
2470.0000		36.4800	1.9000	39.1700	1.82	-6.87%	4.40%
2490.0000		36.5500	1.9200	39.1500	1.84	-6.64%	4.35%
2500.0000		36.6000	1.9300	39.1400	1.85	-6.49%	4.32%
2510.0000		36.5800	1.9300	39.1200	1.87	-6.49%	3.21%
2520.0000		36.4000	1.9400	39.1100	1.88	-6.93%	3.19%
2530.0000		36.4300	1.9400	39.1000	1.89	-6.83%	2.65%
2540.0000		36.3800	1.9300	39.0900	1.90	-6.93%	1.58%
2550.0000		36.2800	1.9300	39.0700	1.91	-7.14%	1.05%

*Channel Frequency Tested

16.0 SYSTEM VERIFICATION TEST RESULTS

Table 16.1 System Verification Results 5250MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
April 2 2022		5250	D5GHzV2		1031
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	20.0	21	25%	50	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
33.58	35.93	-6.54%	4.84	4.71	2.76%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
3.93	3.97	-1.09%	1.19	1.15	3.88%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
78.60	79.47	-1.09%	23.80	22.91	3.88%

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 IEEE 1528-2013, FCC KDB 846224, IEC 62209-1 and IEC 62209-1528.

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 5750MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
Mar 28 2022		5750	D5GHzV2		1031
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	20.7	23	31%	50	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
32.45	35.36	-8.23%	5.45	5.22	4.41%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
4.05	3.78	7.23%	1.16	1.10	5.41%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
81.00	75.54	7.23%	23.20	22.01	5.41%

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 IEEE 1528-2013, FCC KDB 846224, IEC 62209-1 and IEC 62209-1528.

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 16.3 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
Mar 21 2022		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	24.8	27	20%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
36.51	39.20	-6.86%	1.84	1.80	2.22%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
14.00	13.18	6.22%	6.46	6.01	7.58%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
56.00	52.72	6.22%	25.84	24.02	7.60%

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 IEEE 1528-2013, FCC KDB 846224, IEC 62209-1 and IEC 62209-1528.

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 17.1 System Validation Summary

System Validation Summary											
Frequency (MHz)	Validation Date	Probe Model	Probe S/N	Validation Source	Source S/N	Tissue	Tissue Dielectrics		Validation Results		
							Permitivity	Conductivity	Sensitivity	Linearity	Isotropy
2450	29-Jun-21	EX3DV4	3600	D2450V2	825	Head	38.53	1.85	Pass	Pass	Pass
5250	25-May-21	EX3DV4	3600	D5GHzV2	1031	Head	33.74	4.9	Pass	Pass	Pass
5750	28-May-21	EX3DV4	3600	D5GHzV2	1031	Head	34.99	5.10	Pass	Pass	Pass

18.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 18.1 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 V52.10.0.1446
	Postprocessing Software: SEMCAD X, V14.6.10(Deployment Build)
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

Measurement System Specification

Probe Specification

Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In head simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in head tissue (rotation around probe axis) ± 0.4 dB in head tissue (rotation normal to probe axis)
Dynamic Range:	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm; Tip length: 16 mm; Body diameter: 12 mm; Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz; Compliance tests of mobile phone

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, IEEE 1528-2013, IEC 62209-1 and IEC 62209-2.

ELI 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 19.1 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	22-Apr-21	22-Apr-22
-EX3DV4 E-Field Probe	00213	3600	20-Apr-21	20-Apr-22
-CLA 30 Validation Dipole	00300	1005	18-Mar-20	18-Mar-23
-CLA150 Validation Dipole	00251	4007	18-Mar-20	18-Mar-23
-D450V3 Validation Dipole	00221	1068	27-Apr-21	27-Apr-24
-D750V3 Validation Dipole	00238	1061	21-Mar-19	21-Mar-22
-D835V2 Validation Dipole	00217	4D075	27-Apr-21	27-Apr-24
-D900V2 Validation Dipole	00020	54	16-Mar-20	16-Mar-23
ALS-D-01640-S-2	00299	207-00102	15-Dec-20	15-Dec-23
-D1800V2 Validation Dipole	00222	247	16-Mar-20	16-Mar-23
-D1900V2 Validation Dipole	00218	5d107	16-Mar-20	16-Mar-23
ALS-D-2300-S-2	00328	218-00201	26-Feb-19	26-Feb-22
-D2450V2 Validation Dipole	00219	825	24-Apr-21	24-Apr-24
ALS-D-2600-S-2	00327	225-00926	26-Feb-19	26-Feb-22
-D5GHzV2 Validation Dipole	00126	1031	27-Apr-21	27-Apr-24
ELI Phantom	00247	1234	CNR	CNR
SAM Phantom	00154	1033	CNR	CNR
HP 85070C Dielectric Probe Kit	00033	none	CNR	CNR
Gigatronics 8652A Power Meter	00007	1835801	26-Mar-19	26-Mar-22
Gigatronics 80701A Power Sensor	00186	1837002	COU	COU
Gigatronics 80334A Power Sensor	00237	1837001	26-Mar-19	26-Mar-22
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	6-Aug-22
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

20.0 FLUID COMPOSITION

Table 20.1 Fluid Composition 2450MHz HEAD TSL

Tissue Simulating Liquid (TSL) Composition				2450MHz Body
Component by Percent Weight				
Water	Glycol	Salt(1)	HEC(2)	Bacteriacide(3)
69.98	30.0	0.02	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

Table 20.2 Fluid Composition 5250, 5750MHz HEAD TSL
The 5GHz Head TSL is a SPEAG proprietary broad band fluid:

Type: **HBBL3500-5500V2**
Batch number: **131210-2**
P/N: **SL AAH 502 AC**

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 = 1.84 S/m; ε_r = 36.51; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 3/21/2022 3:49:19 PM

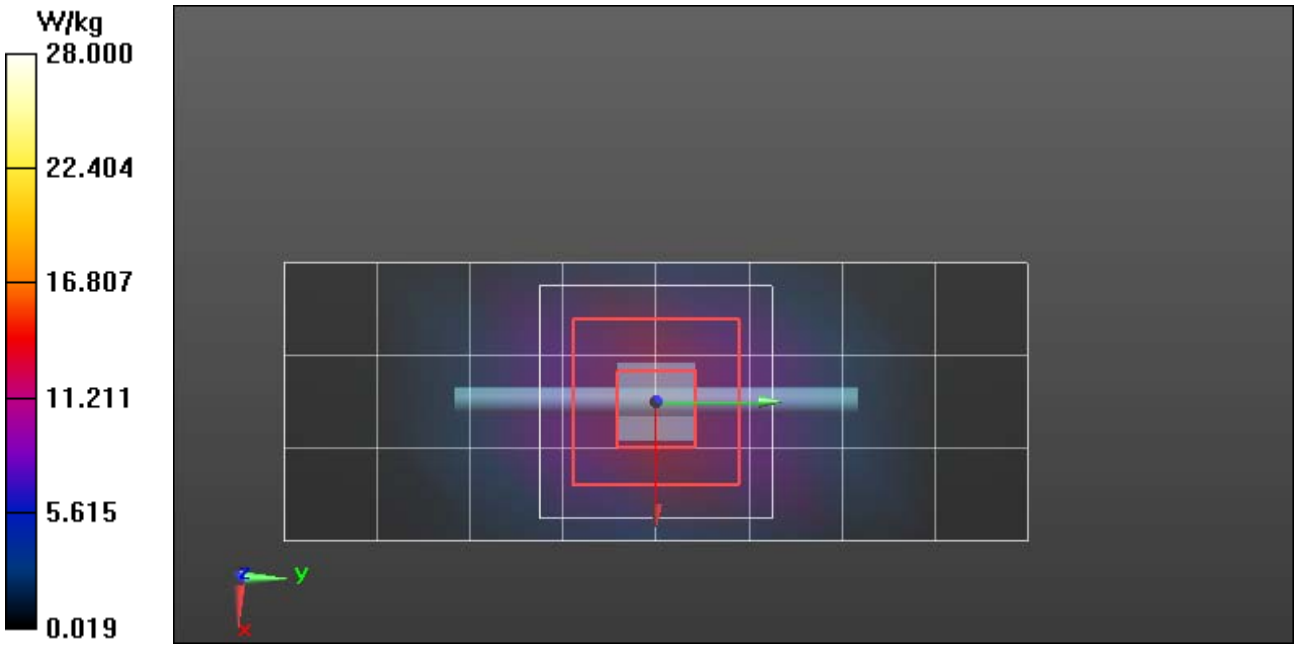
DASY5 Configuration:

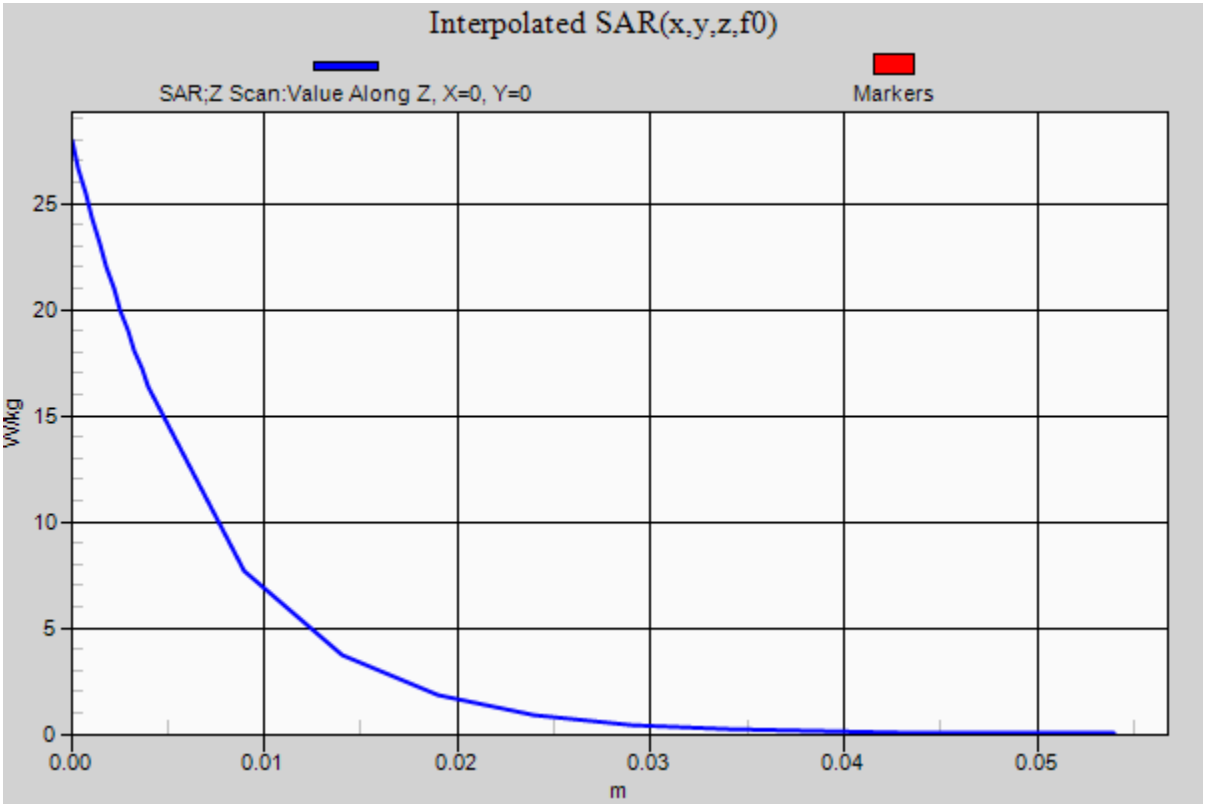
- Probe: EX3DV4 - SN3600; ConvF(6.45, 6.45, 6.45) @ 2450 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/22/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); 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 (4x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 12.7 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 = 93.24 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 29.9 W/kg
SAR(1 g) = 14 W/kg; SAR(10 g) = 6.46 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 48.1%
Maximum value of SAR (measured) = 15.9 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 = 6.947 (6.613, 7.103) [mm]
Maximum value of SAR (interpolated) = 28.0 W/kg


W/kg
28.000
22.404
16.807
11.211
5.615
0.019
y
z
x


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 D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1031
Procedure Name: SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 3

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5250 MHz; σ = 4.84 S/m; ε_r = 33.58; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 4/2/2022 11:50:11 AM

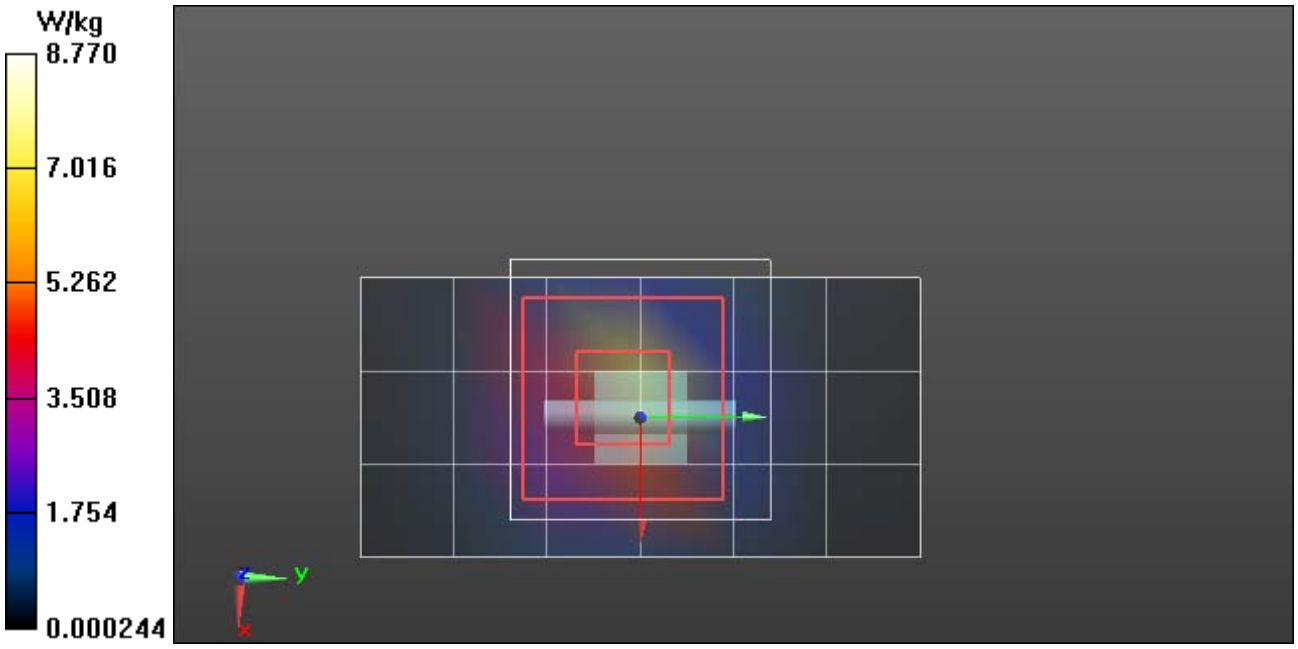
DASY5 Configuration:

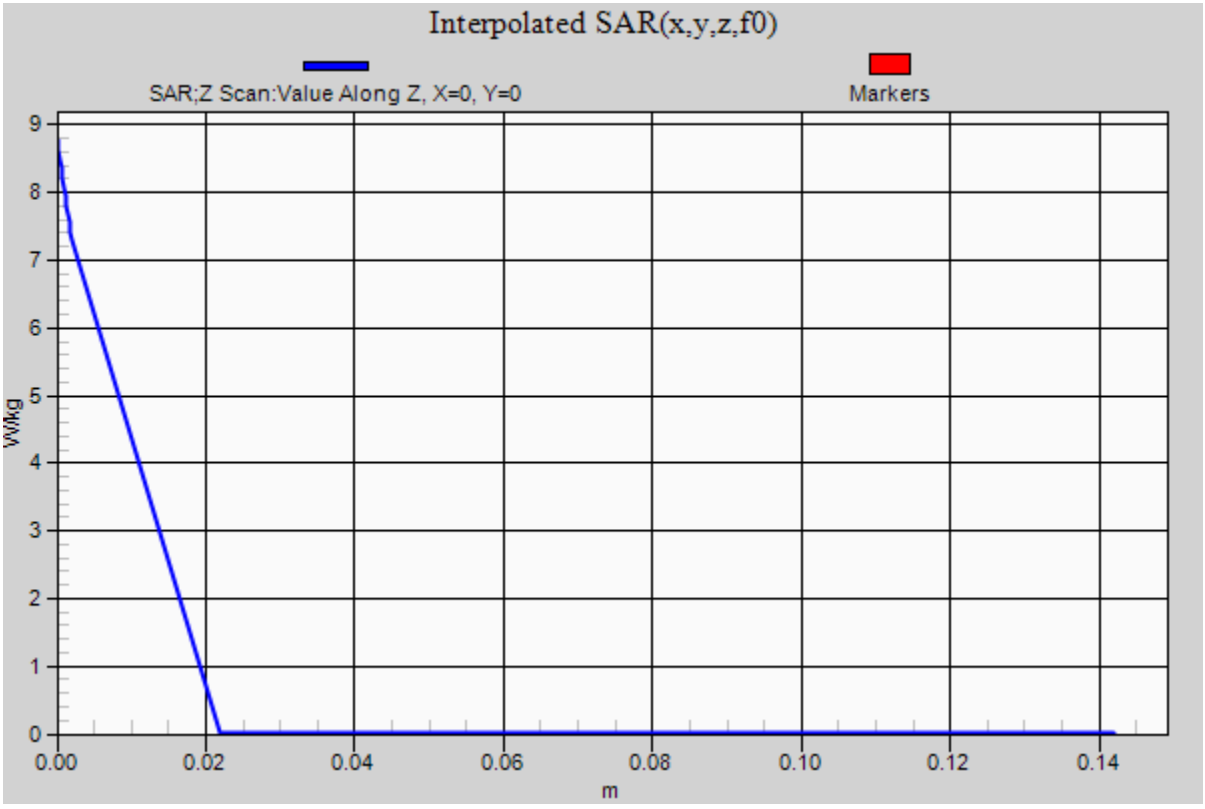
- Probe: EX3DV4 - SN3600; ConvF(4.41, 4.41, 4.41) @ 5250 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/22/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 3/Area Scan (4x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 6.89 W/kg

SPC/SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 3/Zoom Scan (8x8x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 29.66 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 15.3 W/kg
SAR(1 g) = 3.93 W/kg; SAR(10 g) = 1.19 W/kg
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 54.9%
Maximum value of SAR (measured) = 7.89 W/kg

SPC/SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 3/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 3.302) [mm]
Maximum value of SAR (interpolated) = 8.77 W/kg


W/kg
8.770
7.016
5.262
3.508
1.754
0.000244
z
y
x


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
m
0
1
2
3
4
5
6
7
8
9
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1031
Procedure Name: SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 2

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5750 MHz; σ = 5.45 S/m; ε_r = 32.45; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 3/28/2022 12:41:20 PM

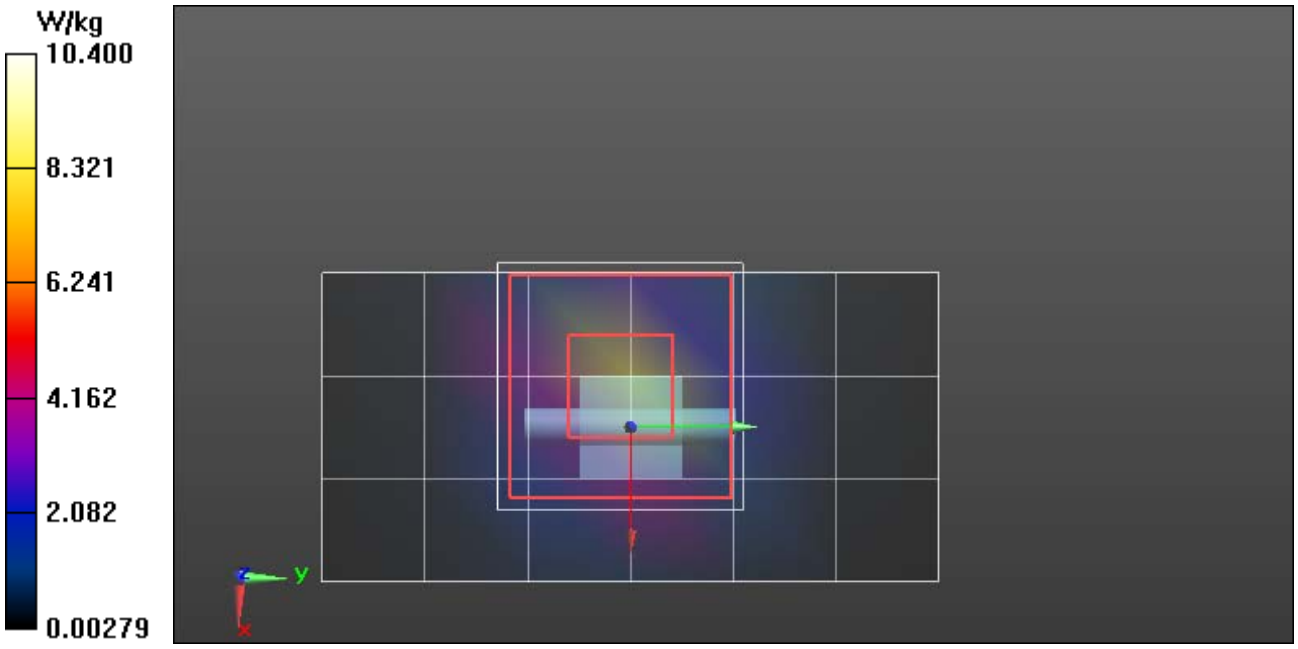
DASY5 Configuration:

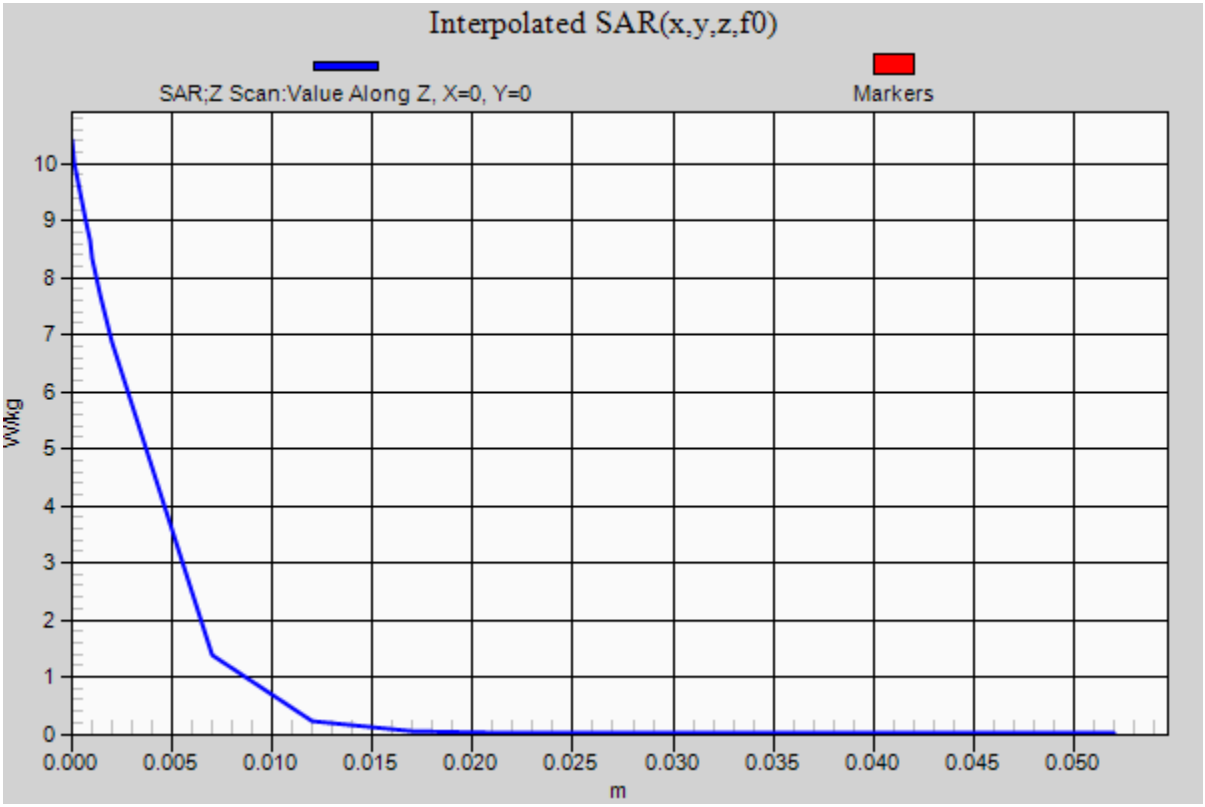
- Probe: EX3DV4 - SN3600; ConvF(4.06, 4.06, 4.06) @ 5750 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/22/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 2/Area Scan (4x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 8.39 W/kg

SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 2/Zoom Scan (7x7x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 26.70 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 4.05 W/kg; SAR(10 g) = 1.16 W/kg
Smallest distance from peaks to all points 3 dB below = 7.9 mm
Ratio of SAR at M2 to SAR at M1 = 51.1%
Maximum value of SAR (measured) = 8.66 W/kg

SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 2/Z Scan (1x1x22): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 2.884 (3.115, 2.791) [mm]
Maximum value of SAR (interpolated) = 10.4 W/kg


W/kg
10.400
8.321
6.241
4.162
2.082
0.00279
y
z
x


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
10
9
8
7
6
5
4
3
2
1
0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
0.045
0.050
m

APPENDIX B – MEASUREMENT PLOTS OF MAXIMUM MEASURED SAR

Plot E4

DUT: A04450/AA4450 - Top/Back; Type: Transmitter; Serial: Sample Prototype
Procedure Name: E4 - A04450/AA4450 , Top Edge 12mm, 5.5mbps

Communication System: UID 0, CW (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.83 S/m; ε_r = 36.57; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 3/22/2022 2:08:28 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.45, 6.45, 6.45) @ 2437 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/22/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

2450H/E4 - A04450/AA4450 , Top Edge 12mm, 5.5mbps/Area Scan (19x6x1): Measurement grid: dx=12mm, dy=12mm

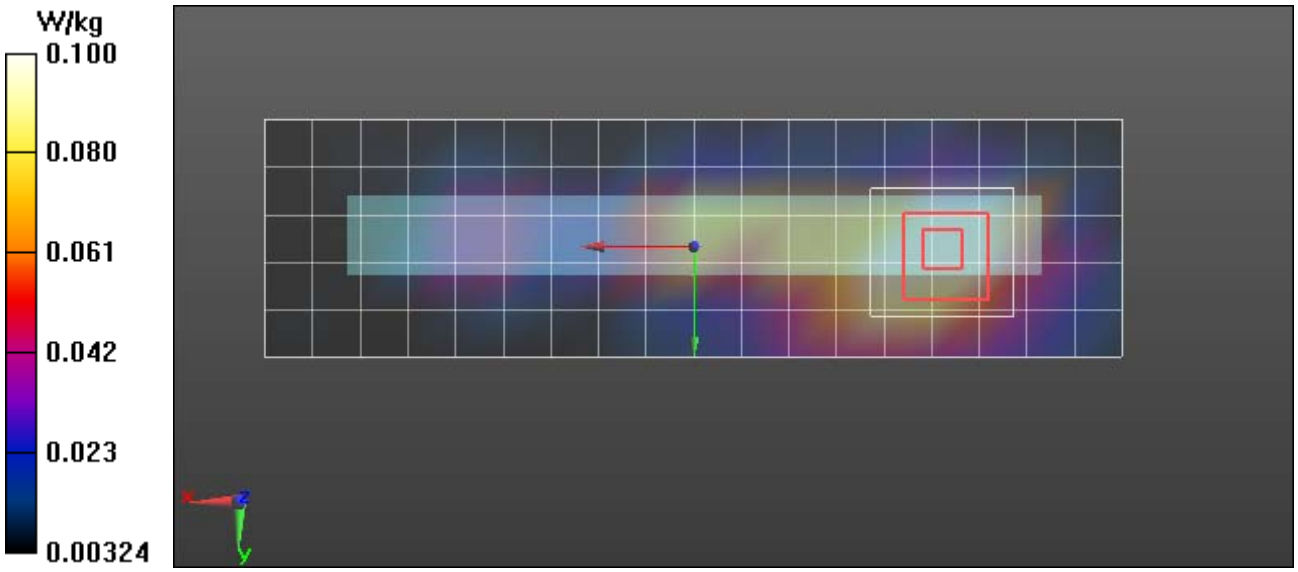
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.168 W/kg

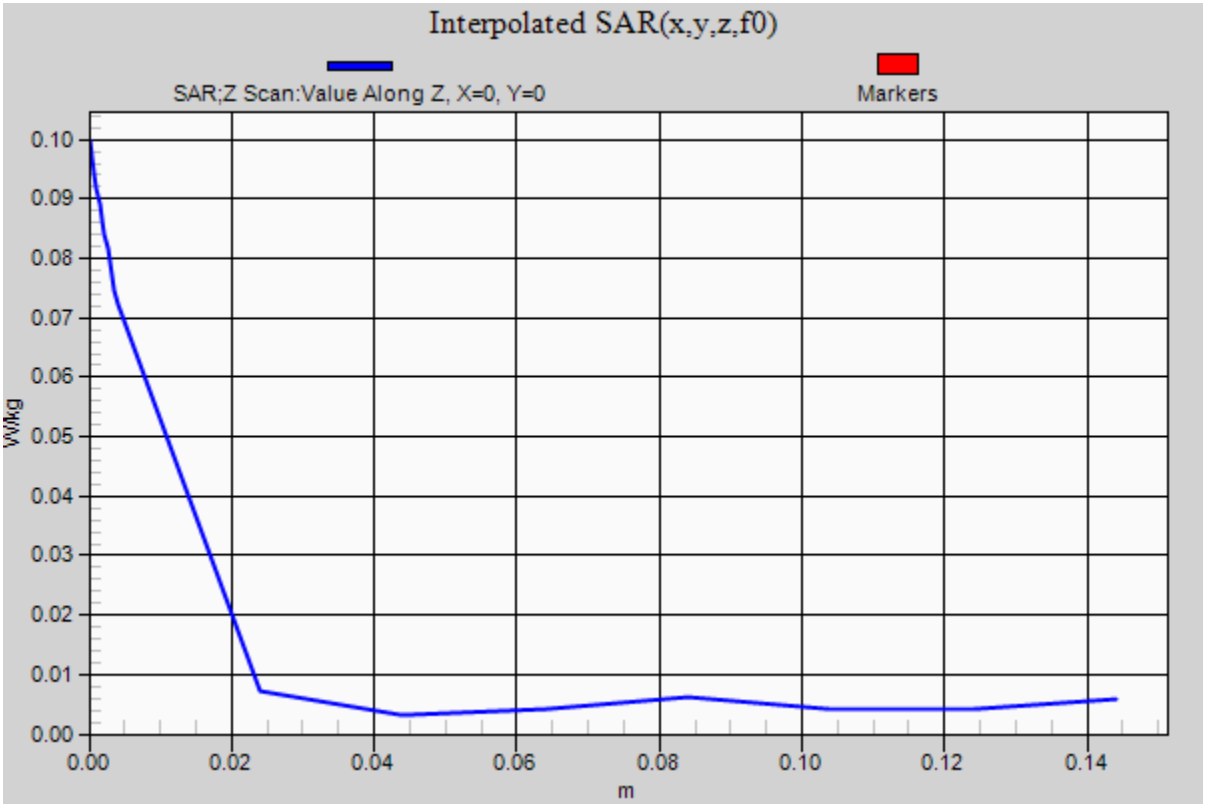
2450H/E4 - A04450/AA4450 , Top Edge 12mm, 5.5mbps/Zoom Scan (10x9x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 4.178 V/m; Power Drift = 0.84 dB
Peak SAR (extrapolated) = 0.392 W/kg
SAR(1 g) = 0.144 W/kg; SAR(10 g) = 0.071 W/kg
Smallest distance from peaks to all points 3 dB below = 5.8 mm
Ratio of SAR at M2 to SAR at M1 = 63.1%

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.251 W/kg

2450H/E4 - A04450/AA4450 , Top Edge 12mm, 5.5mbps/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm

Info: Interpolated medium parameters used for SAR evaluation.
Penetration depth = n/a (n/a, 8.737) [mm]
Maximum value of SAR (interpolated) = 0.0998 W/kg





Plot E12

DUT: A04450/AA4450 - Top/Back; Type: Transmitter; Serial: Sample Prototype
Procedure Name: E12- A04450/AA4450 , Top Edge 5180MHz OFDM-54 BW 20MHz

Communication System: UID 0, CW (0); Frequency: 5180 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5180 MHz; σ = 4.72 S/m; ε_r = 33.52; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 4/2/2022 1:58:29 PM

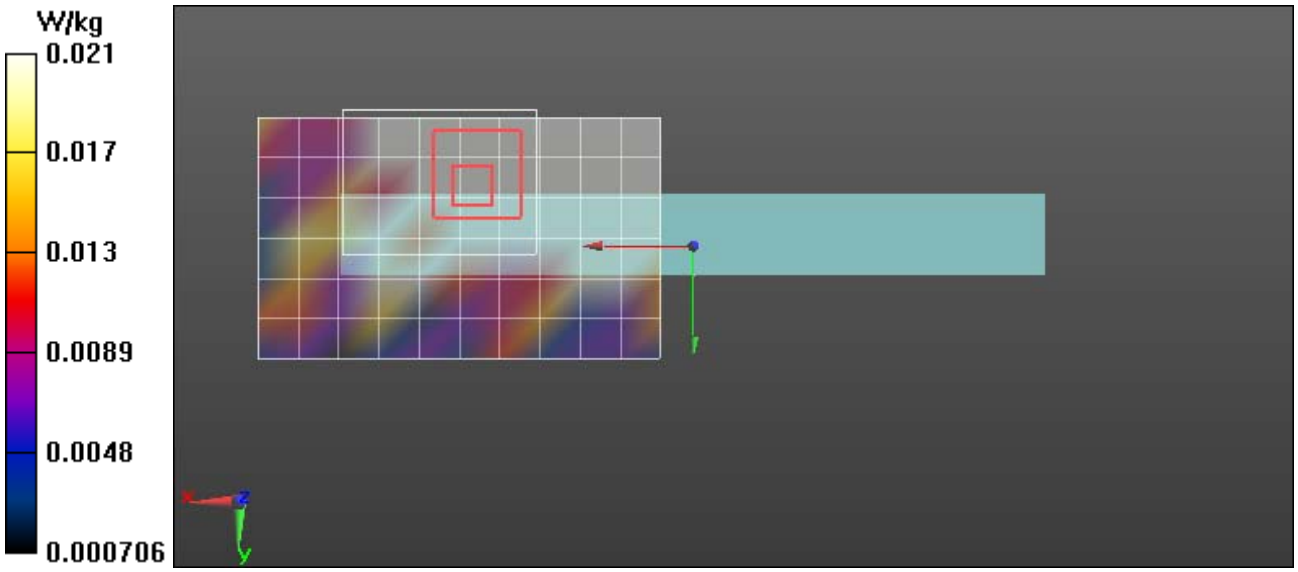
DASY5 Configuration:

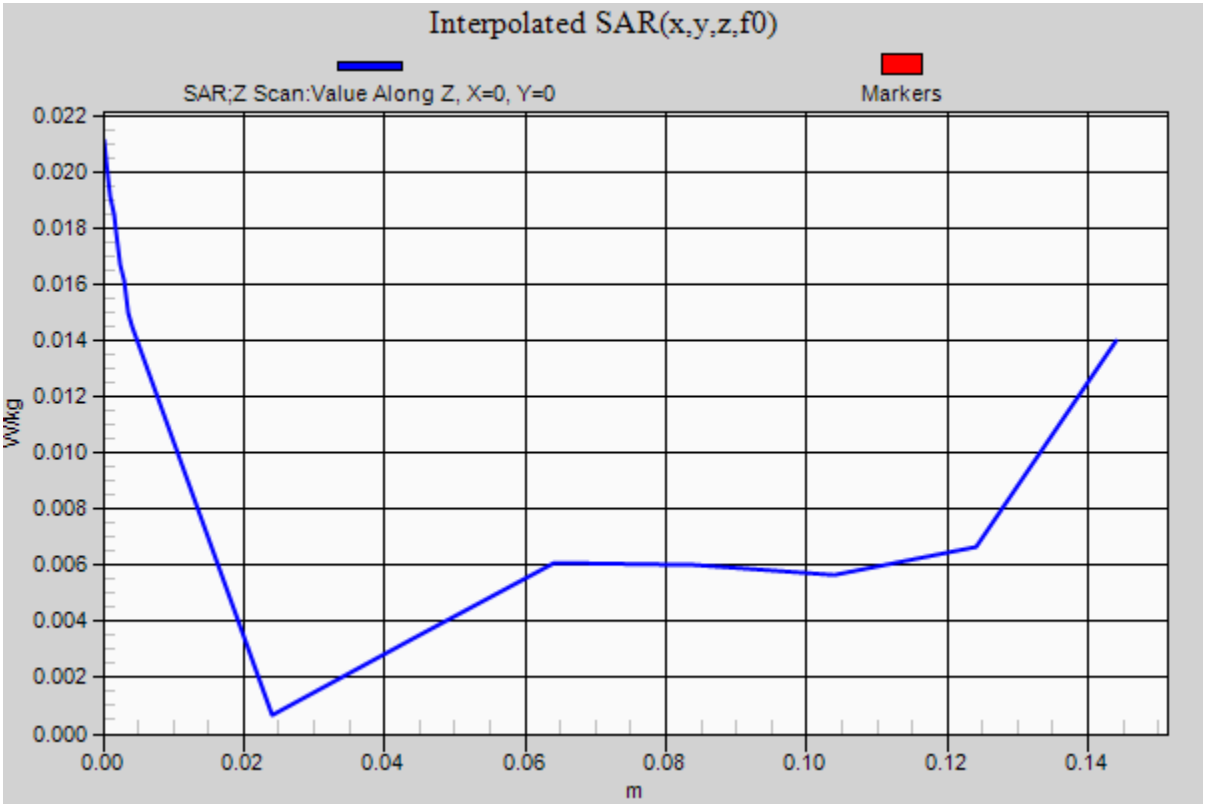
- Probe: EX3DV4 - SN3600; ConvF(4.41, 4.41, 4.41) @ 5180 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/22/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

5250H/E12- A04450/AA4450 , Top Edge 5180MHz OFDM-54 BW 20MHz/Area Scan (11x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.154 W/kg

5250H/E12- A04450/AA4450 , Top Edge 5180MHz OFDM-54 BW 20MHz/Zoom Scan (13x10x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.000 V/m; Power Drift = 2.67 dB
Peak SAR (extrapolated) = 0.466 W/kg
SAR(1 g) = 0.126 W/kg; SAR(10 g) = 0.048 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 52.8%
Maximum value of SAR (measured) = 0.298 W/kg

5250H/E12- A04450/AA4450 , Top Edge 5180MHz OFDM-54 BW 20MHz/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 6.612) [mm]
Maximum value of SAR (interpolated) = 0.0212 W/kg


W/kg
0.021
0.017
0.013
0.0089
0.0048
0.000706


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
0.022
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
m

Plot B10

DUT: A04450/AA4450 - Top/Back; Type: Transmitter; Serial: Sample Prototype
Procedure Name: B10-A04450/AA4450, Back Side-R,5180MHz OFDM-54 BW 20 MHz,WIFI

Communication System: UID 0, CW (0); Frequency: 5180 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5180 MHz; σ = 4.72 S/m; ε_r = 33.52; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 4/2/2022 12:52:05 PM

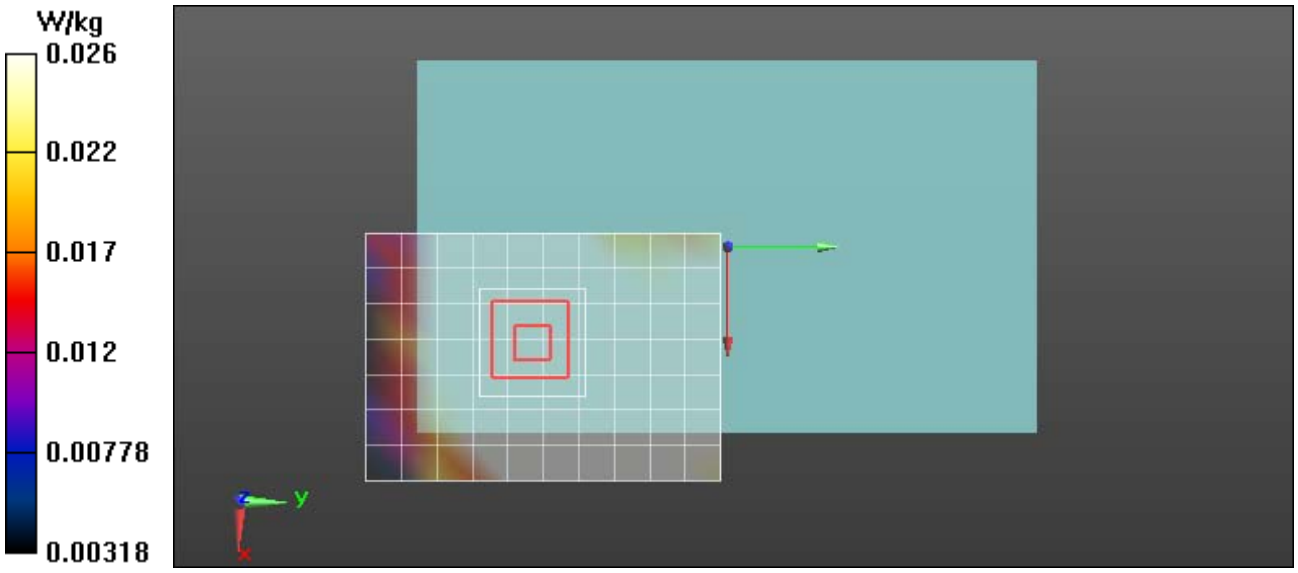
DASY5 Configuration:

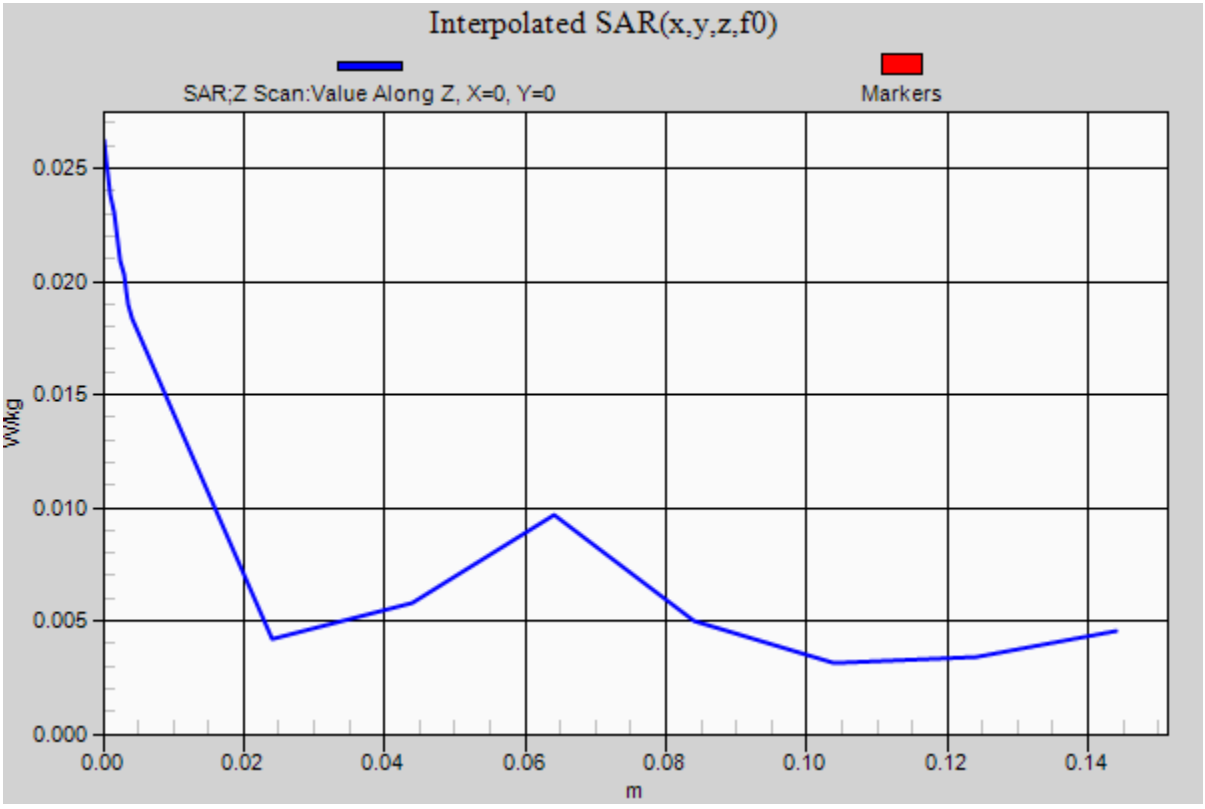
- Probe: EX3DV4 - SN3600; ConvF(4.41, 4.41, 4.41) @ 5180 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/22/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

5250H/B10-A04450/AA4450, Back Side-R,5180MHz OFDM-54 BW 20 MHz,WIFI/Area Scan (8x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.294 W/kg

5250H/B10-A04450/AA4450, Back Side-R,5180MHz OFDM-54 BW 20 MHz,WIFI/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.677 V/m; Power Drift = 0.29 dB
Peak SAR (extrapolated) = 0.759 W/kg
SAR(1 g) = 0.223 W/kg; SAR(10 g) = 0.090 W/kg
Smallest distance from peaks to all points 3 dB below = 13.6 mm
Ratio of SAR at M2 to SAR at M1 = 21.6%
Maximum value of SAR (measured) = 0.487 W/kg

5250H/B10-A04450/AA4450, Back Side-R,5180MHz OFDM-54 BW 20 MHz,WIFI/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 13.62) [mm]
Maximum value of SAR (interpolated) = 0.0262 W/kg


W/kg
0.026
0.022
0.017
0.012
0.00778
0.00318
z
y
x


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
0.025
0.020
0.015
0.010
0.005
0.000
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
m