Celltech
Testing and Engineering Services Lab

Test Report Serial Number:	45461793 R1.0
Test Report Date:	3 February 2023
Project Number:	1612

SAR Test Report - New Application

Applicant:

GARMIN

Garmin International Inc.
Olathe, KS, 66062
USA

Maximum *reported* SAR			
Body (1g)	WiFi - 2.4GHz	0.03	W/kg
	WiFi - 5GHz	0.49	
	Simultaneous	0.61	
General Pop. Limit:		1.60	
Extremity (10g)	WiFi - 2.4GHz	0.04	
	WiFi - 5GHz	0.20	
	Simultaneous	0.24	
General Pop. Limit:		4.00	

FCC ID: **IPH-04536**

IC Registration Number:

Product Model Number / HVIN: **A04536**

Product Name / PMN: **A04536**

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

ilac-MRA ACCREDITED

Test Lab Certificate: 2470.01

Industry Canada

IC Registration 3874A

FC

FCC Registration: CA3874

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1.0 REVISION HISTORY

Revision History				
Samples Tested By:	Ben Hewson	**Date(s) of Evaluation:**		28-30 October & 10-11 November 2022
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	28 January 2023
1.0	Initial Release	n/a	Ben Hewson	3 February 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-04536**
	ISED ID:	
Device Model(s) / HVIN:	A04536	
Test Sample Serial No.:	Production Sample Protoype	
Device Type:	Personal Navigation Device	
Transmit Frequency Range:	ANT (DXX): 2402-2480MHz	
	BT (DTS, DSS): 2402-2480MHz	
	WiFi (DTS): 2412-2462MHz	
	U-NII-1: 5180 - 5240, U-NII-3: 5745-5825	
Manuf. Max. Rated Output Power:	ANT (DXX): 83.7 Average Power (dBµ/Vm@3m) (0.09mW)	
	BT BR (DSS): 0.003W (4.5 dBm)	
	BT 2EDR (DTS): 0.003W (4.5 dBm)	
	BT 3EDR (DTS): 0.003W (4.5 dBm)	
	BT LE (DTS): 0.003W (4.5 dBm)	
	802.11b (DTS): 0.006W (8 dBm)	
	802.11g (DTS): 0.006W (8 dBm)	
	802.11n (DTS): 0.004W (6 dBm)	
	802.11n40 (DTS): 0.002W (3 dBm)	
	U-NII-1 (UNII): 0.024W (13.80dBm)	
	U-NII-3 (UNII): 0.019W (12.78DBm)	
Antenna Type and Gain:	2.4GHz: 1 dBi PIFA, 5GHz: 1.5 dBi PIFA	
Modulation:	ANT: GFSK:	
	BT BR: GFSK	
	BT 2EDR: π/4-DQPSK	
	Bt 3EDR: 8DPSK	
	BLE: GMSK	
	WiFi: CCK, DSSS, OFDM, CCK, MCS	
DUT Power Source:	5V USB, Internal Li-Ion Battery	
DUT Dimensions [LxWxH]	L x W x H: 205mm x 135mm x 24mm	
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 A04536 FCC ID: IPH-04536, IC ID:1792A-04536 is a Low Power Digital Transmitter that offers use as a hand-held, transportation mounted or portable configuration , with a Wi-Fi transceiver that is capable of operating in the 2.4GHz WiFi, 5GHz U-NII-1 & 3 frequency bands as well as 2.4Ghz ANT /BT/BLE frequency bands. The device has two antennas, for the 2.4GHZ and a 5Ghz frequencies and is capable of simultaneous transmisson between the BT and UNII banks. 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. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer and in accordance with the procedures described in IEC/IEEE 62209-1528, FCC KDB 865646, 447498, 248227. A description of the device, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used and the various provisions of the rules are included within this test report.

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.	A04536	
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	[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:**
		28-30 October & 10-11 November 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.	 Ben Hewson Celltech Labs Inc. 28 January 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

DASY 6 Measurement Controller

7.0 RF CONDUCTED POWER MEASUREMENT

Table 7.1 Conducted Power Measurements, 2.4 GHz WiFi

A04536-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	7.49			-	WLAN 2.4G	20	DSSS-1Mbps	802.11b
		6.77			-			DSSS-2Mbps	
		6.78			-			DSSS-5.5Mbps	
		6.90			-			DSSS-11Mbps	
1	2412	6.84	8.00	-1.16	Y			DSSS-1Mbps	
7	2442	8.00	8.00	0.00	Y				
11	2462	6.81	8.00	-1.19	Y				
7	2442	7.75	8.00	-0.25	-	WLAN 2.4G	20	OFDM-6Mbps	802.11g
		7.79	8.00	-0.21	-			OFDM-9Mbps	
		7.81	8.00	-0.19	-			OFDM-12Mbps	
		8.00	8.00	0.00	-			OFDM-36Mbps	
		4.58	8.00	-3.42	-			OFDM-54Mbps	
6	2437	5.98	6.00	-0.02	-	WLAN 2.4G	20	MCS-0	802.11n
		6.00	6.00	0.00	-			MCS-3	
1-11	2412-2462		3.00		-	WLAN 2.4G	40	MCS-0-7	802.11n

Table 7.2 Conducted Power Measurement Results, Bluetooth

A04536- Conducted Power Measurements								
Mode	Modulation	Channel	Frequency (MHz)	Measured Power (dBm)	Measured Power (mW)	Rated Power (mW)	Delta (mW)	SAR test Channel
ANT	GFSK	0-78	2402-2480	-	-	0.09	-	-
BT BR	GFSK	0	2402.00	2.26	1.68	2.81	1.13	-
		38	2441.00	2.56	1.80	2.81	1.01	-
		78	2480.00	2.43	1.75	2.81	1.06	-
BT 2EDR	π/4 -DQPSK	3	2402.00	2.28	1.69	2.81	1.12	-
		38	2441.00	2.60	1.82	2.81	0.99	-
		78	2480.00	2.44	1.75	2.81	1.06	-
BT 3EDR	8DPSK	3	2402.00	2.41	1.74	2.81	1.07	-
		38	2441.00	2.65	1.84	2.81	0.97	-
		78	2480.00	2.57	1.81	2.81	1.00	-
BT BLE	GMSK	37	2402.00	4.17	2.61	2.81	0.20	-
		17	2440.00	4.35	2.72	2.81	0.09	-
		39	2480.00	4.21	2.64	2.81	0.17	-

Table 7.3 Conducted Power Measurements, 5 GHz WiFi UNI-1

A04536-Conducted Power Measurements									
Channel	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Delta (dB)	SAR Test Channel	Mode	BW (MHz)	Modulation	
36	5180	11.85			-	UNI-I 5G	20	OFDM6	802.11a
		11.61			-			OFDM9	
		11.31			-			OFDM12	
		11.14			-			OFDM54	
36	5180	11.85	13.80	-1.95	Y				
40	5200	13.78	13.80	-0.02	Y			OFDM6	
44	5220	13.80	13.80	0.00	Y				
48	5240	13.60	13.80	-0.20	Y				
36	5180	11.47			-			MCS0	802.11n
		11.47			-			MCS3	
		11.19			-			MCS7	
40	5200	13.63	13.80	-0.17	-			MCS0	
44	5220	13.70	13.80	-0.10	-				
48	5240	13.55	13.80	-0.25	-				
38	5190	11.48	12.30	-0.82	-		40	MCS0	802.11n40
46	5230	12.30	12.30	0.00	-				

Table 7.4 Conducted Power Measurements, 5 GHz WiFi UNI-3

A04536-Conducted Power Measurements									
Channel	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Delta (dB)	SAR Test Channel	Mode	BW (MHz)	Modulation	
149	5745	12.77			-	UNI-3 5G	20	OFDM6	802.11a
		12.68			-			OFDM9	
		12.71			-			OFDM12	
		12.17			-			OFDM54	
149	5745	12.77	12.78	-0.01	-			OFDM6	
153	5765	12.70	12.78	-0.08	-				
157	5785	12.65	12.78	-0.13	-				
161	5805	12.78	12.78	0.00	Y				
165	5825	12.40	12.78	-0.38	-				
149	5745	12.76	12.78	-0.02	-			MCS0	802.11n
153	5765	12.69	12.78	-0.09	-				
157	5785	12.61	12.78	-0.17	-				
161	5805	12.51	12.78	-0.27	-				
165	5825	12.44	12.78	-0.34	-				
151	5755	8.45	8.45	0.00			40	MCS0	802.11n40
159	5795	8.26	8.45	-0.19	-				

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

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 mid-channel conducted power at various bit rates was evaluated to derive the worse case and the conducted output power was investigated on channels with this bit rate. The highest conduced power was found on Channel 7. 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 the 2.4 GHz and the UNII1 / 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.

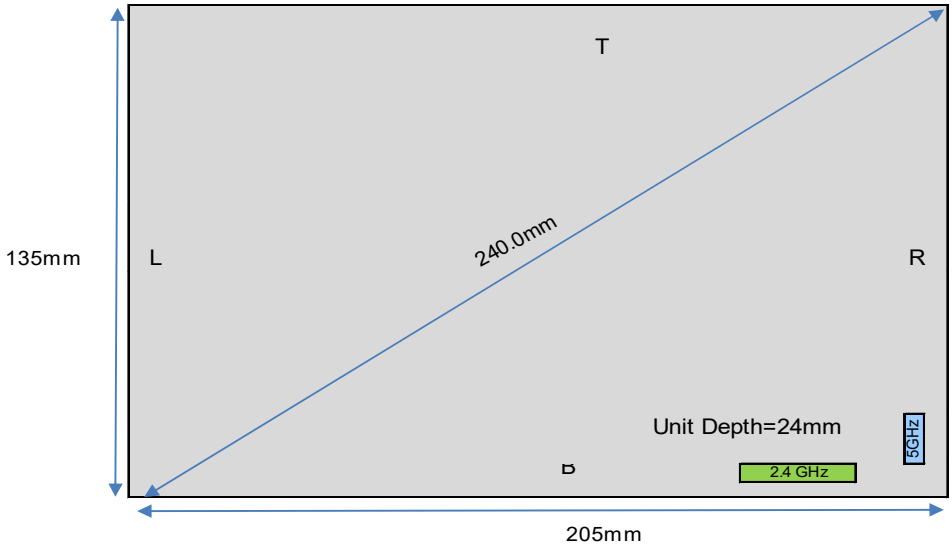
NOTE: The Bluetooth transmitter is capable of simultaneous transmission with the 5GHz WiFi Transmitter. The device SAR was evaluated for simultaneous SAR.

As per KDB 447498 D01V06, where appropriate SAR test exclusion based on antenna test separation distances may be applied.

1. When the distance is < 50mm exclusion threshold is “Ratio”. when the distance is >50 mm exclusion is in “mW”
2. Maximum power is the source-based-time-average power and represents the maximum RF output power among production units.
3. Per KDB 447498 D01v06, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user
4. Per KDB 447498 D01v06, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold
5. Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50mm are determined by; (step a)
   [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]*[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   - f(GHz) is the f channel transmit frequency in GHz
   - power and distance are rounded to the nearest MW and mm before calculation
   - result is rounded to one decimal place for comparison
   - the values 3.0 and 7.5 are referred to as numeric thresholds in step b
6. Per KDB 447498 D01v06, at 100 MHz to 6 GHz and for test separation distance > 50mm, the SAR test exclusion threshold is determined according to t the following; (step b)
   a) [Power allowed at numeric threshold for 50 mm in step a) + test separation distance - 50mm)*(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b) [Power allowed at numeric threshold for 50 mm in step a) + (test separation distance -50mm)* 10] mW at > 1500MHz and ≤ 6GHz

Table 8.2 Antenna Distances

Topographic View
Front Facing



Antenna	Top Edge (mm)	Left Edge (mm)	Bottom Edge (mm)	Right Edge (mm)	Front Depth (mm)	Back Depth (mm)
WLAN/BT	106.0	150.0	15.0	33.0	11.0	11.0
5GHz	95.0	190.0	20.0	10.0	11.0	11.0

Table 8.3 SAR test exclusion based on antenna test separation distances Body

SAR Test Exclusion Analysis Antenna Separation to DUT Surfaces A04536					
EXTREMITY Configuration (10g)		Band			
		2.4GHz WiFi	5GHz WLAN U-NII-1	5GHz WLAN U-NII-3	BT
Exposure Position	Frequency (MHz)	2480	5240	5825	2480
	Power (mW)	63.10	31.60	31.60	1.99
	Antenna Gain (dBi)	1.00	1.50	1.50	1.00
	Total ERP (mW)	79.44	44.64	44.64	2.51
Front Side	Separation Distance (mm)	11.00	11.00	11.00	11.00
	Exclusion Threshold (Pth)(mW)	30.50	19.04	17.81	30.50
	Testing Required	Yes	Yes	Yes	No
Back Side	Separation Distance (mm)	11.00	11.00	11.00	11.00
	Exclusion Threshold (Pth)(mW)	30.50	19.04	17.81	30.50
	Testing Required	Yes	Yes	Yes	No

Table 8.3 SAR test exclusion based on antenna test separation distances Extremity

SAR Test Exclusion Analysis Antenna Separation to DUT Surfaces A04536					
EXTREMITY Configuration (10g)		Band			
		2.4GHz WiFi	5GHz WLAN U-NII-1	5GHz WLAN U-NII-3	BT
Exposure Position	Frequency (MHz)	2480	5240	5825	2480
	Power (mW)	63.10	31.60	31.60	1.99
	Antenna Gain (dBi)	1.00	1.50	1.50	1.00
	Total ERP (mW)	79.44	44.64	44.64	2.51
Front Side	Separation Distance (mm)	11.00	11.00	11.00	11.00
	Exclusion Threshold (Pth)(mW)	30.50	19.04	17.81	30.50
	Testing Required	Yes	Yes	Yes	No
Back Side	Separation Distance (mm)	11.00	11.00	11.00	11.00
	Exclusion Threshold (Pth)(mW)	30.50	19.04	17.81	30.50
	Testing Required	Yes	Yes	Yes	No
Top Edge	Separation Distance (mm)	106.00	95.00	95.00	106.00
	Exclusion Threshold (Pth)(mW)	2282.78	1641.76	1613.91	2282.78
	Testing Required	No	No	No	No
Bottom Edge	Separation Distance (mm)	15.00	20.00	20.00	15.00
	Exclusion Threshold (Pth)(mW)	55.07	65.53	62.15	55.07
	Testing Required	Yes	No	No	No
Left Edge	Separation Distance (mm)	150.00	190.00	190.00	150.00
	Exclusion Threshold (Pth)(mW)	4422.61	6880.36	6872.25	4422.61
	Testing Required	No	No	No	No
Right Edge	Separation Distance (mm)	33.00	10.00	10.00	33.00
	Exclusion Threshold (Pth)(mW)	247.25	15.64	14.60	247.25
	Testing Required	No	Yes	Yes	No

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 (1g)

Measured 1g SAR Results - BODY Configuration																							
Date	Plot ID	Freq. (MHz)	DUT Configuration					Accessories				DUT Spacing		Measured SAR (W/kg)	SAR Drift (dB)	Conducted Power (dBm)	Rated Power (dBm)	Tolerance ± (dB)	Rated Power (dBm)	Delta Power dB	Duty Cycle n	Fluid Sensitivity n	reported SAR (W/kg)
			Pos	Mode	BW	Mod	BR	Ant ID	Batt ID	Body ID	Audio ID	DUT (mm)	Ant (mm)										
29 Oct 2022	B1	2442	Back	802.11b	20	DSSS	11	-	-	-	-	5	16	0.028	0.630	8.00	8.000	0.000	8.000	0.000	1.000	1.000	0.028
29 Oct 2022	B2	2442	Front	802.11b	20	DSSS	11	-	-	-	-	5	16	0.015	1.130	8.00	8.000	0.000	8.000	0.000	1.000	1.000	0.015
30 Oct 2022	B3	5180	Back	UNI-I	20	OFDM	6	-	-	-	-	5	16	0.312	0.750	11.85	13.800	0.000	13.800	-1.950	1.000	1.000	0.489
30 Oct 2022	B4	5180	Front	UNI-I	20	OFDM	6	-	-	-	-	5	16	0.085	0.690	11.85	13.800	0.000	13.800	-1.950	1.000	1.000	0.133
11 Nov 2022	B5R	5220	Back	UNI-I	20	OFDM	6	-	-	-	-	5	16	0.441	0.254	13.80	13.220	0.000	13.220	0.580	1.000	1.000	0.441
11 Nov 2022	B6	5805	Back	UNI-III	20	OFDM	6	-	-	-	-	5	16	0.139	0.680	12.78	12.780	0.000	12.780	0.000	1.000	1.000	0.139
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 (10g)

Measured 10g SAR Results - EXTREMITY Configuration																								
Date	Plot ID	Freq. (MHz)	DUT Configuration					Accessories				DUT Spacing		Measured SAR (W/kg)	SAR Drift (dB)	Conducted Power (dBm)	Rated Power (dBm)	Tolerance ± (dB)	Rated Power (dBm)	Delta Power dB	Duty Cycle n	Fluid Sensitivity n	reported SAR (W/kg)
			Pos	Mode	BW	Mod	BR	Ant ID	Batt ID	Body ID	Audio ID	DUT (mm)	Antenna (mm)										
29 Oct 2022	E1	2442	Front	802.11b	20	DSSS	11	-	-	-	-	0	11	0.015	-0.330	8.000	8.000	0.000	8.000	0.000	1.000	1.000	0.016
29 Oct 2022	E2	2442	Back	802.11b	20	DSSS	11	-	-	-	-	0	11	0.035	-0.220	8.000	8.000	0.000	8.000	0.000	1.000	1.000	0.037
29 Oct 2022	E3	2442	Bottom Edge	802.11b	20	DSSS	11	-	-	-	-	0	15	0.035	0.560	8.000	8.000	0.000	8.000	0.000	1.000	1.000	0.035
29 Oct 2022	E4	2412	Back	802.11b	20	DSSS	11	-	-	-	-	0	11	0.029	-0.310	6.840	8.000	0.000	8.000	-1.160	1.000	1.000	0.041
29 Oct 2022	E5	2462	Back	802.11b	20	DSSS	11	-	-	-	-	0	11	0.023	0.280	6.810	8.000	0.000	8.000	-1.190	1.000	1.000	0.030
30 Oct 2022	E6	5180	Front	UNI-I	20	OFDM	6	-	-	-	-	0	11	0.086	0.100	11.850	13.800	0.000	13.800	-1.950	1.000	1.000	0.135
30 Oct 2022	E7	5180	Back	UNI-I	20	OFDM	6	-	-	-	-	0	11	0.028	1.400	11.850	13.800	0.000	13.800	-1.950	1.000	1.000	0.043
30 Oct 2022	E8	5180	Right Edge	UNI-I	20	OFDM	6	-	-	-	-	0	10	0.125	0.420	11.850	13.800	0.000	13.800	-1.950	1.000	1.000	0.196
10 Nov 2022	E8R	5180	Right Edge	UNI-I	20	OFDM	6	-	-	-	-	0	10	0.108	0.730	11.850	13.800	0.000	13.800	-1.950	1.000	1.000	0.169
11 Nov 2022	E9	5220	Right Edge	UNI-I	20	OFDM	6	-	-	-	-	0	10	0.174	-0.380	13.800	13.800	0.000	13.800	0.000	1.000	1.000	0.190
11 Nov 2022	E10	5240	Right Edge	UNI-I	20	OFDM	6	-	-	-	-	0	10	0.177	2.300	13.600	13.800	0.000	13.800	-0.200	1.000	1.000	0.185
11 Nov 2022	E11	5200	Right Edge	UNI-I	20	OFDM	6	-	-	-	-	0	10	0.151	0.050	13.780	13.800	0.000	13.800	-0.020	1.000	1.000	0.152
11 Nov 2022	E12	5805	Right Edge	UNI-III	20	OFDM	6	-	-	-	-	0	10	0.135	-0.380	12.780	12.780	0.000	12.780	0.000	1.000	1.000	0.147
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 – Body (1g)

Scaling of Maximum Measured SAR (1g)					
Measured Parameters		Configuration			
		Body	Body		
Plot ID		B1	B3		
Maximum Measured SAR_M		0.028	0.312		(W/kg)
Frequency		2442	5180		(MHz)
Drift	Power Drift	0.630 (1)	0.750 (1)		(dB)
Conducted Power		8.000	11.850		(dBm)
DC	Transmit Duty Cycle	100.000	100.0		(%)
Fluid Deviation from Target					
Δe	Permitivity	-7.79%	-5.36%		
Δσ	Conductivity	7.14%	5.62%		

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)	2.442	5.18		
Ce		-0.225	-0.202		
Cσ		0.482	-0.024		
Ce * Δe		0.018	0.011		
Cσ * Δσ		0.034	-0.001		
ΔSAR		0.052 (3)	0.009 (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	8.000	11.850		(dBm)
Rated Conducted Power	8.000	13.800		(dBm)
ΔP	0.000 (4)	-1.950		(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]	0.028	0.312		(W/kg)
SAR Adjustment for Tuneup Tolerance				
$SAR_2 = SAR_1 + [ΔP]$	0.028	0.489		(W/kg)
SAR Adjustment for Drift				
$SAR_3 = SAR_2 + [Drift]$	0.028	0.489		(W/kg)
SAR Adjustment for Crest Factor				
$SAR_4 = SAR_3$ x [CF]	0.028	0.489		(W/kg)
***reported* 1g SAR**				
SAR_4	**0.03**	**0.49**		(W/kg)

Table 11.2 SAR Scaling – Extremity (10g)

Scaling of Maximum Measured SAR (10g)					
Measured Parameters		Configuration			
		Extremity	Extremity		
Plot ID		E4	E8		
Maximum Measured SAR_M		0.029	0.125		(W/kg)
Frequency		2412	5180		(MHz)
Drift	Power Drift	-0.310	0.420 (1)		(dB)
Conducted Power		6.840	11.850		(dBm)
DC	Transmit Duty Cycle	100.000	100.0		(%)
Fluid Deviation from Target					
Δe	Permitivity	-7.54%	-8.78%		
Δσ	Conductivity	6.02%	3.24%		

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)
$Cσ = (0.004479*f^3) - (0.01586*f^2) - (0.1972*f) + 0.7717$					(F.5)
f	Frequency (GHz)	2.412	5.18		
Ce		-0.225	-0.202		
Cσ		0.489	-0.024		
Ce * Δe		0.017	0.018		
Cσ * Δσ		0.029	-0.001		
ΔSAR		0.046 (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	6.840	11.850		(dBm)
Rated Conducted Power	8.000	13.800		(dBm)
ΔP	-1.160	-1.950		(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]	0.029	0.125		(W/kg)
SAR Adjustment for Tuneup Tolerance				
$SAR_2 = SAR_1$ + [ΔP]	0.038	0.196		(W/kg)
SAR Adjustment for Drift				
$SAR_3 = SAR_2$ + [Drift]	0.041	0.196		(W/kg)
SAR Adjustment for Crest Factor				
$SAR_4 = SAR_3$ x [CF]	0.041	0.196		(W/kg)
***reported* 10g SAR**				
SAR_4	**0.04**	**0.20**		(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 SAR – FCC

The estimated Bluetooth SAR, in accordance with FCC KDB 447498 D01v06 4.3.2 (b)(1), is given by:

$$SAR = \frac{P}{d} X \frac{\sqrt{f}}{x}$$

Where P is power, *mW*, d is separation distance, *mm*, f is frequency, *GHz* and x = 7.5 for 1g SAR and 18.75 for 10g SAR

1g SAR ; 2.81mW, d = 5mm, f = 2.440GHz = 0.117W/kg
10g SAR; 2.81mW, d = 5mm, f = 2.440GHz = 0.047W/kg

Simultaneous SAR = SAR_1 + SAR_2

Where SAR_1 = highest measured ***reported*** SAR, SAR_2 = *Standalone* Bluetooth SAR
5Ghz Body Config (1g) SAR_1 = 0.489W/kg, SAR_2 = 0.117W/kg
5Ghz Extremity Config (10g) SAR_1 = 0.197W/kg, SAR_2 = 0.047W/kg

1g Simultaneous *reported* SAR = 0.606W/kg

10g Simultaneous *reported* SAR = 0.244W/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
28 Oct 2022	25.1	23.6	27%	101.6	X	X	X	2450H
29 Oct 2022	24.3	22.6	27%	102.2			X	2450H
30 Oct 2022	23.5	22.5	29%	101.4	X	X	X	5250H
10 Nov 2022	23.4	23.0	20%	103.4	X	X	X	5250H
11 Nov 2022	25.3	23.9	18%	103.0			X	5250H
11 Nov 2022	23.0	23.0	18%	102.8	X	X	X	5750H

13.2 DUT Setup and Configuration

DUT Setup and Configuration
Overview
The DUT was evaluated for Body 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 however the device could be rested on the torso while transmitting. BODY configuration was evaluted at a separation distance of 5mm.
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 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 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.

13.6 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

Per FCC KDB 865664 D01v01r04, 2.8.2, SAR Measurement Uncertainty is only required when the *reported* SAR is:

≥ 1.5 W/kg (General Population) 1g
≥ 3.75 W/kg (General Population) 10g Extremity
≥ 7.5 W/kg (Occupational) 1g
≥ 18.75 W/kg (Occupational) 10g Extremity

The highest *reported* SAR for this evaluation is < 1.5 W/kg.

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 2450MHz HEAD TSL

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date: 28 Oct 2022		Fluid Temp: 23.6		Frequency: 2450MHz		Tissue: Head		ΔSAR	ΔSAR	SAR Correction Factor (1)	
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity	1g	10g	1g	10g
2410.0000		36.3000	1.8700	39.2700	1.76	-7.56%	6.25%	0.048	0.029	1.00	1.00
2412.0000	*	36.3060	1.8680	39.2660	1.76	-7.54%	6.02%	0.046	0.028	1.00	1.00
2420.0000		36.3300	1.8600	39.2500	1.77	-7.44%	5.08%	0.041	0.025	1.00	1.00
2440.0000		36.1500	1.9200	39.2200	1.79	-7.83%	7.26%	0.053	0.031	1.00	1.00
2442.0000	*	36.1620	1.9200	39.2160	1.79	-7.79%	7.14%	0.052	0.031	1.00	1.00
2450.0000		36.2100	1.9200	39.2000	1.80	-7.63%	6.67%	0.049	0.029	1.00	1.00
2460.0000		36.0200	1.9100	39.1900	1.81	-8.09%	5.52%	0.045	0.027	1.00	1.00
2462.0000	*	36.0900	1.9160	39.1860	1.81	-7.90%	5.74%	0.045	0.027	1.00	1.00
2470.0000		36.3700	1.9400	39.1700	1.82	-7.15%	6.59%	0.047	0.028	1.00	1.00

Table 15.2 Fluid Dielectric Parameters 5250MHz HEAD TSL

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date: 30 Oct 2022		Fluid Temp: 22.5		Frequency: 5250MHz		Tissue: Head		ΔSAR	ΔSAR	SAR Correction Factor (1)	
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity	1g	10g	1g	10g
5180.0000	*	32.8500	4.7800	36.0100	4.63	-8.78%	3.24%	0.017	0.021	1.00	1.00
5190.0000		32.8700	4.7700	36.0000	4.64	-8.69%	2.80%	0.017	0.021	1.00	1.00
5200.0000	*	33.3400	4.8000	35.9900	4.65	-7.36%	3.23%	0.014	0.017	1.00	1.00
5210.0000		33.2000	4.7300	35.9700	4.67	-7.70%	1.28%	0.015	0.019	1.00	1.00
5220.0000	*	33.5300	4.6700	35.9600	4.68	-6.76%	-0.21%	0.014	0.017	1.00	1.00
5230.0000		33.1100	4.6200	35.9500	4.69	-7.90%	-1.49%	0.016	0.021	1.00	1.00
5240.0000	*	33.1500	4.5800	35.9400	4.70	-7.76%	-2.55%	0.016	0.021	1.00	1.00
5250.0000		32.8100	4.6300	35.9300	4.71	-8.68%	-1.70%	0.018	0.023	1.00	1.00

Table 15.3 Fluid Dielectric Parameters 5250MHz HEAD TSL

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date: 10 Nov 2022		Fluid Temp: 23		Frequency: 5250MHz		Tissue: Head		ΔSAR	ΔSAR	SAR Correction Factor (1)	
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity	1g	10g	1g	10g
5180.0000	*	34.0800	4.8900	36.0100	4.63	-5.36%	5.62%	0.009	0.011	1.00	1.00
5190.0000		33.9700	4.8600	36.0000	4.64	-5.64%	4.74%	0.010	0.012	1.00	1.00
5200.0000	*	33.8100	4.8900	35.9900	4.65	-6.06%	5.16%	0.011	0.013	1.00	1.00
5210.0000		33.9500	4.9500	35.9700	4.67	-5.62%	6.00%	0.010	0.011	1.00	1.00
5220.0000	*	33.6400	4.9000	35.9600	4.68	-6.45%	4.70%	0.012	0.014	1.00	1.00
5230.0000		33.9100	4.9900	35.9500	4.69	-5.67%	6.40%	0.010	0.011	1.00	1.00
5240.0000	*	33.6600	4.9600	35.9400	4.70	-6.34%	5.53%	0.011	0.013	1.00	1.00
5250.0000		33.7400	4.9000	35.9300	4.71	-6.10%	4.03%	0.011	0.013	1.00	1.00

Table 15.4 Fluid Dielectric Parameters 5750MHz HEAD TSL

FLUID DIELECTRIC PARAMETERS								Fluid Sensitivity Calculation IEC/IEEE 62209-1528 7.8.2			
Date: 11 Nov 2022		Fluid Temp: 23.9		Frequency: 5750MHz		Tissue: Head		ΔSAR	ΔSAR	SAR Correction Factor (1)	
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity	1g	10g	1g	10g
5750.0000		34.0000	5.2800	35.3600	5.22	-3.85%	1.15%	0.007	0.009	1.00	1.00
5800.0000		34.0300	5.3200	35.3000	5.27	-3.60%	0.95%	0.007	0.009	1.00	1.00
5805.0000	*	33.8700	5.3450	35.2950	5.28	-4.04%	1.33%	0.007	0.010	1.00	1.00
5810.0000		33.7100	5.3700	35.2900	5.28	-4.48%	1.70%	0.008	0.011	1.00	1.00

16.0 SYSTEM VERIFICATION TEST RESULTS

Table 16.1 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
28 Oct 2022		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.6	25	27%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
36.21	39.20	-7.63%	1.92	1.80	6.67%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
14.10	13.18	6.98%	6.38	6.01	6.24%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
56.40	52.72	6.98%	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 5250MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
30 Oct 2022		5250	D5GHzV2		1031
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	22.6	24	27%	50	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
32.81	35.93	-8.68%	4.63	4.71	-1.70%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
3.52	3.97	-11.41%	0.93	1.15	-18.55%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
70.40	79.47	-11.41%	18.66	22.91	-18.55%

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 16.3 System Verification Results 5250MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
10 Nov 2022		5250	D5GHzV2		1031
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.0	23	20%	50	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
33.74	35.93	-6.10%	4.90	4.71	4.03%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
3.81	3.97	-4.11%	1.18	1.15	3.01%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
76.20	79.47	-4.11%	23.60	22.91	3.01%

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 16.4 System Verification Results 5750MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
11 Nov 2022		5750	D5GHzV2		1031
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.9	25	18%	50	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
34.00	35.36	-3.85%	5.28	5.22	1.15%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
3.85	3.78	1.93%	1.05	1.10	-4.59%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
77.00	75.54	1.93%	21.00	22.01	-4.59%

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 Summary Chart					
Validation Date	Validation Source	Validation Frequency	Linearity	Isotropy	Extrapolation
✓	= Complete	✓	= Not Required		
3-May-22	D2450V2	2450	✓	✓	✓
13-May-22	D5GHzV2	5250	✓	✓	✓
19-May-22	D5GHzV2	5750	✓	✓	✓

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
Construction	Triangular core fiber optic detection system
Frequency	4 MHz to 10 GHz
Linearity	±0.2 dB (30 MHz to 10 GHz)
Phantom	
Type	ELI Elliptical Planar Phantom
Shell Material	Fiberglass
Thickness	2mm +/- .2mm
Volume	> 30 Liter
Phantom	
Type	SAM Flat Planar Phantom
Shell Material	Fiberglass
Thickness	2mm +/- .2mm
Volume	approx. 25 Liter
Phantom	
Type	MFP Flat Planar Phantom
Shell Material	Fiberglass
Thickness	2mm +/- .2mm
Volume	approx.8.1 Liter

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

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

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

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 19.1 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	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
-D5GHzV2 Validation Dipole	00126	1031	27-Apr-21	27-Apr-24
ELI Phantom	00247	1234	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

20.0 FLUID COMPOSITION

Table 20.1 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

Table 20.4 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 1G target = 52.719 2

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.92 S/m; ε_r = 36.21; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 10/28/2022 11:32:05 AM

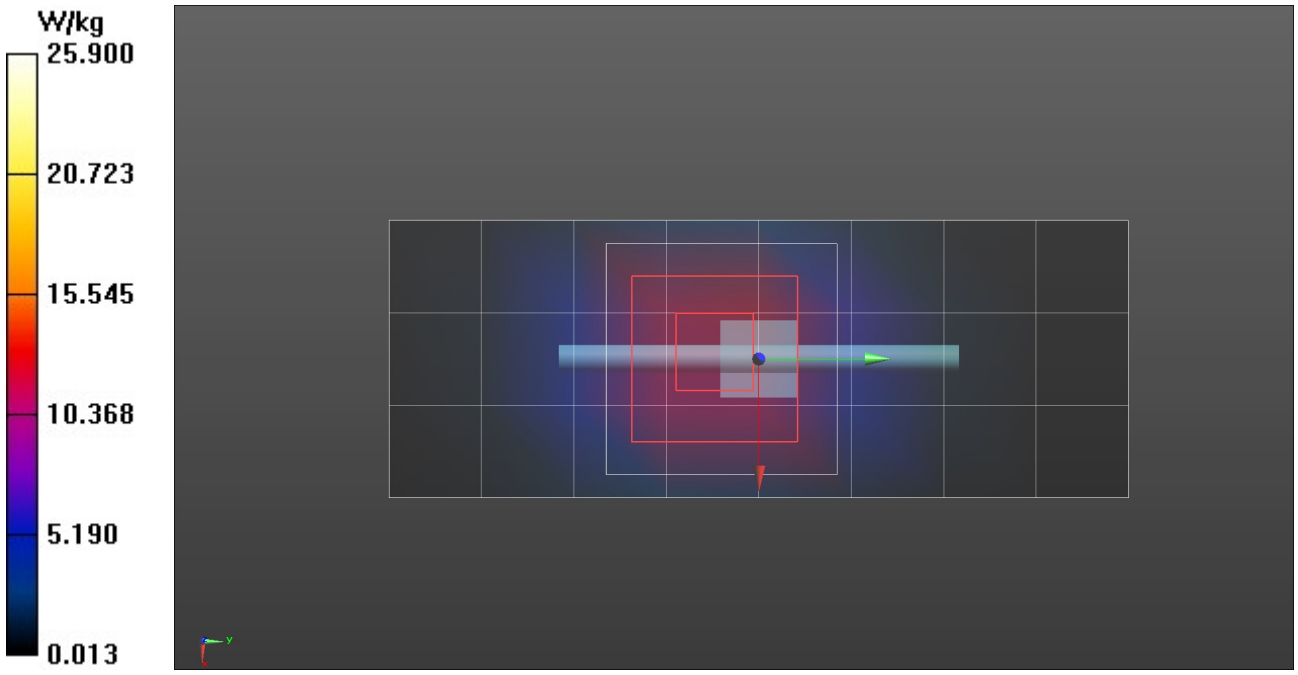
DASY5 Configuration:

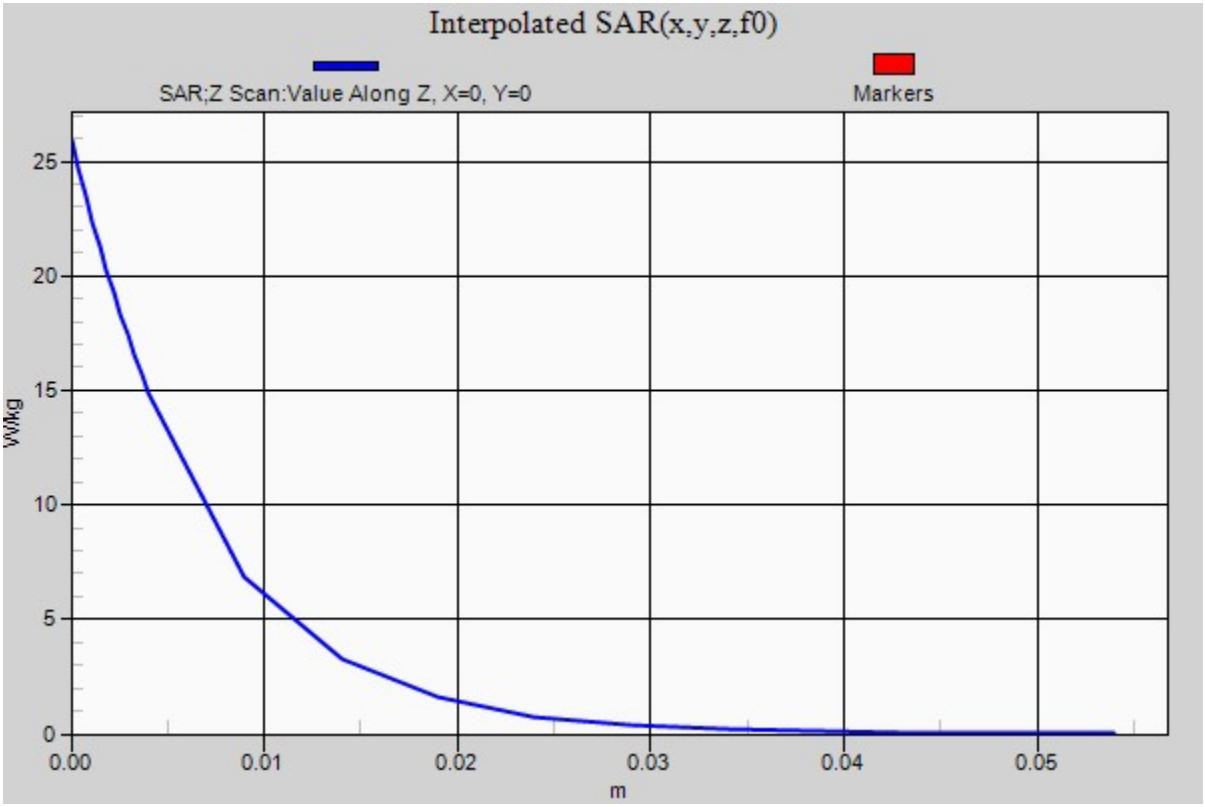
- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2450 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg 1G target = 52.719 2/Area Scan (4x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 12.1 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg 1G target = 52.719 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.08 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 31.3 W/kg
SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.38 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 46.3%
Maximum value of SAR (measured) = 16.0 W/kg

SPC/SPC 2450H_Input=250mw, Target=[11.86]13.18][14.50]W/kg 1G target = 52.719 2/Z Scan (1x1x22): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 6.744 (6.479, 6.868) [mm]
Maximum value of SAR (interpolated) = 25.9 W/kg


W/kg
25.900
20.723
15.545
10.368
5.190
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

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 2 2

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5250 MHz; σ = 4.63 S/m; ε_r = 32.81; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 10/30/2022 11:57:12 AM

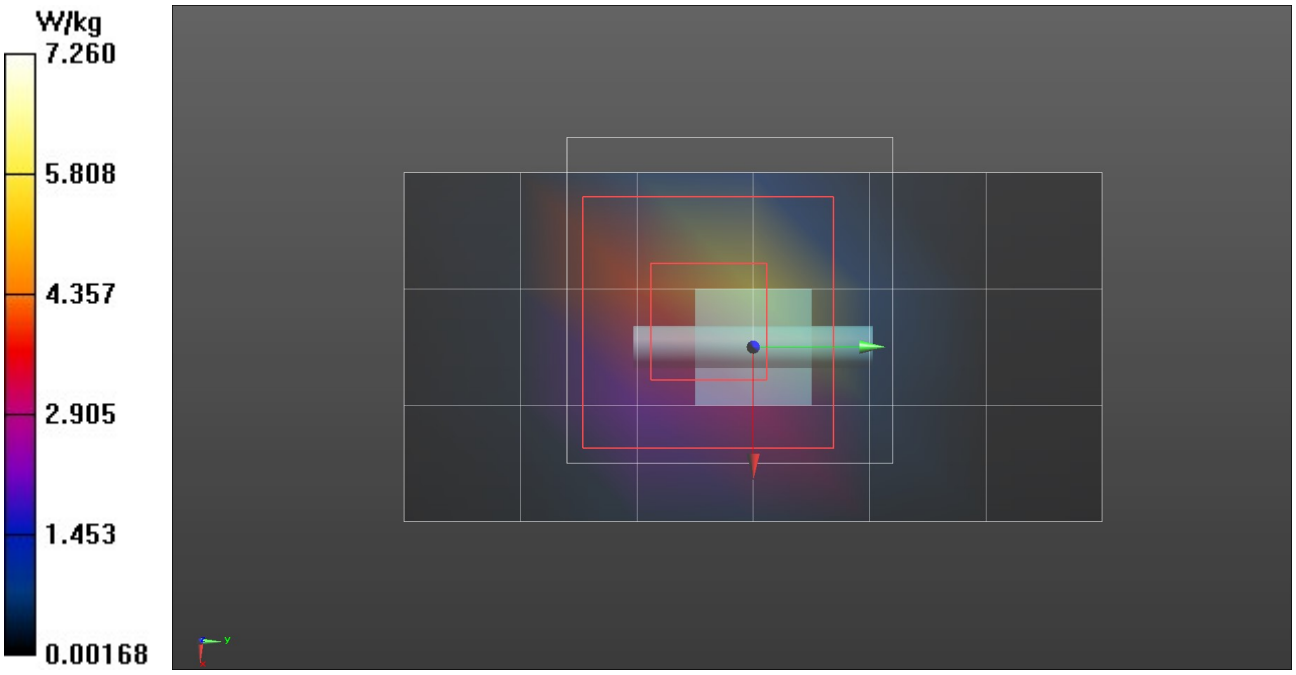
DASY5 Configuration:

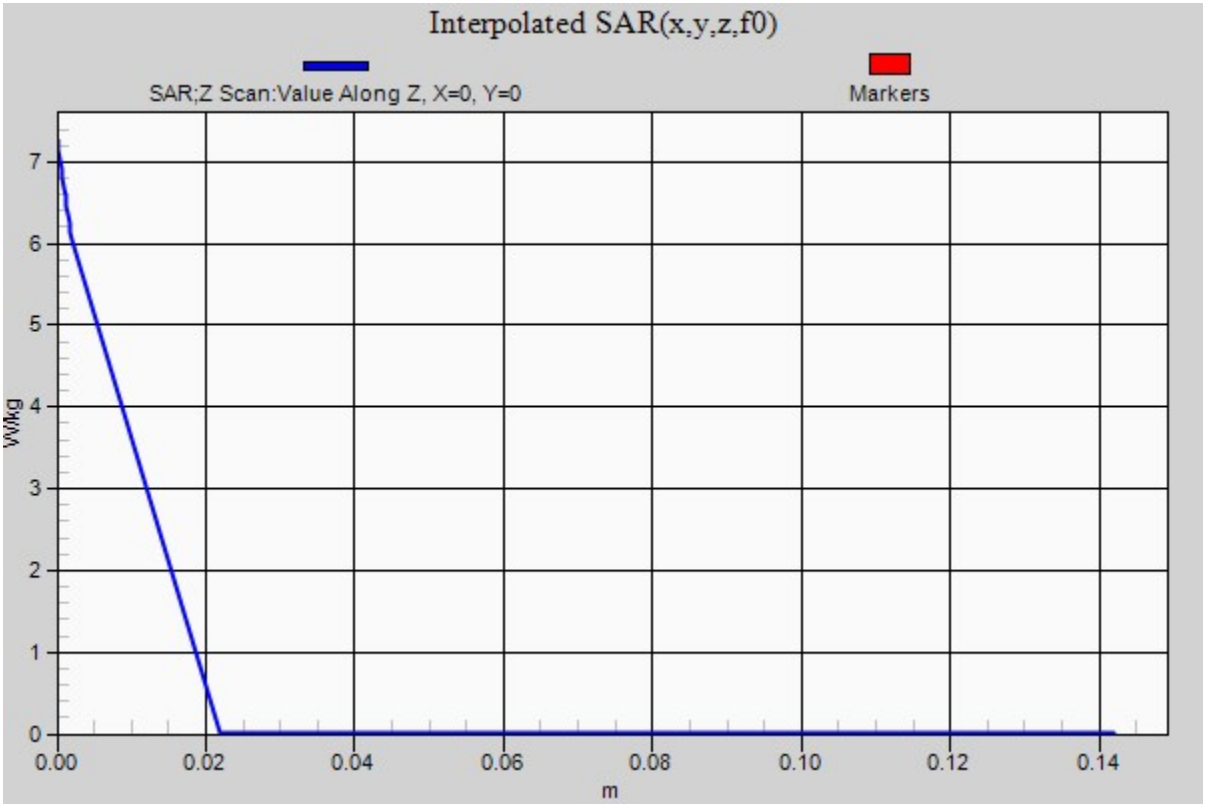
- Probe: EX3DV4 - SN3600; ConvF(4.55, 4.55, 4.55) @ 5250 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); 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 2 2/Area Scan (4x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 5.69 W/kg

SPC/SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 2 2/Zoom Scan (8x8x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 27.32 V/m; Power Drift = 0.25 dB
Peak SAR (extrapolated) = 14.9 W/kg
SAR(1 g) = 3.52 W/kg; SAR(10 g) = 0.933 W/kg
Smallest distance from peaks to all points 3 dB below = 6.4 mm
Ratio of SAR at M2 to SAR at M1 = 54.2%
Maximum value of SAR (measured) = 7.53 W/kg

SPC/SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 2 2/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 3.430) [mm]
Maximum value of SAR (interpolated) = 7.26 W/kg


W/kg
7.260
5.808
4.357
2.905
1.453
0.00168


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

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5250 MHz; σ = 4.9 S/m; ε_r = 33.74; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 11/10/2022 12:54:19 PM

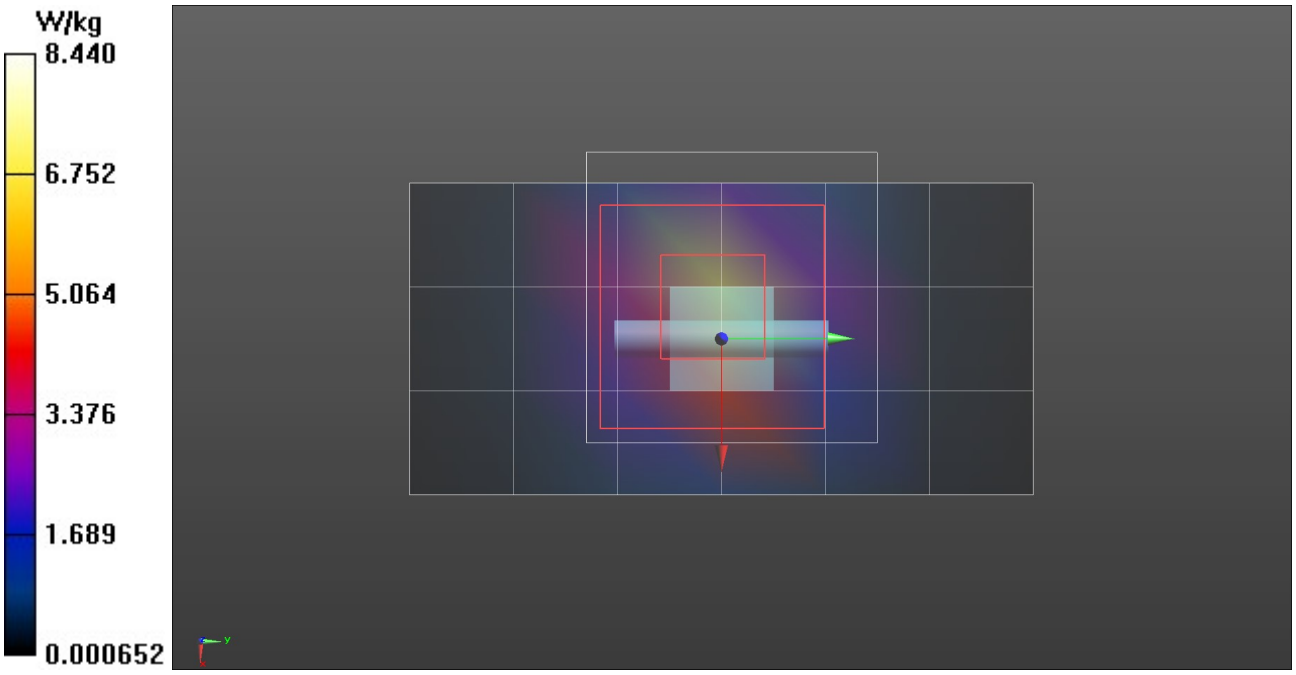
DASY5 Configuration:

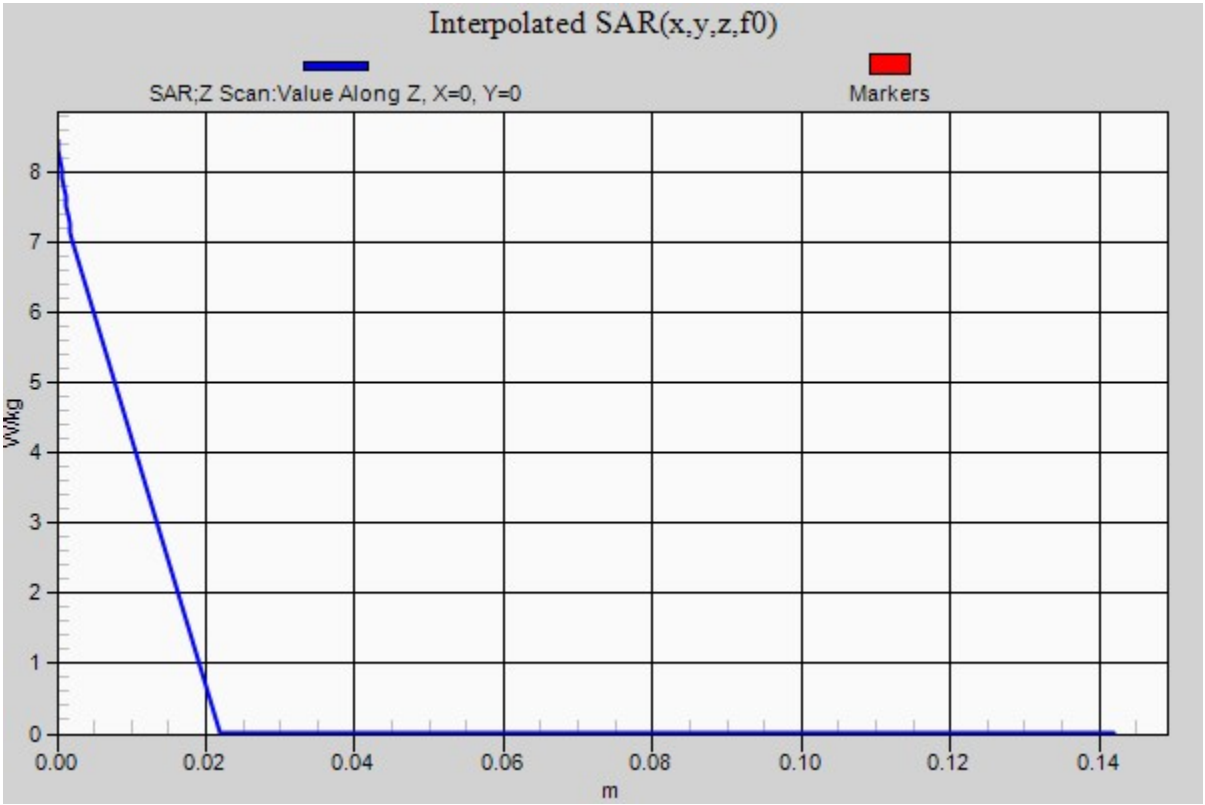
- Probe: EX3DV4 - SN3600; ConvF(4.55, 4.55, 4.55) @ 5250 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); 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 2/Area Scan (4x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 7.14 W/kg

SPC/SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 2/Zoom Scan (8x8x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 29.08 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 14.5 W/kg
SAR(1 g) = 3.81 W/kg; SAR(10 g) = 1.18 W/kg
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 55.4%
Maximum value of SAR (measured) = 7.62 W/kg

SPC/SPC 5250H Input=47 mw, Target= [3.36[3.74][4.11] Target=79.47W/kg@1000mw 2/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 3.145) [mm]
Maximum value of SAR (interpolated) = 8.44 W/kg


W/kg
8.440
6.752
5.064
3.376
1.689
0.000652


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

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

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5750 MHz; σ = 5.28 S/m; ε_r = 34; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 11/11/2022 5:12:09 PM

DASY5 Configuration:

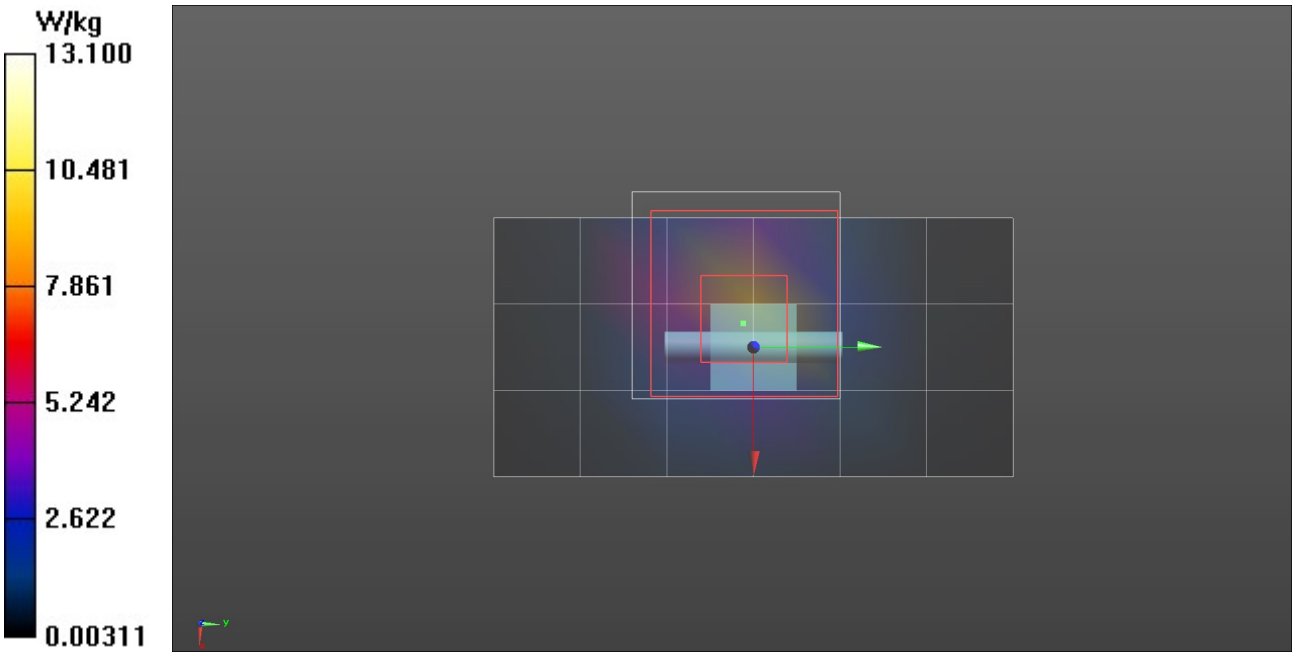
- Probe: EX3DV4 - SN3600; ConvF(4.16, 4.16, 4.16) @ 5750 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/14/2022
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

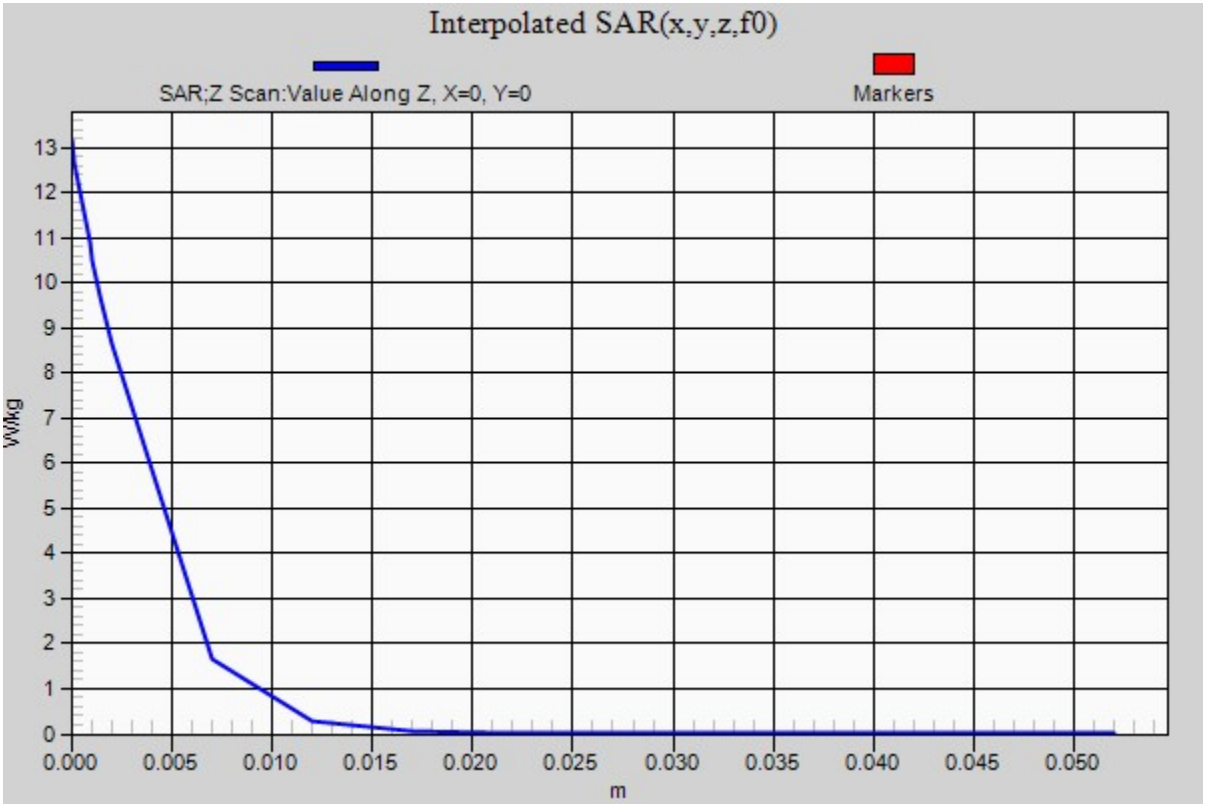
SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 3 3 2/Area Scan (4x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 8.99 W/kg

SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 3 3 2/Zoom Scan (31x31x31)/Cube 0:
Interpolated grid: dx=0.8000 mm, dy=0.8000 mm, dz=0.4000 mm
Reference Value = 25.64 V/m; Power Drift = 1.32 dB
Penetration depth = 2.900 (3.057, 3.203) [mm]
Smallest distance from peaks to all points 3 dB below = 5.6 mm
Ratio of SAR at M2 to SAR at M1 = 51.1%
Maximum value of SAR (interpolated) = 19.0 W/kg

SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 3 3 2/Zoom Scan (7x7x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 25.64 V/m; Power Drift = 1.32 dB
Peak SAR (extrapolated) = 19.0 W/kg
SAR(1 g) = 3.85 W/kg; SAR(10 g) = 1.05 W/kg
Smallest distance from peaks to all points 3 dB below = 5.6 mm
Ratio of SAR at M2 to SAR at M1 = 51.1%
Maximum value of SAR (measured) = 8.79 W/kg

SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000 mw 3 3 2/Z Scan (1x1x22): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 2.880 (3.025, 2.857) [mm]
Maximum value of SAR (interpolated) = 13.1 W/kg


W/kg
13.100
10.481
7.861
5.242
2.622
0.00311


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
13
12
11
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 B1

DUT: A04536; Type: Transmitter; Serial: Production Sample Proto-type
Procedure Name: B1-A04536, Back Side 5mm, 2442MHz 802.11b 20MHz DSSS-1,WIFI

Communication System: UID 0, CW (0); Frequency: 2442 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2442 MHz; σ = 1.92 S/m; ε_r = 36.162; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 10/29/2022 2:18:27 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2442 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 1.4mm (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: 4/14/2022
- 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/B1-A04536, Back Side 5mm, 2442MHz 802.11b 20MHz DSSS-1,WIFI/Area Scan (7x9x1): Measurement grid: dx=12mm, dy=12mm

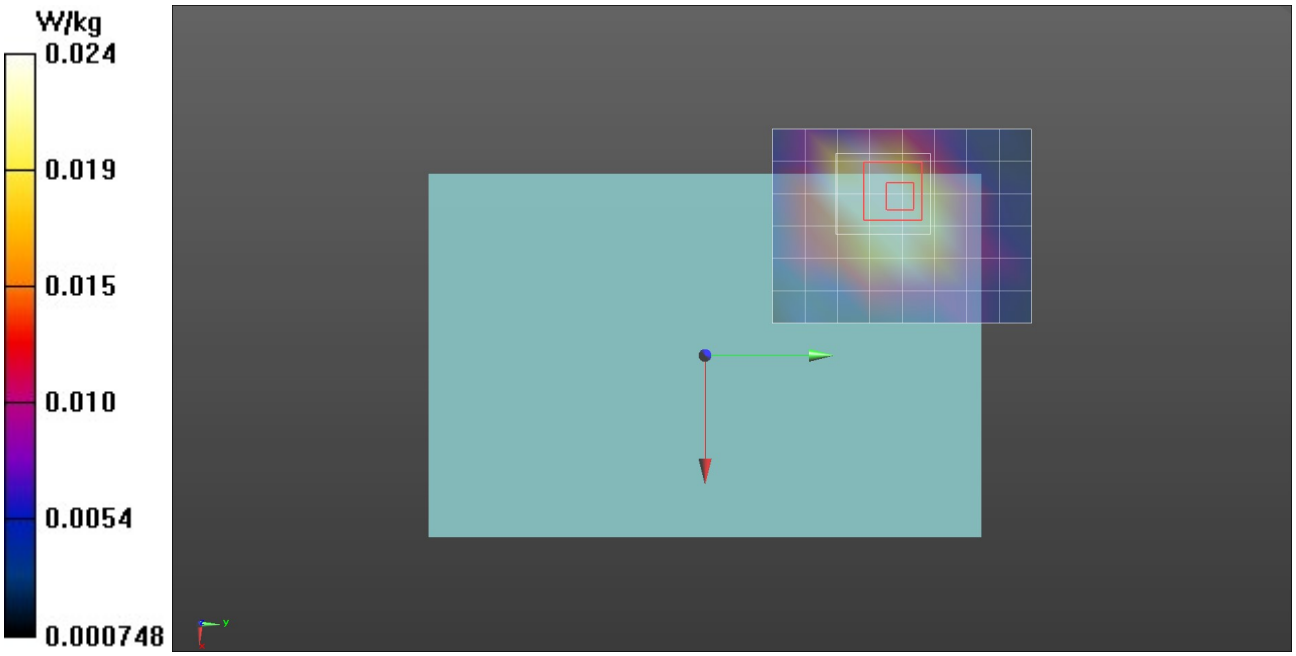
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0437 W/kg

2450H/B1-A04536, Back Side 5mm, 2442MHz 802.11b 20MHz DSSS-1,WIFI/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.141 V/m; Power Drift = 0.63 dB
Peak SAR (extrapolated) = 0.139 W/kg
SAR(1 g) = 0.028 W/kg; SAR(10 g) = 0.013 W/kg
Ratio of SAR at M2 to SAR at M1 = 47.6%

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0470 W/kg

2450H/B1-A04536, Back Side 5mm, 2442MHz 802.11b 20MHz DSSS-1,WIFI/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, 31.01) [mm]
Maximum value of SAR (interpolated) = 0.0240 W/kg



Plot B3

DUT: A04536; Type: Transmitter; Serial: Production Sample Proto-type
Procedure Name: B3-A04536, Back Side 5mm,5180MHz UNI-I OFDM-6 20MHz ,WIFI

Communication System: UID 0, CW (0); Frequency: 5180 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5180 MHz; σ = 4.78 S/m; ε_r = 32.85; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 10/30/2022 9:18:58 AM

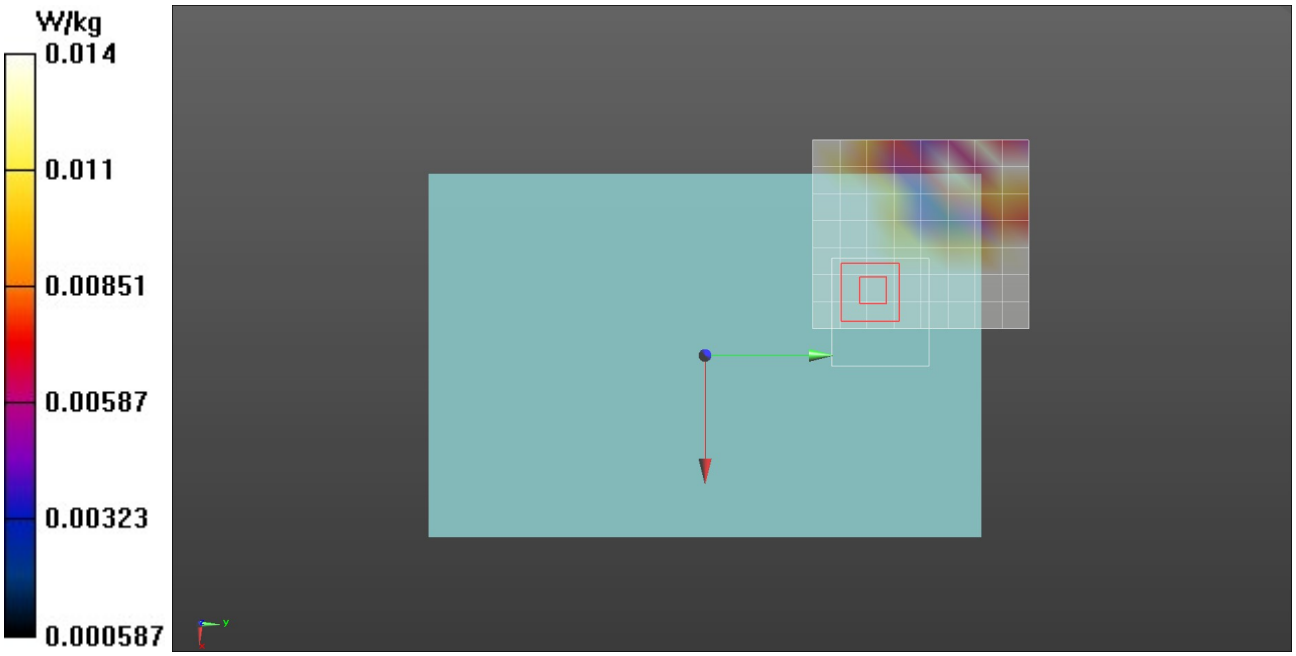
DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(4.55, 4.55, 4.55) @ 5180 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 1.4mm (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: 4/14/2022
- 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/B3-A04536, Back Side 5mm,5180MHz UNI-I OFDM-6 20MHz ,WIFI/Area Scan (8x9x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.782 W/kg

5250H/B3-A04536, Back Side 5mm,5180MHz UNI-I OFDM-6 20MHz ,WIFI/Zoom Scan (9x9x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 7.460 V/m; Power Drift = 0.75 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 0.312 W/kg; SAR(10 g) = 0.109 W/kg
Smallest distance from peaks to all points 3 dB below = 4 mm
Ratio of SAR at M2 to SAR at M1 = 55.6%
Maximum value of SAR (measured) = 0.741 W/kg

5250H/B3-A04536, Back Side 5mm,5180MHz UNI-I OFDM-6 20MHz ,WIFI/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 41.78) [mm]
Maximum value of SAR (interpolated) = 0.0119 W/kg



Plot E4

DUT: A04536; Type: Transmitter; Serial: Production Sample Proto-type
Procedure Name: E4-A04536, Back Side , 2412MHz 802.11b 20MHz DSSS-1,WIFI

Communication System: UID 0, CW (0); Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.868 S/m; ε_r = 36.306; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 10/29/2022 1:48:21 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.58, 6.58, 6.58) @ 2412 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 1.4mm (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: 4/14/2022
- 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-A04536, Back Side , 2412MHz 802.11b 20MHz DSSS-1,WIFI/Area Scan (7x9x1): Measurement grid: dx=12mm, dy=12mm

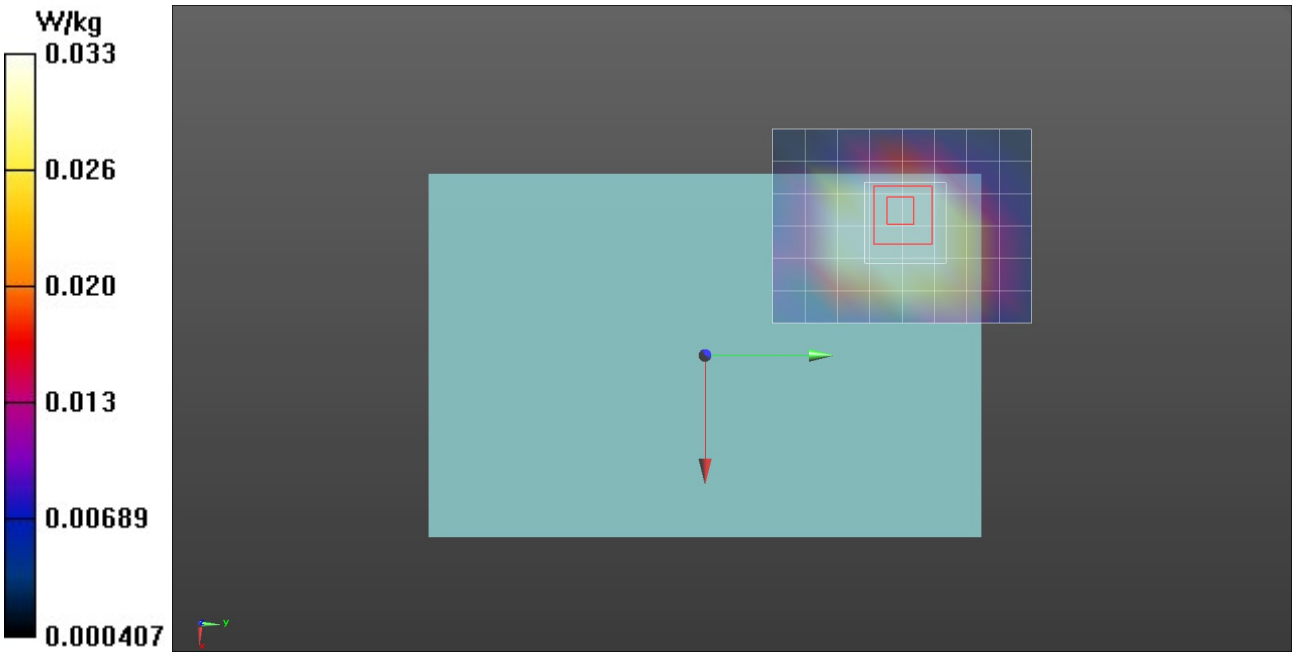
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.124 W/kg

2450H/E4-A04536, Back Side , 2412MHz 802.11b 20MHz DSSS-1,WIFI/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.053 V/m; Power Drift = -0.31 dB
Peak SAR (extrapolated) = 0.154 W/kg
SAR(1 g) = 0.065 W/kg; SAR(10 g) = 0.029 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 41.1%

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.116 W/kg

2450H/E4-A04536, Back Side , 2412MHz 802.11b 20MHz DSSS-1,WIFI/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, 8.981) [mm]
Maximum value of SAR (interpolated) = 0.0328 W/kg



Plot E8

DUT: A04536; Type: Transmitter; Serial: Production Sample Proto-type
Procedure Name: E8-A04536, Right Side , 5180MHz UNI-I OFDM-6 20MHz,WIFI

Communication System: UID 0, CW (0); Frequency: 5180 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5180 MHz; σ = 4.78 S/m; ε_r = 32.85; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 10/30/2022 3:09:40 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(4.55, 4.55, 4.55) @ 5180 MHz; Calibrated: 4/20/2022
- Sensor-Surface: 1.4mm (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: 4/14/2022
- 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/E8-A04536, Right Side , 5180MHz UNI-I OFDM-6 20MHz,WIFI/Area Scan (9x6x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.10 W/kg

5250H/E8-A04536, Right Side , 5180MHz UNI-I OFDM-6 20MHz,WIFI/Zoom Scan (9x9x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 7.551 V/m; Power Drift = 0.42 dB
Peak SAR (extrapolated) = 1.52 W/kg
SAR(1 g) = 0.376 W/kg; SAR(10 g) = 0.125 W/kg
Smallest distance from peaks to all points 3 dB below = 7.9 mm
Ratio of SAR at M2 to SAR at M1 = 50.7%
Maximum value of SAR (measured) = 0.881 W/kg

5250H/E8-A04536, Right Side , 5180MHz UNI-I OFDM-6 20MHz,WIFI/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 0) [mm]
Maximum value of SAR (interpolated) = 0.0503 W/kg