Celltech
Testing and Engineering Services Lab

Test Report Serial Number:	45461699 R0.1
Test Report Date:	16 December 2021
Project Number:	1553

SAR Test Report - New Application

Applicant:

GARMIN

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

Maximum Reported 1g BODY SAR			
FCC/ISED	IRIDIUM	1.52	W/kg
FCC/ISED	WIFI	0.83	
FCC/ISED	SIMULTANEOUS	0.96	
General Pop. Limit:		1.60	

Maximum Reported 10g EXTREMITY SAR			
FCC/ISED	IRIDIUM	0.74	W/kg
FCC/ISED	WIFI	0.30	
FCC/ISED	SIMULTANEOUS	0.35	
General Pop. Limit:		4.00	

FCC ID:	IC Registration Number
IPH-04167	1792A-04167
Product Model Number / HVIN	Product Name / PMN
A04167	A04167

In Accordance With:

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

IC RSS-102 Issue 5
Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Approved By:

Ben Hewson, President
Celltech Labs Inc.
21-364 Lougheed Rd.
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ilac-MRA ACCREDITED

Test Lab Certificate: 2470.01

Industry Canada

IC Registration 3874A

FCC

FCC Registration: CA3874

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1.0 DOCUMENT CONTROL

Revision History					
Samples Tested By:	Trevor Whillock/Ben Hewson		**Date(s) of Evaluation:**		1,12,16,17 Nov & 3,8 Dec 2021
Report Prepared By:	Ben Hewson		**Report Reviewed By:**		Art Voss
Report Revision	**Description of Revision**		**Revised Section**	**Revised By**	**Revision Date**
0.1	Draft Report		n/a	Ben Hewson	14 December 2021
1.0	Initial Release		n/a	Ben Hewson	16 December 2021

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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	
Type of Equipment:	Handheld Transceiver
Device Model(s) / HVIN:	A04167
Device Marketing Name / PMN:	TREAD XL OVERLAND EDITION
Test Sample Serial No.:	3370905720
Transmit Frequency Range:	IRIDIUM 1616-1626MHz (FCC ID: IPH-03302/ ISED ID:1792A-03302)
	WiFi: 2412 - 2462 MHz
	WiFi UNII 1: 5200 - 5240 MHz
	WiFi UNII 3: 5745-5825 MHz
	BT/ANT: 2402 - 2480 MHz
Number of Channels:	See Section 8.0
Manuf. Max. Avg Rated Output Power:	IRIDIUM 1620 MhZ 31.54dBm
	WiFi 2.4GHz: 802.11b:7.8dBm /802.11g:7.8dBm /802.11n: 4.8dBm /802.11n40: 3.0dBm
	WiFi 5 GHz UNII-1 802.11a: 14.31dBm / 802.11n: 14.31dBm/ 802.11n40: 10.0dBm/ 802.11ac80: 9.0dBm
	WiFi 5 GHz UNII-3 802.11a: 13.8dBm / 802.11n: 13.6dBm/ 802.11n40: 9.5Bm/802.11ac80: 8.5dBm
	ANT:GFSK: 2.0dBm / BT BR:GFSK: 2.0dBm / PI/4-DQPSK:4.8dBm / 8-DPSK: 4.8dBm /BT BLE (GMSK): 0dBm
Modulation:	FDMA-FM
	WiFi 802.11b/g/n: DSSS, OFDM, MCS0-7
	WiFi 802.11 a/ac: OFDM,MCS0-7
	BT: GFSK, PI/4-DQPSK, 8-DPSK
	BLE: GMSK
DUT Power Source:	5V USB, Internal Li-ion battery
Deviation(s) from standard/procedure:	None

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3.0 SCOPE OF EVALUATION

,(the '*Applicant*"), in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (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 A04167, FCC ID: IPH-04167 ISEDC ID: 1792A-04167 is a hand held transceiver with three transmiiters, one that operates in the 16GHz Iridium frequncy band, another in the 5GHz WiFi frequency band and the third in the 2.4GHz WiFi and BT/ANT frequency band. The transceiver is capable of simultaneous transmission between the 5GHz WiFi and BT/ANT. 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, IEEE 1528, IEC 62209-2, FCC KDB 865646, 447498, 248227 and RSS 102.

Application:

This is an application for a new device certification.

Scope:

Due to the nature of the device, the scope of this evaluation is to evaluate the SAR for intended and non-intended applications. It will include evaluation of the Iridium, 5GHz & 2.4 GHz transmitters for all required RF exposure configurations. The analysis of the Standalone Transmission SAR is found in Section 11.0 of this report.

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, IEEE 1528, IEC 62209-1, IEC 62209-2, FCC 447498, and RSS 102

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4.0 NORMATIVE REFERENCES

Normative References*	
ANSI / ISO 17025:2017	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
Health Canada	
Safety Code 6 (2015)	Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3kHz to 300GHz
Industry Canada Spectrum Management & Telecommunications Policy	
RSS-102 Issue 5:	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
IEC International Standard /IEEE International Committee on Electromagnetic Safety	
IEC/IEEE 62209-1528-2020:	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)
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
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 Test Guidane for IEEE 802.11 (WiFI) Transmitters

* When the issue number or issue date is omitted, the latest version is assumed.

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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.	A04166	
Standard(s) Applied:	**Measurement Procedure(s):**	
FCC 47 CFR §2.1093 Health Canada's Safety Code 6	FCC KDB 865664, FCC KDB 447498, FCC KDB248227, FCC KDB 941225 Industry Canada RSS-102 Issue 5 IEC\IEEE 62209-1528, IEEE Standard 1528-2013, 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:**
Original Filing		1,12,16,17 Nov & 3,8 Dec 2021

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. 13 December 2021 Date

PROFESSIONAL PROVINCE OF A. F. VOSS # 31327 BRITISH COLUMBIA ENGINEER

6.0 SAR MEASUREMENT SYSTEM

SAR Measurement System

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

DASY 6 SAR System with SAM Phantom

DASY 6 Measurement Controller

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7.0 RF CONDUCTED POWER MEASUREMENT

Table 7.1 Conducted Power Measurements – WiFi 2.4 GHz 802.11

Conducted Power Measurements										
Channel	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dB)	SAR Test Channel (Y/N)	Mode	Modulation		CB
1	2412	7.59	7.80	0.006	-0.21	-	WLAN 2.4G	DSSS-1Mbps	802.11b	20MHz
2	2417	7.62	7.80	0.006	-0.18	-		DSSS-1Mbps		
6	2437	7.73	7.80	0.006	-0.07	Y		DSSS-1Mbps		
10	2457	7.65	7.80	0.006	-0.15	-		DSSS-1Mbps		
11	2462	7.68	7.80	0.006	-0.12	-		DSSS-1Mbps		
13	2472	7.71	7.80	0.006	-0.09	-		DSSS-1Mbps		
1	2412	7.32	7.80	0.006	-0.48	-		DSSS-2Mbps		
		7.71	7.80	0.006	-0.09	-		DSSS-11Mbps		
		7.80	7.80	0.006	0.00	Y		OFDM-6Mbps	802.11g	
		4.66	4.80	0.003	-0.14	-		MCS-0	802.11n	
2	2417	7.41	7.80	0.006	-0.39	-		DSSS-2Mbps	802.11b	
6	2437	7.39	7.80	0.006	-0.41	-		DSSS-2Mbps	802.11b	
		7.77	7.80	0.006	-0.03	-		DSSS-5.5Mbps		
		7.73	7.80	0.006	-0.07	-		DSSS-11Mbps		
		7.79	7.80	0.006	-0.01	Y		OFDM-6Mbps	802.11g	
		4.66	4.80	0.003	-0.14	-		MCS-0	802.11n	
11	2462	7.35	7.80	0.006	-0.45	-		DSSS-2Mbps	802.11b	
		7.77	7.80	0.006	-0.03	-		DSSS-5.5Mbps		
		7.71	7.80	0.006	-0.09	-		DSSS-11Mbps		
		7.79	7.80	0.006	-0.01	Y		OFDM-6Mbps	802.11g	
		7.76	7.80	0.006	-0.04			OFDM-9Mbps		
		7.71	7.80	0.006	-0.09	-		OFDM-12Mbps		
		4.75	4.80	0.003	-0.05	-		MCS-0	802.11n	
		4.52	4.80	0.003	-0.28	-		MCS-3		
		4.38	4.80	0.003	-0.42	-		MCS-7		
13	2472	7.32	7.80	0.006	-0.48	-		DSSS-2Mbps	802.11b	
		7.76	7.80	0.006	-0.04	-		DSSS-5.5Mbps		
		7.71	7.80	0.006	-0.09	-		DSSS-11Mbps		
		7.77	7.80	0.006	-0.03	Y		OFDM-6Mbps	802.11g	
		6.32	7.80	0.006	-1.48	-		OFDM-9Mbps		
		3.50	4.80	0.003	-1.30	-		MCS-0	802.11n	
		0.14	4.80	0.003	-4.66	-		MCS-7		
5	2432	2.85	3.00	0.002	-0.15	-		MCS-0	802.11n	40MHz
		0.67	3.00	0.002	-2.33	-		MCS-7		
6	2437	2.78	3.00	0.002	-0.22	Y		MCS-0		
		0.63	3.00	0.002	-2.37			MCS-7		
7	2442	2.72	3.00	0.002	-0.28	-		MCS-0		
		0.59	3.00	0.002	-2.41	-		MCS-7		
9	2452	2.26	3.00	0.002	-0.74	-		MCS-0		
		0.23	3.00	0.002	-2.77	-		MCS-7		
11	2462	2.24	3.00	0.002	-0.76	-		MCS-0		
		-0.22	3.00	0.002	-3.22	-		MCS-7		

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Table 7.2 Conducted Power Measurements – WiFi 5Ghz UNII-1

Conducted Power Measurements										
Channel	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dB)	SAR Test Channel (Y/N)	Mode	Modulation		
36	5180	12.67	14.31	0.027	-1.64	Y	WiFI 5G	OFDM-6Mbps	802.11a - UNII-1	20MHz
36	5180	12.64	14.31	0.027	-1.67	-		OFDM-9Mbps		
36	5180	12.44	14.31	0.027	-1.87	-		OFDM-24Mbps		
40	5200	12.66	14.31	0.027	-1.65	-		OFDM-6Mbps		
44	5220	14.31	14.31	0.027	0.00	Y		OFDM-6Mbps		
48	5240	12.65	14.31	0.027	-1.66	-		OFDM-6Mbps		
36	5180	12.44	14.31	0.027	-1.87	-		MCS-0	802.11n - UNII-1	
36	5180	13.11	14.31	0.027	-1.20	-		MCS-3		
36	5180	12.39	14.31	0.027	-1.92	-		MCS-7		
40	5200	14.27	14.31	0.027	-0.04	-		MCS-0		
44	5220	14.21	14.31	0.027	-0.10	-		MCS-0		
48	5240	14.28	14.31	0.027	-0.03	Y		MCS-0		
38	5190	9.31	10.00	0.010	-0.69	Y		MCS-0	802.11n - UNII-1	40MHz
46	5230	8.52	10.00	0.010	-1.48	-		MCS-0		
42	5210	8.21	8.50	0.007	-0.29	Y		MCS-0	802.11ac - UNII-1	80MHz

Table 7.3 Conducted Power Measurements – WiFi 5GHz UNII-3

Conducted Power Measurements										
Channel	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dB)	SAR Test Channel (Y/N)	Mode	Modulation		
149	5745	13.67	13.80	0.024	-0.13	Y	WiFI 5G	OFDM-6Mbps	802.11a - UNII-3	20MHz
149	5745	13.50	13.80	0.024	-0.30	-		OFDM-9Mbps		
149	5745	13.59	13.80	0.024	-0.21	-		OFDM-24Mbps		
157	5745	13.58	13.80	0.024	-0.22	-		MCS-0		
165	5825	13.20	13.80	0.024	-0.60	-		MCS-0		
149	5745	13.63	13.60	0.023	0.03	-		MCS-0	802.11n - UNII-3	
149	5745	13.23	13.60	0.023	-0.37	-		MCS-3		
149	5745	12.38	13.60	0.023	-1.22	-		MCS-7		
157	5785	13.55	13.60	0.023	-0.05	-		MCS-0		
165	5825	13.11	13.60	0.023	-0.49	-		MCS-0		
151	5755	9.49	9.50	0.009	-0.01	-		MCS-0	802.11n - UNII-3	40MHz
159	5795	9.42	9.50	0.009	-0.08	-		MCS-0		
155	5775	8.48	9.50	0.009	-1.02	-		MCS-0	802.11ac - UNII-1	80MHz

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Table 7.4 Conducted Power Measurements – IRIDIUM 1600MHz FDMA-FM

Conducted Power Measurements										
Channel	Frequency *(MHz)*	Measured Power *(dBm)*	Rated Power *(dBm)*	Rated Power *(W)*	Delta *(dB)*	SAR Test Channel *(Y/N)*	Duty Cycle	Crest Factor	Mode	Modulation
1	1616.02	31.54	31.54	1.43	0.00	**Y**	9.30%	1075.3	IRIDIUM	FDMA-FM
2	1620.98	31.45	31.54	1.43	-0.09	**Y**				
3	1625.98	31.40	31.54	1.43	-0.14	**Y**				

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. Continuous Wave (CW) mode is a test mode not typical with normal transmission modes and may produce higher 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 .CW mode at the Maximum output power level setting and produced the most conservative SAR. The *reported* SAR was not scaled down.

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8.0 NUMBER OF TEST CHANNELS (N_C) AND CONFIGURATIONS

This device is intended to be mounted on a vehicle dashboard; optionally, the device can be hand-held .Due to the physical dimensions of the device and Iridium Antenna it would not be used within the user's apparel, however may be in contact with the user's body (i.e lap) ; the device was evaluated to Body SAR limits. Body SAR Limits are more stringent than Extremity SAR limits. Additional SAR measurements were made where the transmitter antenna location to an edge was sufficiently near that it was required in accordance to the FCC KDB guidance. The back side of the device was found to be the worst case setup configuration and produced the highest SAR. The back side of the device was chosen as the primary test position. Note: Only worst case test data from the preliminary evaluation was reported. FCC KDB 941225D07V01r02 was used as guidance for the selection of test positions for SAR evaluation..

As per FCC KDB 248227, the required 802.11 test channels are Ch1, Ch6 & Ch 11 and the worse case exposure configuration derived was the right edge position;

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 Iridium band had the highest rated power and has an operating duty cycle of 9.3%, the SAR system uses a crest factor to adjust the SAR evaluation to 100%, and the device position was assessed for worse configuration and tested in the low, mid and high channels.

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/ANT transmitter is capable of simultaneous transmission with the 5GHz WiFi Transmitter.

Due to the nature of this device, Bluetooth/ANT was evaluated for Simultaneous Transmission SAR.

See 11.3 for evaluation of Simultaneous Transmission 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

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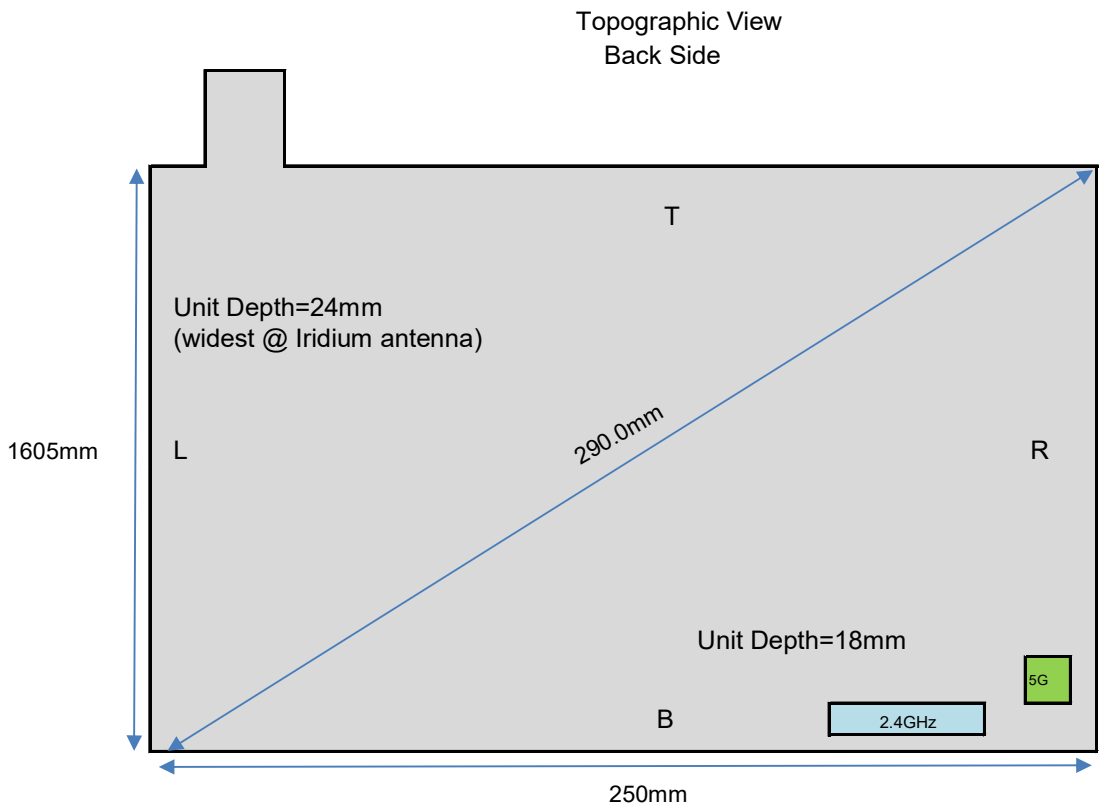
4. Per KDB 447498 D01v06, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold
5. Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separaton distances ≤ 50mm are 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 8.1 Antenna Distances



Antenna	Top Edge (mm)	Left Edge (mm)	Bottom Edge (mm)	Right Edge (mm)	Depth (mm)
WLAN/BT	140.0	200.0	8.0	35.0	9.0
5GHz	120.0	230.0	15.0	6.0	9.0

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Table 8.2 Body SAR test Exclusion Workchart

Body SAR Test Exclusion Workchart: (≤ 3.0 for 1-g SAR - exclusion threshold < 50mm Ratio; >50mm mW)

Exposure Position	Wireless Interface	BT	2.4GHz WLAN	5GHz WLAN (UNII-1)	5GHz WLAN (UNII-3)
	Calculated Frequency	2480	2462	5240	5825
	Maximum Power (dBm)	4.80	7.80	14.31	13.80
	Maximum rated Power (mW)	3.0	6.0	27.0	24.0
Top -Display Side	Separation Distance (mm)	9	9	9	9
	exclusion threshold (ratio)	0.5	1.1	6.9	6.4
	testing required ? (>3)	No	No	Yes	Yes
Back Side	Separation Distance (mm)	9	9	9	9
	exclusion threshold (ratio)	0.5	1.1	6.9	6.4
	testing required ? (>3)	No	No	Yes	Yes
Top Edge	Separation Distance (mm)	140	140	120	120
	exclusion threshold (mW)	995	996	766	762
	testing required ?	No	No	No	No
Left Edge	Separation Distance (mm)	200	200	230	230
	exclusion threshold (mW)	1595	1596	1866	1862
	testing required ?	No	No	No	No
Right Edge	Separation Distance (mm)	35	35	6	6
	exclusion threshold (ratio)	0.14	0.27	10.29	9.65
	testing required ? (>3)	No	No	Yes	Yes
Bottom Edge	Separation Distance (mm)	8	8	15	15
	exclusion threshold (ratio)	0.6	1.2	4.1	3.9
	testing required ? (>3)	No	No	Yes	Yes

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Table 8.2 Extremity SAR test Exclusion Workchart

Extremity SAR Test Exclusion Workchart: (≤ 7.5 for 10-g exclusion threshold < 50mm Ratio; >50mm mW)

Exposure Position	Wireless Interface	BT	2.4GHz WLAN	5GHz WLAN (UNII-1)	5GHz WLAN (UNII-3)
	Calculated Frequency	2480	2462	5240	5825
	Maximum Power (dBm)	4.80	7.80	14.31	13.80
	Maximum rated Power (mW)	3.0	6.0	27.0	24.0
Top -Display Side	Separation Distance (mm)	9	9	9	9
	exclusion threshold (ratio)	0.5	1.1	6.9	6.4
	testing required ? (>7.5)	No	No	No	No
Back Side	Separation Distance (mm)	9	9	9	9
	exclusion threshold (ratio)	0.5	1.1	6.9	6.4
	testing required ? (>7.5)	No	No	No	No
Top Edge	Separation Distance (mm)	140	140	120	120
	exclusion threshold (mW)	995	996	766	762
	testing required ?	No	No	No	No
Left Edge	Separation Distance (mm)	200	200	230	230
	exclusion threshold (mW)	1595	1596	1866	1862
	testing required ?	No	No	No	No
Right Edge	Separation Distance (mm)	35	35	6	6
	exclusion threshold (ratio)	0.14	0.27	10.29	9.65
	testing required ? (>7.5)	No	No	Yes	Yes
Bottom Edge	Separation Distance (mm)	8	8	15	15
	exclusion threshold (ratio)	0.6	1.2	4.1	3.9
	testing required ? (>7.5)	No	No	No	No

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9.0 ACCESSORIES EVALUATED

Table 9.1 Manufacturer's Accessory List

No accessories evaluated.

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10.0 SAR MEASUREMENT SUMMARY

Table 10.1: Measured Results – BODY/EXTREMITY

Measured SAR Results (1g) - BODY (10g) - EXTREMITY																
Date	Plot ID	DUT		Test Frequency (MHz)			Accessories				DUT Spacing		Conducted Power (dBm)	Measured SAR (1g) 100% DC (W/kg)	Measured SAR (10g) 100% DC (W/kg)	SAR Drift (dB)
		M/N	Type		Modulation	Configuration	Antenna ID	Battery ID	Body ID	Audio ID	DUT (mm)	Antenna (mm)				
2-Nov-2021	B101	A04167	Hand-Held Transmitter	ch44-5220	OFDM-6	Display-Top Side	20Mhz	UNI-1	n/a	n/a	0	0	14.31	0.140	0.049	1.590
2-Nov-2021	B102	A04167	Hand-Held Transmitter	ch44-5220	OFDM-6	Back Side	20Mhz	UNI-1	n/a	n/a	0	0	14.31	0.373	0.142	-0.200
2-Nov-2021	B103	A04167	Hand-Held Transmitter	ch44-5220	OFDM-6	Right Edge	20Mhz	UNI-1	n/a	n/a	0	0	14.31	0.794	0.288	0.190
2-Nov-2021	B104	A04167	Hand-Held Transmitter	ch44-5220	OFDM-6	Bottom Edge	20Mhz	UNI-1	n/a	n/a	0	0	14.31	0.652	0.025	1.270
2-Nov-2021	B105	A04167	Hand-Held Transmitter	Ch48-5240	MCS0	Back Side	20MHz	UNI-1	n/a	n/a	0	0	14.31	0.353	0.137	0.760
2-Nov-2021	B106	A04167	Hand-Held Transmitter	Ch48-5240	MCS0	Right Edge	20MHz	UNI-1	n/a	n/a	0	0	14.31	0.815	0.298	1.460
2-Nov-2021	B107	A04167	Hand-Held Transmitter	Ch38-5190	MCS0	Right Edge	40MHz	UNI-1	n/a	n/a	0	0	9.31	0.248	0.087	2.100
2-Nov-2021	B108	A04167	Hand-Held Transmitter	Ch42-5210	MCS0	Right Edge	80MHz	UNI-1	n/a	n/a	0	0	8.21	0.279	0.098	1.300
4-Dec-2021	B350	A04167	Hand-Held Transmitter	ch149-5745	6mb	Display-Top Side	20Mhz	UNI-3	n/a	n/a	0	0	13.67	0.043	0.014	2.870
4-Dec-2021	B351	A04167	Hand-Held Transmitter	ch149-5745	6mb	Back Side	20Mhz	UNI-3	n/a	n/a	0	0	13.67	0.201	0.072	0.800
4-Dec-2021	B352	A04167	Hand-Held Transmitter	ch149-5745	6mb	Right Edge	20Mhz	UNI-3	n/a	n/a	0	0	13.67	0.384	0.140	0.820
12-Nov-2021	B300	A04167	Hand-Held Transmitter	ch6-2437	802.11b -1 mb	Back Side	20Mhz	DSSS	n/a	n/a	0	0	7.73	0.030	0.015	1.430
12-Nov-2021	B301	A04167	Hand-Held Transmitter	ch6-2437	802.11b -1 mb	Display-Top Side	20Mhz	DSSS	n/a	n/a	0	0	7.73	0.007	0.003	0.950
12-Nov-2021	B302	A04167	Hand-Held Transmitter	ch6-2437	802.11b -1 mb	Bottom Edge	20Mhz	DSSS	n/a	n/a	0	0	7.73	0.020	0.009	0.470
17-Nov-2021	B303	A04167	Hand-Held Transmitter	ch6-2437	802.11g -6 mb	Back Side	20Mhz	DSSS	n/a	n/a	0	0	7.73	0.049	0.023	0.520
17-Nov-2021	B304	A04167	Hand-Held Transmitter	ch1-2412	802.11g -6 mb	Back Side	20Mhz	DSSS	n/a	n/a	0	0	7.8	0.035	0.017	0.540
17-Nov-2021	B305	A04167	Hand-Held Transmitter	ch11-2462	802.11g -6 mb	Back Side	20Mhz	DSSS	n/a	n/a	0	0	7.79	0.044	0.022	1.310
17-Nov-2021	B306	A04167	Hand-Held Transmitter	ch13-2472	802.11g -6 mb	Back Side	20Mhz	DSSS	n/a	n/a	0	0	7.77	0.052	0.025	0.870
17-Nov-2021	B309	A04167	Hand-Held Transmitter	ch6-2437	MCS0	Back Side	40MHz	802.11n40	n/a	n/a	0	0	2.78	0.029	0.005	-0.260
8-Dec-2021	B500	A04167	Hand-Held Transmitter	Low-1616 Mhz	Iridium	Back Side	1MHz	IRIDIUM	n/a	n/a	0	0	31.54	1.350	0.595	0.900
8-Dec-2021	B501	A04167	Hand-Held Transmitter	Low-1616 Mhz	Iridium	Display-Top Side	1MHz	IRIDIUM	n/a	n/a	0	0	31.54	0.653	0.336	0.770
8-Dec-2021	B502	A04167	Hand-Held Transmitter	Low-1616 Mhz	Iridium	Left Edge	1MHz	IRIDIUM	n/a	n/a	0	0	31.54	0.083	0.512	-0.540
8-Dec-2021	B503	A04167	Hand-Held Transmitter	Mid-1621 Mhz	Iridium	Back Side	1MHz	IRIDIUM	n/a	n/a	0	0	31.45	1.270	0.620	0.230
8-Dec-2021	B504	A04167	Hand-Held Transmitter	High-1626 MHz	Iridium	Back Side	1MHz	IRIDIUM	n/a	n/a	0	0	31.4	1.280	0.619	-0.610
8-Dec-2021	B505	A04167	Hand-Held Transmitter	Low-1616 Mhz	Iridium	Back Side Repeat	1MHz	IRIDIUM	n/a	n/a	0	0	31.54	1.270	0.622	0.310
SAR Limit								Spatial Peak			Head/Body		RF Exposure Category			
FCC 47 CFR 2.1093				Health Canada Safety Code 6				1 & 10 Gram Average			1.6W/kg/ 4W/kg		General Population			

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11.0 SCALING OF MAXIMUM MEASURE SAR

Table 11.1 SAR Scaling – BODY CONFIGURATION

Scaling of Maximum Measured SAR (1g)					
Measured Parameters		Body Configuration			
			Wifi	Iridium	
Plot ID			B106	B504	
Maximum Measured SAR_M			0.815	1.280	(W/kg)
Frequency			5240	1626	(MHz)
Power Drift			1.460 (1)	-0.610 (1)	(dB)
Conducted Power			14.350	31.400	(dBm)
Fluid Deviation from Target					
Δe	Permitivity		-6.07% (2)	-4.08% (2)	
Δσ	Conductivity		-1.70% (2)	1.22% (2)	

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

Note(2): Fluid Dielectric Parameters are Within 5% of Targets. SAR Adjustment for Fluid Sensitivity is 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)
$C\sigma = (0.009804*f^3) - (0.08661*f^2) + (0.02981*f) + 0.7829$					(F.3)
f	Frequency (GHz)		5.24	1.626	
Ce			-0.201	-0.226	
Cσ			-0.028	0.645	
Ce * Δe			0.012	0.009	
Cσ * Δσ			0.000	0.008	
ΔSAR			0.013	0.017	(%)

Manufacturer's Tuneup Tolerance				
Measured Conducted Power		14.350	31.400	(dBm)
Rated Conducted Power		14.370	31.540	(dBm)
ΔP		-0.020	-0.140	(dB)

SAR Adjustment for Fluid Sensitivity				
$SAR_1 = SAR_M * \Delta SAR$		0.825	1.280	(W/kg)

SAR Adjustment for Tuneup Tolerance				
$SAR_2 = SAR_1 + [\Delta P]$		0.829	1.322	(W/kg)

SAR Adjustment for Drift				
$SAR_3 = SAR_2 + Drift$		0.829	1.521	(W/kg)

reported SAR				
$ISED = SAR_3$		**0.83**	**1.52**	(W/kg)

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Table 11.2 SAR Scaling – EXTREMITY CONFIGURATION

Scaling of Maximum Measured SAR (10g)					
Measured Parameters		Extremity Configuration			
			Wifi	Iridium	
Plot ID			B106	B504	
Maximum Measured SAR_M			0.298	0.619	(W/kg)
Frequency			5240	1626	(MHz)
Power Drift			1.460 (1)	-0.610	(dB)
Conducted Power			14.350	31.400	(dBm)
Fluid Deviation from Target					
Δe	Permitivity		-6.07% (2)	-4.08% (2)	
Δσ	Conductivity		-1.70% (2)	1.22% (2)	

Note(2): Fluid Dielectric Parameters are Within 5% of Targets. SAR Adjustment for Fluid Sensitivity is not Required.

Fluid Sensitivity Calculation (10g)				IEC 62209-2 Annex	
Delta SAR = Ce * Δe + Cσ * Δσ					
$Ce = (-0.0007854*f^3) + (0.009402*f^2) - (0.02742*f) - 0.2026$					
$C\sigma = (0.009804*f^3) - (0.08661*f^2) + (0.02981*f) + 0.7829$					
f	Frequency (GHz)		5.24	1.626	
Ce			-0.201	-0.226	
Cσ			-0.028	0.645	
Ce * Δe			0.012	0.009	
Cσ * Δσ			0.000	0.008	
ΔSAR			0.013	0.017	(%)

Manufacturer's Tuneup Tolerance				
Measured Conducted Power		14.350	31.400	(dBm)
Rated Conducted Power		14.370	31.540	(dBm)
ΔP		-0.020	-0.140	(dB)

SAR Adjustment for Fluid Sensitivity				
$SAR_1 = SAR_M * \Delta SAR$		0.302	0.619	(W/kg)

SAR Adjustment for Tuneup Tolerance				
$SAR_2 = SAR_1 + [\Delta P]$		0.303	0.639	(W/kg)

SAR Adjustment for Drift				
$SAR_3 = SAR_2 + Drift$		0.303	0.736	(W/kg)

reported SAR				
ISED = SAR_3		**0.30**	**0.74**	(W/kg)

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NOTES to Table11.1
(1) Scaling of the Maximum Measured SAR is based on the highest, 100% duty cycle for Face, Body and/or Head icluding ALL test channels, configurations and accessories used during THIS evaluation. The Measured Fluid Deviation parameters apply only to deviation of the tissue equivalent fluids used at the frequencies which produced the highest measured SAR. The Measured Conducted Power applies to the Conducted Power measured at the frequencies producing the highest Face and Body SAR. The Measured Drift is the SAR drift associated with that specific SAR measurement. The Reported SAR is the accumulation of all SAR Adjustments from the applicable Steps 1 through 4. The Plot ID is for indentification of the SAR Measurement Plots in Annex A of this report. NOTE: Some of the scaling factors in Steps 1 through 4 may not apply and are identified by light gray text.
Step 1
Per IEC-62209-1 and FCC KDB 865664. Scaling required only when Measured Fluid Deviation is greater than 5%. If the Measured Fluid Deviation is greater than 5%, Table 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 KDB 447498. Scaling required only when the difference (Delta) between the Measured Conducted Power and the Manufacturer's Rated Conducted Power is (-) Negative. The absolute value of Delta is ADDED to the SAR.
Step 3
Per IEC 62209-1. Scaling required only when Measured Drift is (-) Negative. The absolute value of Measured Drift is added to Reported or Simultaneous Reported SAR.
Step 4
Per KDB 447498 4.3.2. The SAR, either measured or calculated, of ANY and ALL simultaneous transmitters must be added together and includes all contributors.
Step 5
The Reported SAR is the Maximum Final Adjusted Cumulative SAR from the applicable Steps 1 through 4 and are reported on Page 1 of this report.

Table 11.3: Simultaneous SAR Evaluation – BODY/EXTREMITY

SAR Data Summary - Simultaneous Evaluation

Wifi & BT Body SAR					
Plot ID	Frq	ch	Protocol	Modulation	SAR
B106	5240	48	UNII-1	MCS-0	0.83
n/a	2480	n/a	BT 3EDR	8DPSK	0.13
				total SAR	0.96
Body 1.6 W/kg - averaged over 1 gram					

Wifi & BT Extremity SAR					
Plot ID	Frq	ch	Protocol	Modulation	SAR
B106	5240	48	UNII-1	MCS-0	0.3
n/a	2480	n/a	BT 3EDR	8DPSK	0.05
				total SAR	0.35
Extremity 4.0 W/kg - averaged over 10 gram					

Wifi & ANT Body SAR					
Plot ID	Frq	ch	Protocol	Modulation	SAR
B106	5240	48	UNII-1	MCS-0	0.83
n/a	2480	n/a	ANT	GFSK	0.05
				total SAR	0.88
Body 1.6 W/kg - averaged over 1 gram					

Wifi & ANT Extremity SAR					
Plot ID	Frq	ch	Protocol	Modulation	SAR
B106	5240	48	UNII-1	MCS-0	0.3
n/a	2480	n/a	ANT	GFSK	0.03
				total SAR	0.33
Extremity 4.0 W/kg - averaged over 10 gram					

Wifi in 5GHz can operate simultaneously with BT or ANT 2.4GHz

The sum of the two transmitters is less than the limit; therefore, the simultansous transmisson meets the requirements of KDB447468 D01 V06 section 4.3.2 page 13

The estimated SAR value for the BT and ANT+ transmitters are listed below.
[max. power, mW / mim. seperation distance, mm] * [√f(GHz) / x], where x =7.5 for 1 gram SAR and x=18.75 for 10 gram SAR

BT
[3/5] * [√2.48/7.5] = 0.13

ANT
[1.6/5] * [√2.480/7.5] = 0.05

BT
[3/5] * [√2.48/18.75] = 0.05

ANT
[1.6/5] * [√2.480/18.75] = 0.03

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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.			

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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
31 Oct 2021	22.6	20.6	25%	102.9	X	X		5250H Fluid, SPC
01 Nov 2021	23.6	23.5	20%	101.5			X	5250H Testing
02 Nov 2021	25.4	20.9	28%	102.3			X	5250H Testing
11 Nov 2021	26	23.5	25%	102.6	X	X		2450H Fluid, SPC
12 Nov 2021	22.8	21.2	26%	102.7			X	2450H SAR Testing
16 Nov 2021	26.1	23.3	23%	102.5	X	X	X	2450H Fluid, SPC, SAR Testing
02 Dec 2021	25.7	20.7	24%	101.9	X			5750H Fluid
03 Dec 2021	25.6	20.5	23%	102.8		X	X	5750H SPC, SAR Testing
06 Dec 2021	26.3	20.0	19%	101.5	X	X		1640H Fluid, SPC
08 Dec 2021	25.5	20.1	23%	100.7			X	1640H SAR Testing

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13.2 DUT Setup and Configuration

DUT Setup and Configuration	
1	The DUT was evaluated for SAR in accordance with the procedures described in IEC\IEEE 62209-1528, IEEE 1528, FCC KDB 865646, 447498, 941225, 248227, and RSS-102. The device was evaluated at a phantom separation distance of 0mm.
2	The intended use of the device is to be hand held or mounted. The DUT was additionaly evaluated for SAR in accordance with the procedures described in KDB 941225D07V01r02. The Back Side of the device was the highest SAR value for the highest output power channel, and was used as the default position. Additonally the Right Edge and Bottom Edge and Display SIde were evaluated as proximity to the transmitter was sufficiently near to require evaluation. The Left Edge was also evaluated on the Iridium band based on proximity to the transmitter.
3	The Initial Test Position SAR Test Reduction Procedure As per KDB 248227D01. The DUT has an extending antenna that would not facilitate positioning the DUT in an upside position in use, and was not considered for evaluation . When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration .
4	The Device was capable of transmitting at various modulations and data rates. The Conducted Power was higher when measured in DSSS Mode 1Mbps 2.4GHz ,OFDM 6Mbps & MCS0 UNII-1, OFDM 6Mbps UNII-3. The Iridium band was and was evaluated across the low, mid and high channels. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer. Each SAR evaluation was performed with a fully charged battery.

13.3 DUT Positioning

DUT Positioning
Positioning
The DUT Positioner was securely fastened to the Phantom Platform. Registration marks were placed on the DUT and the Positioner to ensure consistent positioning of the DUT for each test evaluation.
BODY/EXTREMITY Configuration
The DUT, was securely clamped into the device holder with the surface of the DUT normally in contact with the body in direct contact with the bottom of the phantom, or 0mm separation from the DUT to the phantom.
HEAD Configuration
This device is not intended to be held to the ear and was not tested in the HEAD configuration.
FACE Configuration
This device is not intended to be held to the face and was not tested in the FACE configuration.

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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 100% DC (Duty Cycle) column are the SAR values reported by the SAR Measurement Server with the DUT operating at 100% transmit duty cycle. These tables also include other information such as transmit channel and frequency, modulation, accessories tested and DUT-phantom separation distance. In the Scaling of Maximum Measured SAR Section of this report, the highest measured SAR in the BODY configuration, within the entire scope of this assessment, are, when applicable, scaled for Fluid Sensitivity, Manufacturer's Tune-Up Tolerance, Simultaneous Transmission and Drift. With the exception of Duty Cycle correction/compensation, SAR values are ONLY scaled up, not down. The final results of this scaling is the *reported SAR* which appears on the Cover Page of this report.

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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	

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13.7 Scan Resolution 2GHz to 3GHz

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	

13.8 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	

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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

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Table 14.2 Calculation of Degrees of Freedom

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

15.0 FLUID DIELECTRIC PARAMETERS

Table 15.1 Fluid Dielectric Parameters 5250MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Sun 31/Oct/2021 10:48:21
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	33.65	4.49
5.1600	36.03	4.61	33.55	4.47
5.1700	36.02	4.62	33.52	4.48
5.1800	36.01	4.63	33.69	4.52
5.1900	36.00	4.64	33.75	4.54
5.2000	35.99	4.65	33.96	4.50
5.2100	35.97	4.67	33.95	4.58
5.2200	35.96	4.68	33.84	4.50
5.2300	35.95	4.69	33.70	4.54
5.2400	35.94	4.70	33.76	4.62
5.2500	35.93	4.71	33.40	4.58
5.2600	35.92	4.72	33.47	4.57
5.2700	35.91	4.73	33.49	4.64
5.2800	35.89	4.74	33.42	4.62
5.2900	35.88	4.75	33.39	4.66
5.3000	35.87	4.76	33.91	4.64
5.3100	35.86	4.77	33.75	4.67
5.3200	35.85	4.78	33.93	4.63
5.3300	35.84	4.79	33.77	4.66
5.3400	35.83	4.80	33.35	4.62
5.3500	35.81	4.81	33.49	4.68

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FLUID DIELECTRIC PARAMETERS

Date:	31 Oct 2021	Fluid Temp:	20.7	Frequency:	5250MHz	Tissue:	Head
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
5150.0000		33.6500	4.4900	36.0400	4.60	-6.63%	-2.39%
5160.0000		33.5500	4.4700	36.0300	4.61	-6.88%	-3.04%
5170.0000		33.5200	4.4800	36.0200	4.62	-6.94%	-3.03%
5180.0000		33.6900	4.5200	36.0100	4.63	-6.44%	-2.38%
5190.0000	*	33.7500	4.5400	36.0000	4.64	-6.25%	-2.16%
5200.0000		33.9600	4.5000	35.9900	4.65	-5.64%	-3.23%
5210.0000	*	33.9500	4.5800	35.9700	4.67	-5.62%	-1.93%
5220.0000	*	33.8400	4.5000	35.9600	4.68	-5.90%	-3.85%
5230.0000		33.7000	4.5400	35.9500	4.69	-6.26%	-3.20%
5240.0000	*	33.7600	4.6200	35.9400	4.70	-6.07%	-1.70%
5250.0000		33.4000	4.5800	35.9300	4.71	-7.04%	-2.76%
5260.0000		33.4700	4.5700	35.9200	4.72	-6.82%	-3.18%
5270.0000		33.4900	4.6400	35.9100	4.73	-6.74%	-1.90%
5280.0000		33.4200	4.6200	35.8900	4.74	-6.88%	-2.53%
5290.0000		33.3900	4.6600	35.8800	4.75	-6.94%	-1.89%
5300.0000		33.9100	4.6400	35.8700	4.76	-5.46%	-2.52%
5310.0000		33.7500	4.6700	35.8600	4.77	-5.88%	-2.10%
5320.0000		33.9300	4.6300	35.8500	4.78	-5.36%	-3.14%
5330.0000		33.7700	4.6600	35.8400	4.79	-5.78%	-2.71%
5340.0000		33.3500	4.6200	35.8300	4.80	-6.92%	-3.75%
5350.0000		33.4900	4.6800	35.8100	4.81	-6.48%	-2.70%

*Channel Frequency Tested

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Table 15.2 Fluid Dielectric Parameters 2450MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Thu 11/Nov/2021 17:25:34
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	36.13	1.69
2.3600	39.36	1.72	36.15	1.71
2.3700	39.34	1.73	36.29	1.72
2.3800	39.32	1.74	36.08	1.72
2.3900	39.31	1.75	36.14	1.71
2.4000	39.29	1.76	36.01	1.71
2.4100	39.27	1.76	35.71	1.72
2.4200	39.25	1.77	35.62	1.73
2.4300	39.24	1.78	35.72	1.76
2.4400	39.22	1.79	35.69	1.79
2.4500	39.20	1.80	35.80	1.80
2.4600	39.19	1.81	35.76	1.80
2.4700	39.17	1.82	35.89	1.81
2.4800	39.16	1.83	35.78	1.81
2.4900	39.15	1.84	35.67	1.86
2.5000	39.14	1.85	35.64	1.86
2.5100	39.12	1.87	35.57	1.86
2.5200	39.11	1.88	35.30	1.88
2.5300	39.10	1.89	35.25	1.88
2.5400	39.09	1.90	35.38	1.90
2.5500	39.07	1.91	35.57	1.92

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FLUID DIELECTRIC PARAMETERS

Date:	11 Nov 2021	Fluid Temp:	23.5	Frequency:	2450MHz	Tissue:	Head

Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
2350.0000		36.1300	1.6900	39.3800	1.71	-8.25%	-1.17%
2360.0000		36.1500	1.7100	39.3600	1.72	-8.16%	-0.58%
2370.0000		36.2900	1.7200	39.3400	1.73	-7.75%	-0.58%
2380.0000		36.0800	1.7200	39.3200	1.74	-8.24%	-1.15%
2390.0000		36.1400	1.7100	39.3100	1.75	-8.06%	-2.29%
2400.0000		36.0100	1.7100	39.2900	1.76	-8.35%	-2.84%
2410.0000		35.7100	1.7200	39.2700	1.76	-9.07%	-2.27%
2420.0000		35.6200	1.7300	39.2500	1.77	-9.25%	-2.26%
2430.0000		35.7200	1.7600	39.2400	1.78	-8.97%	-1.12%
2437.0000	*	35.7140	1.7660	39.2360	1.78	-8.98%	1.22%
2440.0000		35.6900	1.7900	39.2200	1.79	-9.00%	0.00%
2450.0000		35.8000	1.8000	39.2000	1.80	-8.67%	0.00%
2460.0000		35.7600	1.8000	39.1900	1.81	-8.75%	-0.55%
2470.0000		35.8900	1.8100	39.1700	1.82	-8.37%	-0.55%
2480.0000		35.7800	1.8100	39.1600	1.83	-8.63%	-1.09%
2490.0000		35.6700	1.8600	39.1500	1.84	-8.89%	1.09%
2500.0000		35.6400	1.8600	39.1400	1.85	-8.94%	0.54%
2510.0000		35.5700	1.8600	39.1200	1.87	-9.07%	-0.53%
2520.0000		35.3000	1.8800	39.1100	1.88	-9.74%	0.00%
2530.0000		35.2500	1.8800	39.1000	1.89	-9.85%	-0.53%
2540.0000		35.3800	1.9000	39.0900	1.90	-9.49%	0.00%
2550.0000		35.5700	1.9200	39.0700	1.91	-8.96%	0.52%

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Table 15.3 Fluid Dielectric Parameters 2450MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Tue 16/Nov/2021 11:00:46
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	35.99	1.74
2.3600	39.36	1.72	36.00	1.74
2.3700	39.34	1.73	35.94	1.73
2.3800	39.32	1.74	35.73	1.73
2.3900	39.31	1.75	35.68	1.73
2.4000	39.29	1.76	35.60	1.74
2.4100	39.27	1.76	35.44	1.78
2.4200	39.25	1.77	35.50	1.78
2.4300	39.24	1.78	35.41	1.80
2.4400	39.22	1.79	35.49	1.83
2.4500	39.20	1.80	35.50	1.84
2.4600	39.19	1.81	35.53	1.85
2.4700	39.17	1.82	35.54	1.82
2.4800	39.16	1.83	35.44	1.86
2.4900	39.15	1.84	35.50	1.86
2.5000	39.14	1.85	35.22	1.86
2.5100	39.12	1.87	35.18	1.87
2.5200	39.11	1.88	35.21	1.90
2.5300	39.10	1.89	35.07	1.90
2.5400	39.09	1.90	35.00	1.94
2.5500	39.07	1.91	35.11	1.95

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FLUID DIELECTRIC PARAMETERS

Date:	16 Nov 2021	Fluid Temp:	23.3	Frequency:	2450MHz	Tissue:	Head
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
2350.0000		35.9900	1.7400	39.3800	1.71	-8.61%	1.75%
2360.0000		36.0000	1.7400	39.3600	1.72	-8.54%	1.16%
2370.0000		35.9400	1.7300	39.3400	1.73	-8.64%	0.00%
2380.0000		35.7300	1.7300	39.3200	1.74	-9.13%	-0.57%
2390.0000		35.6800	1.7300	39.3100	1.75	-9.23%	-1.14%
2400.0000		35.6000	1.7400	39.2900	1.76	-9.39%	-1.14%
2410.0000		35.4400	1.7800	39.2700	1.76	-9.75%	1.14%
2412.0000	*	35.4520	1.7800	39.2660	1.76	-9.71%	1.22%
2420.0000		35.5000	1.7800	39.2500	1.77	-9.55%	0.56%
2430.0000		35.4100	1.8000	39.2400	1.78	-9.76%	1.12%
2437.0000	*	35.4260	1.8060	39.2360	1.78	-9.71%	1.22%
2440.0000		35.4900	1.8300	39.2200	1.79	-9.51%	2.23%
2450.0000		35.5000	1.8400	39.2000	1.80	-9.44%	2.22%
2460.0000		35.5300	1.8500	39.1900	1.81	-9.34%	2.21%
2462.0000	*	35.5320	1.8440	39.1860	1.81	-9.32%	1.22%
2470.0000		35.5400	1.8200	39.1700	1.82	-9.27%	0.00%
2472.0000	*	35.5200	1.8280	39.1680	1.82	-9.31%	1.22%
2480.0000	*	35.4400	1.8600	39.1600	1.83	-9.50%	1.64%
2490.0000		35.5000	1.8600	39.1500	1.84	-9.32%	1.09%
2500.0000		35.2200	1.8600	39.1400	1.85	-10.02%	0.54%
2510.0000		35.1800	1.8700	39.1200	1.87	-10.07%	0.00%
2520.0000		35.2100	1.9000	39.1100	1.88	-9.97%	1.06%
2530.0000		35.0700	1.9000	39.1000	1.89	-10.31%	0.53%
2540.0000		35.0000	1.9400	39.0900	1.90	-10.46%	2.11%

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Table 15.4 Fluid Dielectric Parameters 5750MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Wed 02/Dec/2021 17:32:54
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
5.6500	35.47	5.12	33.01	5.34
5.6600	35.46	5.13	32.91	5.33
5.6700	35.45	5.14	32.80	5.33
5.6800	35.44	5.15	32.96	5.26
5.6900	35.43	5.16	33.04	5.28
5.7000	35.41	5.17	32.87	5.32
5.7100	35.40	5.18	32.80	5.31
5.7200	35.39	5.19	33.10	5.36
5.7300	35.38	5.20	32.90	5.26
5.7400	35.37	5.21	32.76	5.48
5.7500	35.36	5.22	32.88	5.33
5.7600	35.35	5.23	32.77	5.41
5.7700	35.33	5.24	32.93	5.40
5.7800	35.32	5.25	32.93	5.32
5.7900	35.31	5.26	32.73	5.36
5.8000	35.30	5.27	32.88	5.42
5.8100	35.29	5.28	32.72	5.47
5.8200	35.28	5.29	32.83	5.43
5.8300	35.27	5.30	32.70	5.41
5.8400	35.25	5.31	32.70	5.42
5.8500	35.24	5.32	32.83	5.50

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FLUID DIELECTRIC PARAMETERS

Date:	2 Dec 2021	Fluid Temp:	22.2	Frequency:	5750MHz	Tissue:	Head
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
5650.0000		33.0100	5.3400	35.4700	5.12	-6.94%	4.30%
5660.0000		32.9100	5.3300	35.4600	5.13	-7.19%	3.90%
5670.0000		32.8000	5.3300	35.4500	5.14	-7.48%	3.70%
5680.0000		32.9600	5.2600	35.4400	5.15	-7.00%	2.14%
5690.0000		33.0400	5.2800	35.4300	5.16	-6.75%	2.33%
5700.0000		32.8700	5.3200	35.4100	5.17	-7.17%	2.90%
5710.0000		32.8000	5.3100	35.4000	5.18	-7.34%	2.51%
5720.0000		33.1000	5.3600	35.3900	5.19	-6.47%	3.28%
5730.0000		32.9000	5.2600	35.3800	5.20	-7.01%	1.15%
5740.0000		32.7600	5.4800	35.3700	5.21	-7.38%	5.18%
5745.0000	*	32.7840	5.4500	35.3680	5.21	-7.31%	1.22%
5750.0000		32.8800	5.3300	35.3600	5.22	-7.01%	2.11%
5760.0000		32.7700	5.4100	35.3500	5.23	-7.30%	3.44%
5770.0000		32.9300	5.4000	35.3300	5.24	-6.79%	3.05%
5780.0000		32.9300	5.3200	35.3200	5.25	-6.77%	1.33%
5790.0000		32.7300	5.3600	35.3100	5.26	-7.31%	1.90%
5800.0000		32.8800	5.4200	35.3000	5.27	-6.86%	2.85%
5810.0000		32.7200	5.4700	35.2900	5.28	-7.28%	3.60%
5820.0000		32.8300	5.4300	35.2800	5.29	-6.94%	2.65%
5830.0000		32.7000	5.4100	35.2700	5.30	-7.29%	2.08%
5840.0000		32.7000	5.4200	35.2500	5.31	-7.23%	2.07%
5850.0000		32.8300	5.5000	35.2400	5.32	-6.84%	3.38%

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Table 15.5 Fluid Dielectric Parameters 1640MHz HEAD TSL

****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Sat 06/Dec/2021 15:02:35
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
1.5400	40.39	1.25	39.00	1.20
1.5500	40.38	1.26	39.29	1.20
1.5600	40.36	1.26	38.95	1.20
1.5700	40.35	1.27	39.01	1.20
1.5800	40.34	1.27	38.82	1.22
1.5900	40.33	1.28	38.77	1.23
1.6000	40.31	1.28	38.55	1.24
1.6100	40.30	1.29	38.82	1.24
1.6200	40.28	1.30	38.63	1.25
1.6300	40.27	1.30	38.64	1.26
1.6400	40.25	1.31	38.76	1.26
1.6500	40.24	1.31	38.53	1.28
1.6600	40.22	1.32	38.59	1.29
1.6700	40.21	1.32	38.48	1.31
1.6800	40.19	1.33	38.64	1.31
1.6900	40.17	1.34	38.57	1.30
1.7000	40.16	1.34	38.42	1.32
1.7100	40.14	1.35	38.34	1.33
1.7200	40.13	1.35	38.33	1.34
1.7300	40.11	1.36	38.47	1.36
1.7400	40.09	1.37	38.17	1.36

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FLUID DIELECTRIC PARAMETERS

Date:	6 Dec 2021	Fluid Temp:	22.8	Frequency:	1640MHz	Tissue:	Head
Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
1540.0000		39.0000	1.2000	40.3900	1.25	-3.44%	-4.00%
1550.0000		39.2900	1.2000	40.3800	1.26	-2.70%	-4.76%
1560.0000		38.9500	1.2000	40.3600	1.26	-3.49%	-4.76%
1570.0000		39.0100	1.2000	40.3500	1.27	-3.32%	-5.51%
1580.0000		38.8200	1.2200	40.3400	1.27	-3.77%	-3.94%
1590.0000		38.7700	1.2300	40.3300	1.28	-3.87%	-3.91%
1600.0000		38.5500	1.2400	40.3100	1.28	-4.37%	-3.13%
1610.0000		38.8200	1.2400	40.3000	1.29	-3.67%	-3.88%
1616.0000	*	38.7820	1.2420	40.2960	1.29	-3.76%	1.22%
1620.0000		38.6300	1.2500	40.2800	1.30	-4.10%	-3.85%
1621.0000	*	38.6320	1.2520	40.2780	1.30	-4.09%	1.22%
1626.0000	*	38.6336	1.2536	40.2764	1.30	-4.08%	1.22%
1630.0000		38.6400	1.2600	40.2700	1.30	-4.05%	-3.08%
1640.0000		38.7600	1.2600	40.2500	1.31	-3.70%	-3.82%
1650.0000		38.5300	1.2800	40.2400	1.31	-4.25%	-2.29%
1660.0000		38.5900	1.2900	40.2200	1.32	-4.05%	-2.27%
1670.0000		38.4800	1.3100	40.2100	1.32	-4.30%	-0.76%
1680.0000		38.6400	1.3100	40.1900	1.33	-3.86%	-1.50%
1690.0000		38.5700	1.3000	40.1700	1.34	-3.98%	-2.99%
1700.0000		38.4200	1.3200	40.1600	1.34	-4.33%	-1.49%
1710.0000		38.3400	1.3300	40.1400	1.35	-4.48%	-1.48%
1720.0000		38.3300	1.3400	40.1300	1.35	-4.49%	-0.74%
1730.0000		38.4700	1.3600	40.1100	1.36	-4.09%	0.00%
1740.0000		38.1700	1.3600	40.0900	1.37	-4.79%	-0.73%

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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
31 Oct 2021		5250	D5GHzV2		1031
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	20.6	23	25%	50	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
33.40	35.93	-7.04%	4.58	4.71	-2.76%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
3.96	3.97	-0.34%	1.18	1.15	3.01%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
79.20	79.47	-0.34%	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 IEEE 1528-2013, FCC KDB 846224 and IEC 62209-1.

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.

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Table 16.2 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
11 Nov 2021		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.5	26	25%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
35.80	39.20	-8.67%	1.80	1.80	0.00%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
12.00	13.18	-8.95%	5.54	6.01	-7.74%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
48.00	52.72	-8.95%	22.16	24.02	-7.72%

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 and IEC 62209-1.

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.

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Table 16.3 System Verification Results 2450MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
16 Nov 2021		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	23.3	26	23%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
35.50	39.20	-9.44%	1.84	1.80	2.22%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
13.60	13.18	3.19%	6.20	6.01	3.25%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
54.40	52.72	3.19%	24.80	24.02	3.27%

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

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.

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Table 16.4 System Verification Results 5750MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
03 Dec 2021		5750	D5GHzV2		1031
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	20.5	26	23%	50	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
32.88	35.36	-7.01%	5.33	5.22	2.11%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
3.81	3.78	0.87%	1.08	1.10	-1.86%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
76.20	75.54	0.87%	21.60	22.01	-1.86%

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 and IEC 62209-1.

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.

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Table 16.5 System Verification Results 1640MHz HEAD TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
06 Dec 2021		1640	ALS-D-1620-S-2		207-00102
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Head	20.0	26	19%	1000	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
38.76	40.25	-3.70%	1.26	1.31	-3.82%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
34.60	32.49	6.49%	18.60	17.19	8.20%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
34.60	32.49	6.49%	18.60	17.19	8.20%

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 and IEC 62209-1.

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.

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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
1640	12-Jun-21	EX3DV4	3600	1620-S-2	207-00102	Head	39.87	1.27	Pass	Pass	Pass
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

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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

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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°. 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

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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

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20.0 FLUID COMPOSITION

Table 20.1 Fluid Composition 5250MHz & 5750MHz HEAD TSL

This is a proprietary composition by SPEAG.

Table 20.2 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 20.3 Fluid Composition 1640MHz HEAD TSL

Tissue Simulating Liquid (TSL) Composition				1640MHz Head
Component by Percent Weight				
Water	Glycol	Salt(1)	HEC(2)	Bacteriacide(3)
47.5	45.5	0.5	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

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APPENDIX A – SYSTEM VERIFICATION PLOTS

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 = 4.58 S/m; ε_r = 33.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

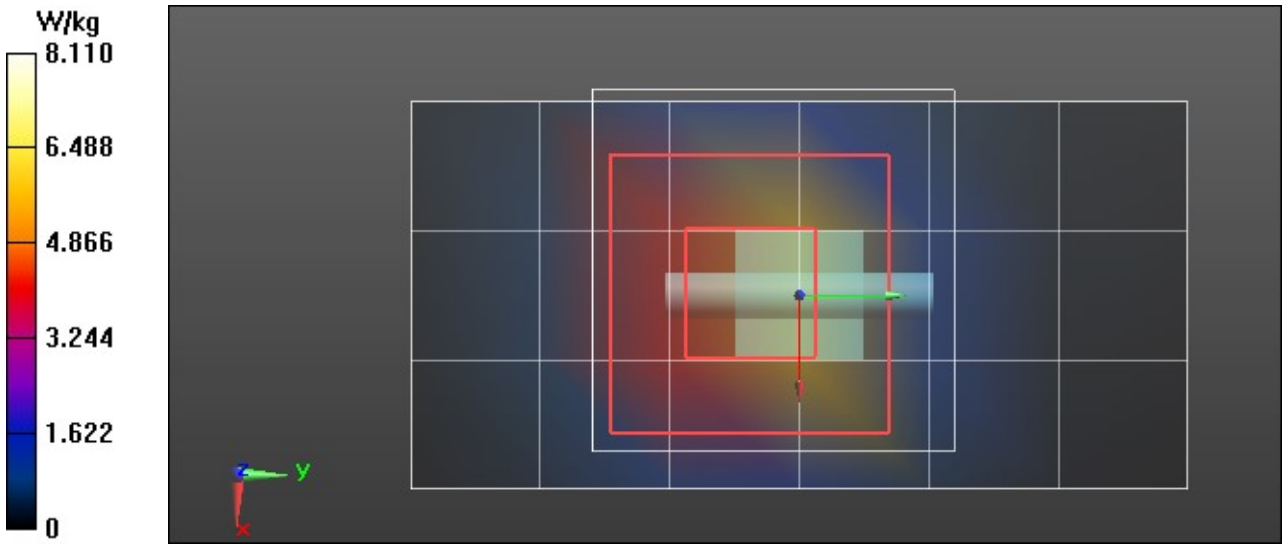
Date/Time: 10/31/2021 12:23:05 PM

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 2 2/Area Scan (4x7x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 5.64 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 = 30.63 V/m; Power Drift = -0.21 dB
Peak SAR (extrapolated) = 15.8 W/kg
SAR(1 g) = 3.96 W/kg; SAR(10 g) = 1.18 W/kg
Smallest distance from peaks to all points 3 dB below = 7.9 mm
Ratio of SAR at M2 to SAR at M1 = 54.4%
Maximum value of SAR (measured) = 8.11 W/kg



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

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.8 S/m; ε_r = 35.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

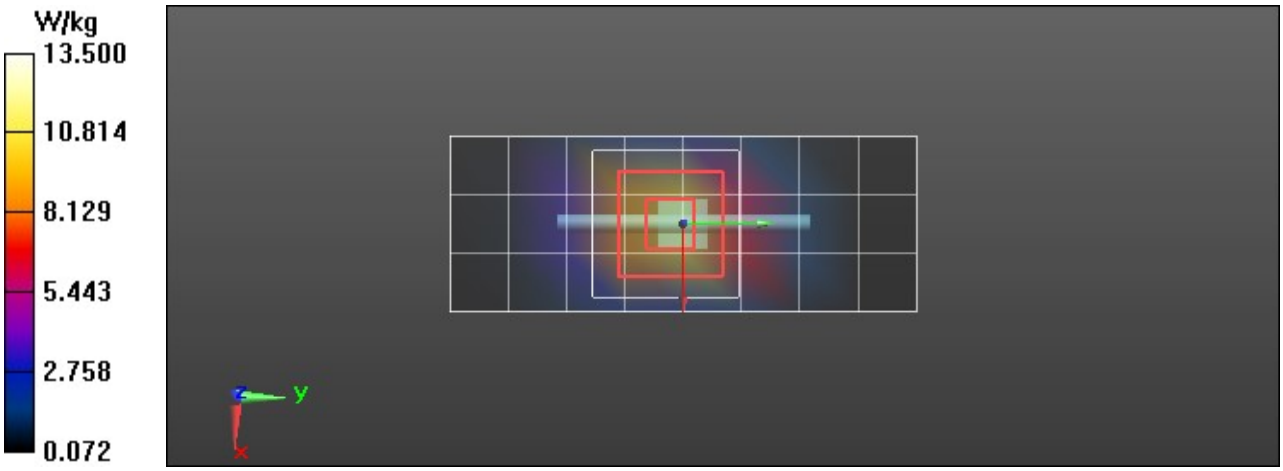
Date/Time: 11/11/2021 5:50:12 PM

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/Area Scan (4x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 10.7 W/kg

SPC/SPC 2450H Input=250mw, Target=[11.86]13.18][14.50]W/kg 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 86.17 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 25.5 W/kg
SAR(1 g) = 12 W/kg; SAR(10 g) = 5.54 W/kg
Smallest distance from peaks to all points 3 dB below = 10.8 mm
Ratio of SAR at M2 to SAR at M1 = 47.8%
Maximum value of SAR (measured) = 13.5 W/kg



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

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 = 35.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

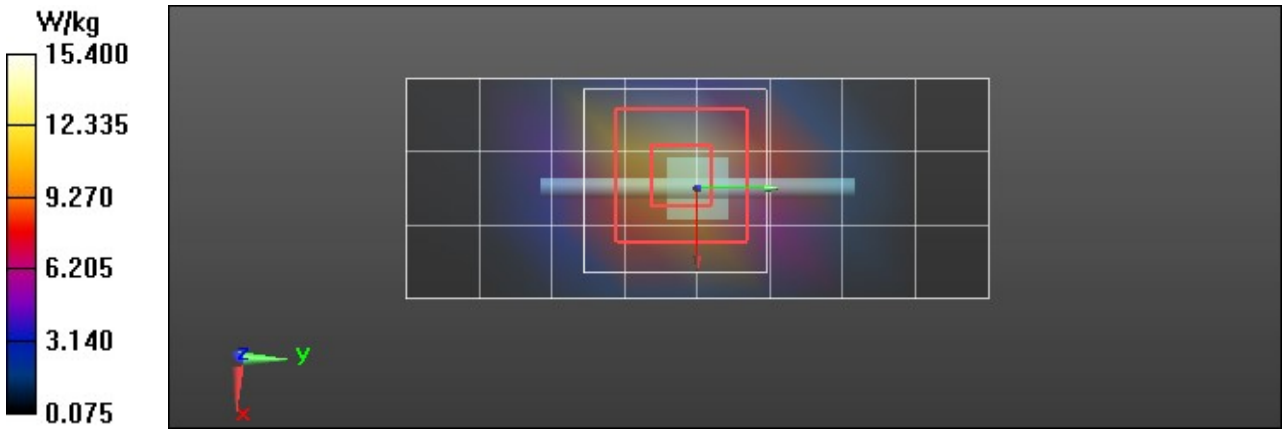
Date/Time: 11/16/2021 11:46:48 AM

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/Area Scan (4x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 13.8 W/kg

SPC/SPC 2450H Input=250mw, Target=[11.86]13.18][14.50]W/kg/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.65 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.2 W/kg
Smallest distance from peaks to all points 3 dB below = 10.2 mm
Ratio of SAR at M2 to SAR at M1 = 47.7%
Maximum value of SAR (measured) = 15.4 W/kg



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

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5750 MHz; σ = 5.33 S/m; ε_r = 32.88; ρ = 1000 kg/m^3
Phantom section: Flat Section

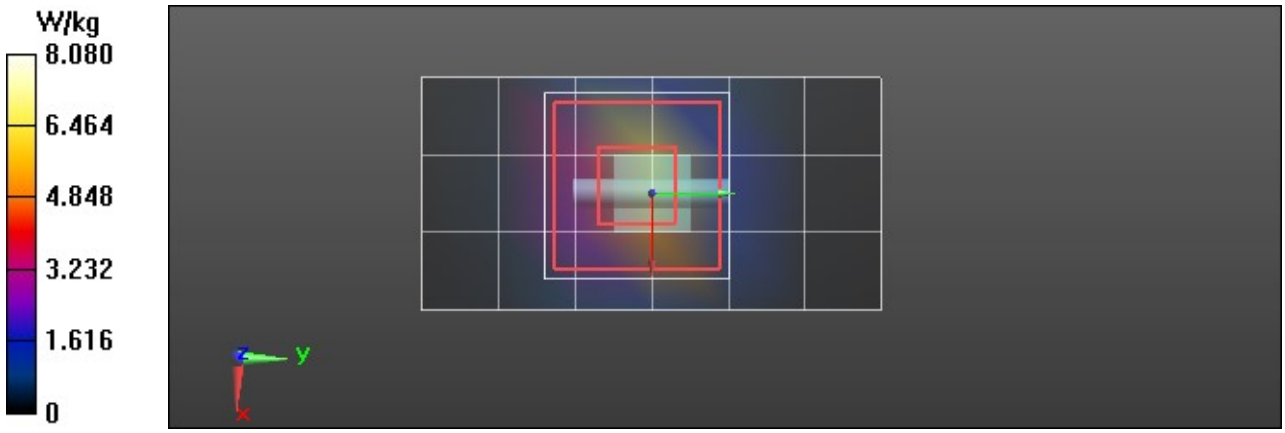
Date/Time: 12/3/2021 1:16:11 PM

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@1000mw 2/Area Scan (4x7x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 6.44 W/kg

SPC/SPC 5750H Input=50mw, Target=[3.40][3.78][4.16], Target=75.54W/kg@1000mw 2/Zoom Scan (7x7x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 28.22 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 3.81 W/kg; SAR(10 g) = 1.08 W/kg
Smallest distance from peaks to all points 3 dB below = 7.5 mm
Ratio of SAR at M2 to SAR at M1 = 52.2%
Maximum value of SAR (measured) = 8.08 W/kg



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DUT: Dipole 1640 MHz D1640V2; Type: D1640V2; Serial: D1640V2 - SN:207-00102
Procedure Name: SPC 1640H Input=1.0W, Target=[31.52]33.18[36.5] W/kg 18.21 10gm 2

Communication System: UID 0, CW (0); Frequency: 1640 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1640 MHz; σ = 1.26 S/m; ε_r = 38.76; ρ = 1000 kg/m^3
Phantom section: Flat Section

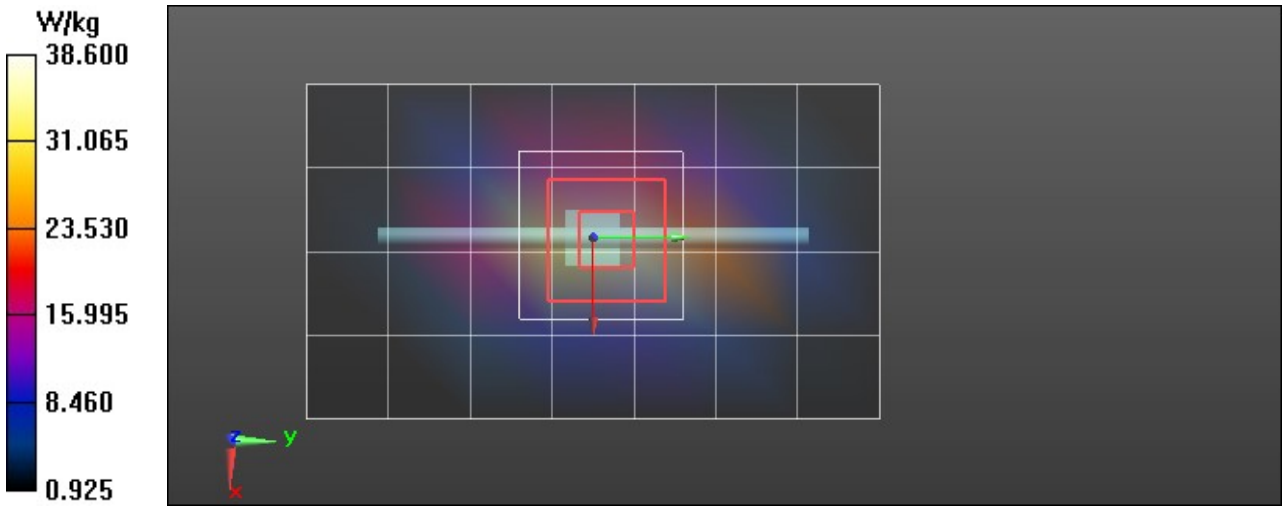
Date/Time: 12/6/2021 5:57:51 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(7.31, 7.31, 7.31) @ 1640 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 1640H Input=1.0W, Target=[31.52]33.18[36.5] W/kg 18.21 10gm 2/Area Scan (5x8x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 36.5 W/kg

SPC/SPC 1640H Input=1.0W, Target=[31.52]33.18[36.5] W/kg 18.21 10gm 2/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 174.8 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 61.8 W/kg
SAR(1 g) = 34.6 W/kg; SAR(10 g) = 18.6 W/kg
Smallest distance from peaks to all points 3 dB below = 12 mm
Ratio of SAR at M2 to SAR at M1 = 56.9%
Maximum value of SAR (measured) = 38.6 W/kg



APPENDIX B – MEASUREMENT PLOTS OF MAXIMUMUM MEASURED SAR

Plot B106

DUT: A04167; Type: Transmitter; Serial: 3370905720
Procedure Name: B106-A04167,Right Edge -P, 5240MHz MCS0,WIFI

Communication System: UID 0, CW (0); Frequency: 5240 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5240 MHz; σ = 4.62 S/m; ε_r = 33.76; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 11/2/2021 1:40:59 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(4.41, 4.41, 4.41) @ 5240 MHz; Calibrated: 4/28/2021
- 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: 4/22/2021
- 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/B106-A04167,Right Edge -P, 5240MHz MCS0,WIFI/Area Scan (20x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 2.25 W/kg

5250H/B106-A04167,Right Edge -P, 5240MHz MCS0,WIFI/Zoom Scan (9x9x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 6.203 V/m; Power Drift = 1.47 dB
Peak SAR (extrapolated) = 3.22 W/kg
SAR(1 g) = 0.815 W/kg; SAR(10 g) = 0.298 W/kg
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 52.6%
Maximum value of SAR (measured) = 1.92 W/kg

5250H/B106-A04167,Right Edge -P, 5240MHz MCS0,WIFI/Z Scan (1x1x19): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 2.725) [mm]
Maximum value of SAR (interpolated) = 0.212 W/kg

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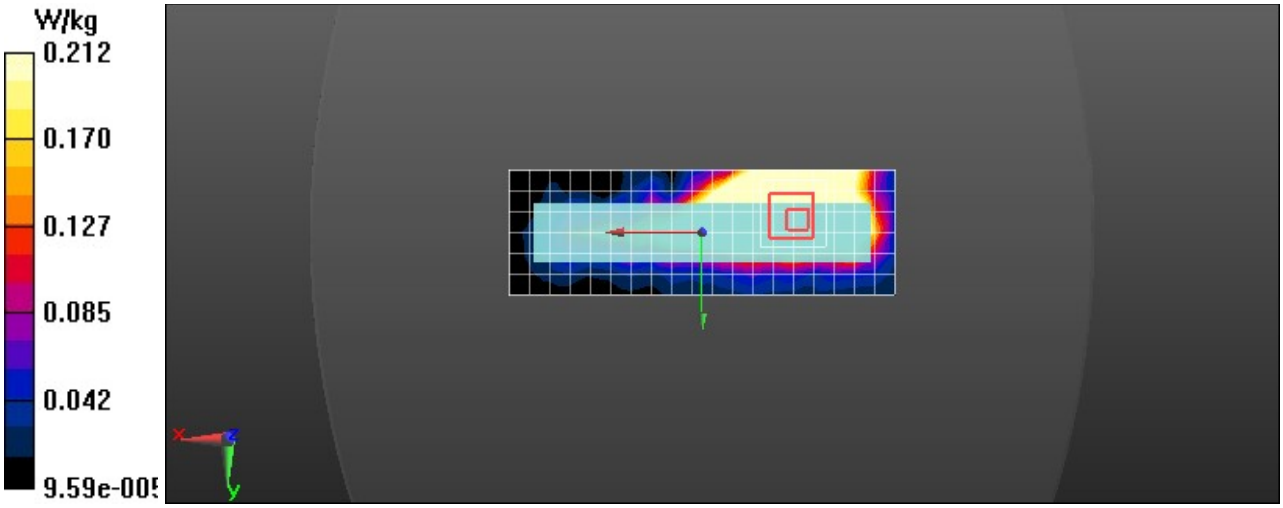

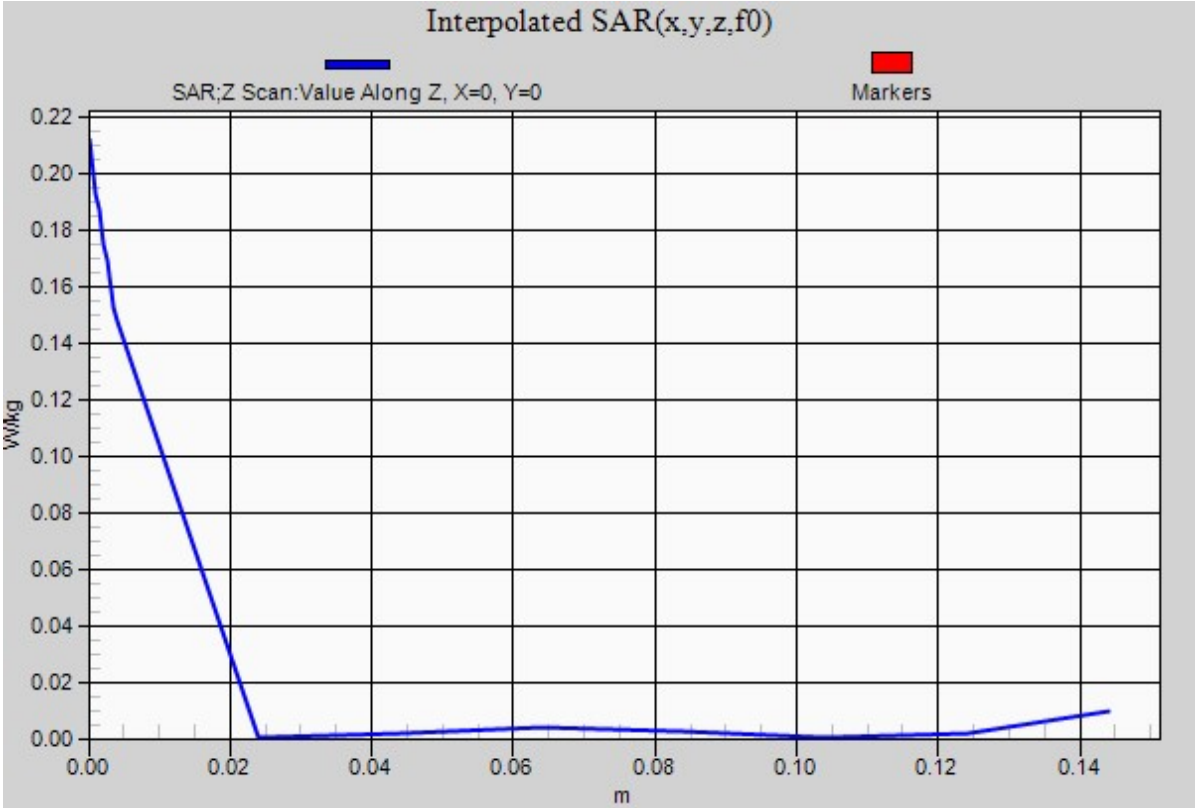

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Plot B504

DUT: A04166; Type: Transmitter; Serial: 3370905720
Procedure Name: B504-A04167, Back Side - Reduced, 1626MHz 15mm

Communication System: UID 0, CW (0); Frequency: 1626 MHz;Duty Cycle: 1:10.7498
Medium parameters used (interpolated): f = 1626 MHz; σ = 1.256 S/m; ε_r = 38.636; ρ = 1000 kg/m^3
Phantom section: Flat Section

Date/Time: 12/8/2021 2:27:54 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(7.31, 7.31, 7.31) @ 1626 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (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)

1640H/B504-A04167, Back Side - Reduced, 1626MHz 15mm/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.34 W/kg

1640H/B504-A04167, Back Side - Reduced, 1626MHz 15mm/Zoom Scan (9x9x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 5.337 V/m; Power Drift = -0.61 dB
Peak SAR (extrapolated) = 5.26 W/kg
SAR(1 g) = 1.28 W/kg; SAR(10 g) = 0.619 W/kg
Smallest distance from peaks to all points 3 dB below = 4 mm
Ratio of SAR at M2 to SAR at M1 = 42.2%

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.51 W/kg

1640H/B504-A04167, Back Side - Reduced, 1626MHz 15mm/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, 12.28) [mm]
Maximum value of SAR (interpolated) = 0.00617 W/kg

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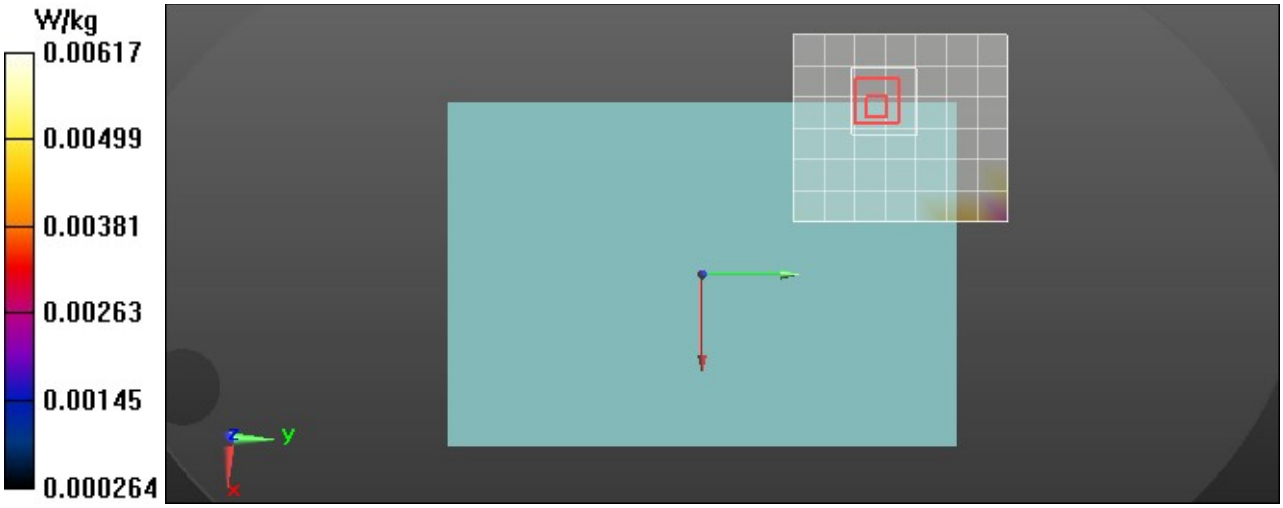

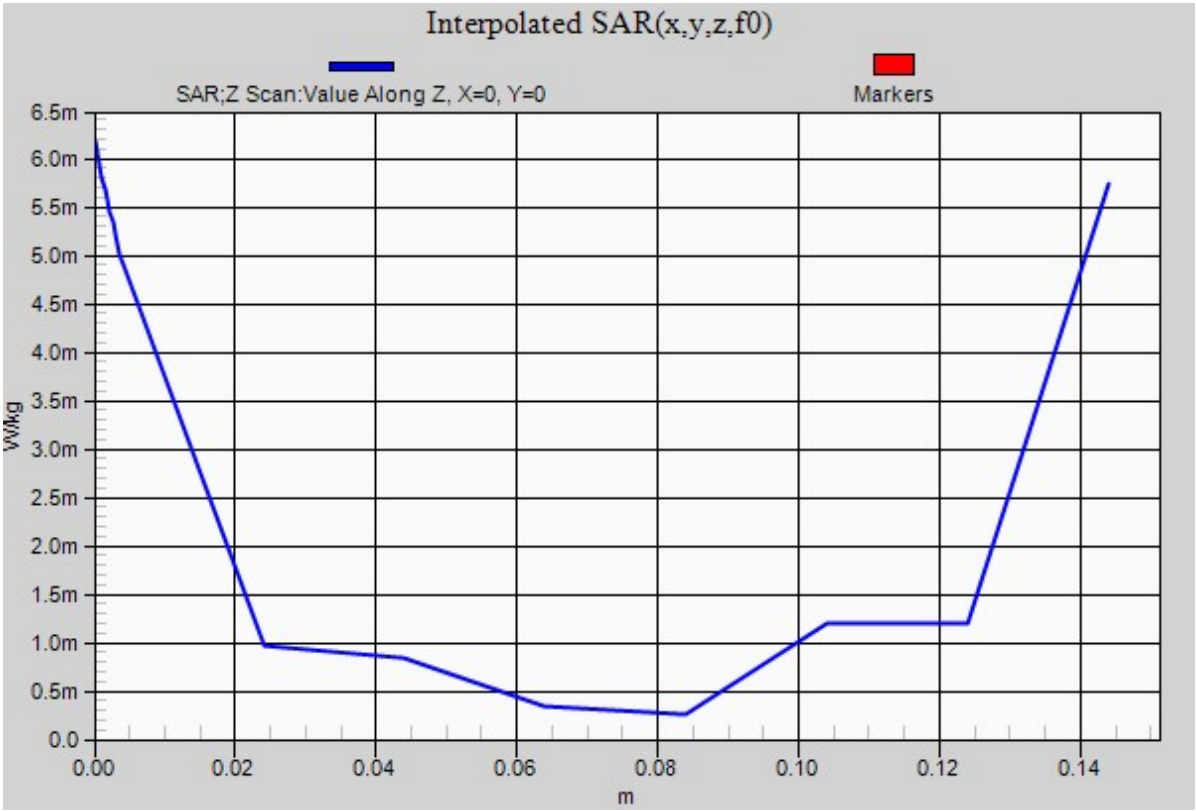

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