

## SAR Test Report - New Application

Applicant:



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

| Maximum Reported 1g BODY SAR |              |      |      |
|------------------------------|--------------|------|------|
| FCC/ISED                     | IRIDIUM      | 1.48 | W/kg |
| FCC/ISED                     | WIFI         | 0.47 |      |
| FCC/ISED                     | SIMULTANEOUS | 0.64 |      |
| General Pop. Limit:          |              | 1.60 |      |

| Maximum Reported 10g EXTREMITY SAR |              |      |      |
|------------------------------------|--------------|------|------|
| FCC/ISED                           | IRIDIUM      | 0.69 | W/kg |
| FCC/ISED                           | WIFI         | 0.16 |      |
| FCC/ISED                           | SIMULTANEOUS | 0.19 |      |
| General Pop. Limit:                |              | 4.00 |      |

FCC ID:

**IPH-04166**

Product Model Number / HVIN

**A04166**

IC Registration Number

**1792A-04166**

Product Name / PMN

**A04166**

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**

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Test Lab Certificate: 2470.01



**Industry  
Canada**

IC Registration 3874A



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 | 13 December 2021              |

## 2.0 CLIENT AND DEVICE INFORMATION

| Client Information                           |                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Applicant Name</b>                        | <b>Garmin International Inc.</b>                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Applicant Address</b>                     | 1200 East 151 St.<br>Olathe, KS, 66062<br>USA                                                                                                                                                                                                                                                                                                                                                                  |
| DUT Information                              |                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Type of Equipment:</b>                    | Handheld Transceiver                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Device Model(s) / HVIN:</b>               | A04166                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Device Marketing Name / PMN:</b>          | A04166                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Test Sample Serial No.:</b>               | 3374769248                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Transmit Frequency Range:</b>             | IRIDIUM 1616-1626MHz (FCC ID: IPH-03302/ISED ID:1792A-03302)<br>WiFi: 2412 - 2462 MHz<br>WiFi UNII 1: 5200 - 5240 MHz<br>WiFi UNII 3: 5745-5825 MHz<br>BT/ANT: 2402 - 2480 MHz                                                                                                                                                                                                                                 |
| <b>Number of Channels:</b>                   | See Section 8.0                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Manuf. Max. Avg Rated Output Power:</b>   | IRIDIUM 1620 MHz 31.54dBm<br>WiFi 2.4GHz: 802.11b: 8.5dBm /802.11g: 9.0dBm /802.11n:6.0dBm/802.11n40:3.0dBm<br>WiFi 5 GHz UNII-1 802.11a: 13.6dBm / 802.11n: 13.4dBm/ 802.11n40: 8.5dBm/ 802.11ac80: 9.0dBm<br>WiFi 5 GHz UNII-3 802.11a: 13.0dBm / 802.11n: 12.8dBm/ 802.11n40: 9.0dBm/802.11ac80: 8.5dBm<br>ANT:GFSK: 0.6dBm / BT BR:GFSK: 0.6dBm / PI/4-DQPSK: 3.0dBm / 8-DPSK: 3.0dBm /BT BLE (GMSK): 0dBm |
| <b>Modulation:</b>                           | FDMA-FM<br>WiFi 802.11b/g/n: DSSS, OFDM, MCS0-7<br>WiFi 802.11 a/ac: OFDM,MCS0-7<br>BT: GFSK, PI/4-DQPSK, 8-DPSK<br>BLE: GMSK                                                                                                                                                                                                                                                                                  |
| <b>DUT Power Source:</b>                     | 5V USB, Internal Li-ion battery                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Deviation(s) from standard/procedure:</b> | 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 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 A04166, FCC ID: IPH-04166 ISEDC ID: 1792A-04166 is a hand held transceiver with three transmitters, one that operates in the 16GHz Iridium frequency 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

## 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 procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528; Human models, instrumentation, 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 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.

|                                                                                                                                                                                                |  |                                                                                                                                                                                                   |                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Applicant:</b><br>Garmin International Inc.                                                                                                                                                 |  | <b>Model / HVIN:</b><br>A04166                                                                                                                                                                    |                                                                                                                                                                                               |
| <b>Standard(s) Applied:</b><br>FCC 47 CFR §2.1093<br>Health Canada's Safety Code 6                                                                                                             |  | <b>Measurement Procedure(s):</b><br>FCC KDB 865664, FCC KDB 447498, FCC KDB248227, FCC KDB 941225<br>Industry Canada RSS-102 Issue 5<br>IEC/IEEE 62209-1528, IEEE Standard 1528-2013, IEC 62209-2 |                                                                                                                                                                                               |
| <b>Reason For Issue:</b><br><input checked="" type="checkbox"/> New Certification<br><input type="checkbox"/> Class I Permissive Change<br><input type="checkbox"/> Class II Permissive Change |  | <b>Use Group:</b><br><input checked="" type="checkbox"/> General Population / Uncontrolled<br><input type="checkbox"/> Occupational / Controlled                                                  | <b>Limits Applied:</b><br><input checked="" type="checkbox"/> 1.6W/kg - 1g Volume<br><input type="checkbox"/> 8.0W/kg - 1g Volume<br><input checked="" type="checkbox"/> 4.0W/kg - 10g Volume |
| <b>Reason for Change:</b><br>Original Filing                                                                                                                                                   |  |                                                                                                                                                                                                   | <b>Date(s) Evaluated:</b><br>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



## 6.0 SAR MEASUREMENT SYSTEM

### SAR Measurement System

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



**DASY 6 SAR System with SAM Phantom**



**DASY 6 Measurement Controller**

## 7.0 RF CONDUCTED POWER MEASUREMENT

Table 7.1 Conducted Power Measurements

| Conducted Power Measurements |                    |                |                |              |       |                  |           |              |         |       |
|------------------------------|--------------------|----------------|----------------|--------------|-------|------------------|-----------|--------------|---------|-------|
| Channel                      | Frequency<br>(MHz) | Measured       | Rated          | Rated        | Delta | SAR Test         | Mode      | Modulation   |         | BW    |
|                              |                    | Power<br>(dBm) | Power<br>(dBm) | Power<br>(W) |       | Channel<br>(Y/N) |           |              |         |       |
| 1                            | 2412               | 8.31           | 8.40           | 0.007        | -0.09 | -                | WLAN 2.4G | DSSS-1Mbps   | 802.11b | 20MHz |
| 2                            | 2417               | 8.32           | 8.40           | 0.007        | -0.08 | -                |           | DSSS-1Mbps   |         |       |
| 6                            | 2437               | 8.38           | 8.40           | 0.007        | -0.02 | Y                |           | DSSS-1Mbps   |         |       |
| 10                           | 2457               | 8.35           | 8.40           | 0.007        | -0.05 | -                |           | DSSS-1Mbps   |         |       |
| 11                           | 2462               | 8.36           | 8.40           | 0.007        | -0.04 | -                |           | DSSS-1Mbps   |         |       |
| 13                           | 2472               | 8.05           | 8.40           | 0.007        | -0.36 | -                |           | DSSS-1Mbps   |         |       |
| 1                            | 2412               | 8.12           | 8.40           | 0.007        | -0.28 | -                |           | DSSS-2Mbps   |         |       |
|                              |                    | 8.05           | 8.40           | 0.007        | -0.36 | -                |           | DSSS-11Mbps  |         |       |
|                              |                    | 8.60           | 8.90           | 0.008        | -0.30 | Y                |           | OFDM-6Mbps   | 802.11g |       |
|                              |                    | 5.30           | 6.00           | 0.004        | -0.71 | -                |           | MCS-0        | 802.11n |       |
| 2                            | 2417               | 8.21           | 8.40           | 0.007        | -0.19 | -                |           | DSSS-2Mbps   | 802.11b |       |
| 6                            | 2437               | 8.19           | 8.40           | 0.007        | -0.21 | -                |           | DSSS-2Mbps   | 802.11b |       |
|                              |                    | 8.26           | 8.40           | 0.007        | -0.14 | -                |           | DSSS-5.5Mbps |         |       |
|                              |                    | 8.07           | 8.40           | 0.007        | -0.34 | -                |           | DSSS-11Mbps  |         |       |
|                              |                    | 8.37           | 8.40           | 0.007        | -0.03 | Y                |           | OFDM-6Mbps   | 802.11g |       |
|                              |                    | 5.30           | 6.00           | 0.004        | -0.71 | -                |           | MCS-0        | 802.11n |       |
| 11                           | 2462               | 8.04           | 8.40           | 0.007        | -0.36 | -                |           | DSSS-2Mbps   | 802.11b |       |
|                              |                    | 8.06           | 8.40           | 0.007        | -0.34 | -                |           | DSSS-5.5Mbps |         |       |
|                              |                    | 8.05           | 8.40           | 0.007        | -0.36 | -                |           | DSSS-11Mbps  |         |       |
|                              |                    | 8.26           | 8.40           | 0.007        | -0.14 | Y                |           | OFDM-6Mbps   | 802.11g |       |
|                              |                    | 8.25           | 8.40           | 0.007        | -0.15 | -                |           | OFDM-9Mbps   |         |       |
|                              |                    | 8.09           | 8.40           | 0.007        | -0.31 | -                |           | OFDM-12Mbps  |         |       |
|                              |                    | 5.39           | 6.00           | 0.004        | -0.62 | -                |           | MCS-0        | 802.11n |       |
|                              |                    | 5.16           | 6.00           | 0.004        | -0.85 | -                |           | MCS-3        |         |       |
|                              |                    | 5.02           | 6.00           | 0.004        | -0.98 | -                |           | MCS-7        |         |       |
| 13                           | 2472               | 7.66           | 8.40           | 0.007        | -0.75 | -                |           | DSSS-2Mbps   | 802.11b |       |
|                              |                    | 8.10           | 8.40           | 0.007        | -0.31 | -                |           | DSSS-5.5Mbps |         |       |
|                              |                    | 8.05           | 8.40           | 0.007        | -0.36 | -                |           | DSSS-11Mbps  |         |       |
|                              |                    | 8.11           | 8.40           | 0.007        | -0.30 | Y                |           | OFDM-6Mbps   | 802.11g |       |
|                              |                    | 6.66           | 8.40           | 0.007        | -1.75 | -                |           | OFDM-9Mbps   | 802.11n |       |
|                              |                    | 4.14           | 6.00           | 0.004        | -1.87 | -                |           | MCS-0        |         |       |
|                              |                    | 0.78           | 6.00           | 0.004        | -5.23 | -                |           | MCS-7        |         |       |
| 5                            | 2432               | 1.67           | 1.77           | 0.002        | -0.10 | -                |           | MCS-0        | 802.11n | 40MHz |
|                              |                    | -0.51          | 1.77           | 0.002        | -2.28 | -                |           | MCS-7        |         |       |
| 6                            | 2437               | 1.6            | 1.77           | 0.002        | -0.17 | -                |           | MCS-0        |         |       |
|                              |                    | -0.55          | 1.77           | 0.002        | -2.32 | -                |           | MCS-7        |         |       |
| 7                            | 2442               | 1.54           | 1.77           | 0.002        | -0.23 | -                |           | MCS-0        |         |       |
|                              |                    | -0.59          | 1.77           | 0.002        | -2.36 | -                |           | MCS-7        |         |       |
| 9                            | 2452               | 1.08           | 1.77           | 0.002        | -0.69 | -                |           | MCS-0        |         |       |
|                              |                    | -0.95          | 1.77           | 0.002        | -2.72 | -                |           | MCS-7        |         |       |
| 11                           | 2462               | 1.06           | 1.77           | 0.002        | -0.71 | -                |           | MCS-0        |         |       |
|                              |                    | -1.4           | 1.77           | 0.002        | -3.17 | -                |           | MCS-7        |         |       |

**Table 7.2 Conducted Power Measurements**

| Conducted Power Measurements |           |                |             |             |       |                  |         |             |                   |       |
|------------------------------|-----------|----------------|-------------|-------------|-------|------------------|---------|-------------|-------------------|-------|
|                              | Frequency | Measured Power | Rated Power | Rated Power | Delta | SAR Test Channel |         |             |                   |       |
| Channel                      | (MHz)     | (dBm)          | (dBm)       | (W)         | (dB)  | (Y/N)            | Mode    | Modulation  |                   |       |
| 36                           | 5180      | 12.63          | 13.60       | 0.023       | -0.97 | -                | WiFi 5G | OFDM-6Mbps  | 802.11a - UNII-1  | 20MHz |
| 36                           | 5180      | 12.60          | 13.60       | 0.023       | -1.00 | -                |         | OFDM-9Mbps  |                   |       |
| 36                           | 5180      | 12.40          | 13.60       | 0.023       | -1.20 | -                |         | OFDM-24Mbps |                   |       |
| 40                           | 5200      | 13.57          | 13.60       | 0.023       | -0.03 | -                |         | OFDM-6Mbps  |                   |       |
| 44                           | 5220      | 13.60          | 13.60       | 0.023       | 0.00  | Y                |         | OFDM-6Mbps  |                   |       |
| 48                           | 5240      | 13.59          | 13.60       | 0.023       | -0.01 | -                |         | OFDM-6Mbps  |                   |       |
| 36                           | 5180      | 12.48          | 13.50       | 0.022       | -1.02 | -                |         | MCS-0       | 802.11n - UNII-1  |       |
| 36                           | 5180      | 12.15          | 13.50       | 0.022       | -1.35 | -                |         | MCS-3       |                   |       |
| 36                           | 5180      | 11.56          | 13.50       | 0.022       | -1.94 | -                |         | MCS-7       |                   |       |
| 40                           | 5200      | 13.41          | 13.50       | 0.022       | -0.09 | -                |         | MCS-0       |                   |       |
| 44                           | 5220      | 13.25          | 13.50       | 0.022       | -0.25 | -                |         | MCS-0       |                   |       |
| 48                           | 5240      | 13.49          | 13.50       | 0.022       | -0.01 | Y                |         | MCS-0       |                   |       |
| 38                           | 5190      | 8.48           | 8.50        | 0.007       | -0.02 | Y                |         | MCS-0       | 802.11n - UNII-1  | 40MHz |
| 46                           | 5230      | 7.69           | 8.50        | 0.007       | -0.81 | -                |         | MCS-0       |                   |       |
| 42                           | 5210      | 7.66           | 8.90        | 0.008       | -1.24 | Y                |         | MCS-0       | 802.11ac - UNII-1 | 80MHz |

**Table 7.3 Conducted Power Measurements**

| Conducted Power Measurements |           |          |       |       |       |          |         |             |                   |       |
|------------------------------|-----------|----------|-------|-------|-------|----------|---------|-------------|-------------------|-------|
| Channel                      | Frequency | Measured | Rated | Rated | Delta | SAR Test | Mode    | Modulation  |                   |       |
|                              |           | Power    | Power | Power |       | Channel  |         |             |                   |       |
|                              | (MHz)     | (dBm)    | (dBm) | (W)   | (dB)  | (Y/N)    |         |             |                   |       |
| 149                          | 5745      | 12.86    | 13.00 | 0.020 | -0.14 | y        | WiFi 5G | OFDM-6Mbps  | 802.11a - UNII-3  | 20MHz |
| 149                          | 5745      | 12.69    | 13.00 | 0.020 | -0.31 | -        |         | OFDM-9Mbps  |                   |       |
| 149                          | 5745      | 12.78    | 13.00 | 0.020 | -0.22 | -        |         | OFDM-24Mbps |                   |       |
| 149                          | 5745      | 12.77    | 13.00 | 0.020 | -0.23 | -        |         | MCS-0       |                   |       |
| 149                          | 5745      | 12.39    | 13.00 | 0.020 | -0.61 | -        |         | MCS-3       |                   |       |
| 149                          | 5745      | 12.68    | 12.70 | 0.019 | -0.02 | -        |         | MCS-0       | 802.11n - UNII-3  |       |
| 149                          | 5745      | 12.44    | 12.70 | 0.019 | -0.26 | -        |         | MCS-3       |                   |       |
| 149                          | 5745      | 12.39    | 12.70 | 0.019 | -0.31 | -        |         | MCS-7       |                   |       |
| 157                          | 5785      | 12.76    | 12.70 | 0.019 | 0.06  | -        |         | MCS-0       |                   |       |
| 165                          | 5825      | 12.32    | 12.70 | 0.019 | -0.38 | -        |         | MCS-0       |                   |       |
| 151                          | 5755      | 8.74     | 9.00  | 0.008 | -0.26 | -        |         | MCS-0       | 802.11n - UNII-3  | 40MHz |
| 159                          | 5795      | 8.67     | 9.00  | 0.008 | -0.33 | -        |         | MCS-0       |                   |       |
| 155                          | 5775      | 7.53     | 8.30  | 0.007 | -0.77 | -        |         | MCS-0       | 802.11ac - UNII-1 | 80MHz |

**Table 7.4 Conducted Power Measurements**

| 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%      | 10.75        | 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.

## 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 back side 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  $\leq 0.8$  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  $\leq 1.2$  W/kg.

See 12.1 for details.

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  $\leq 1.2$  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.

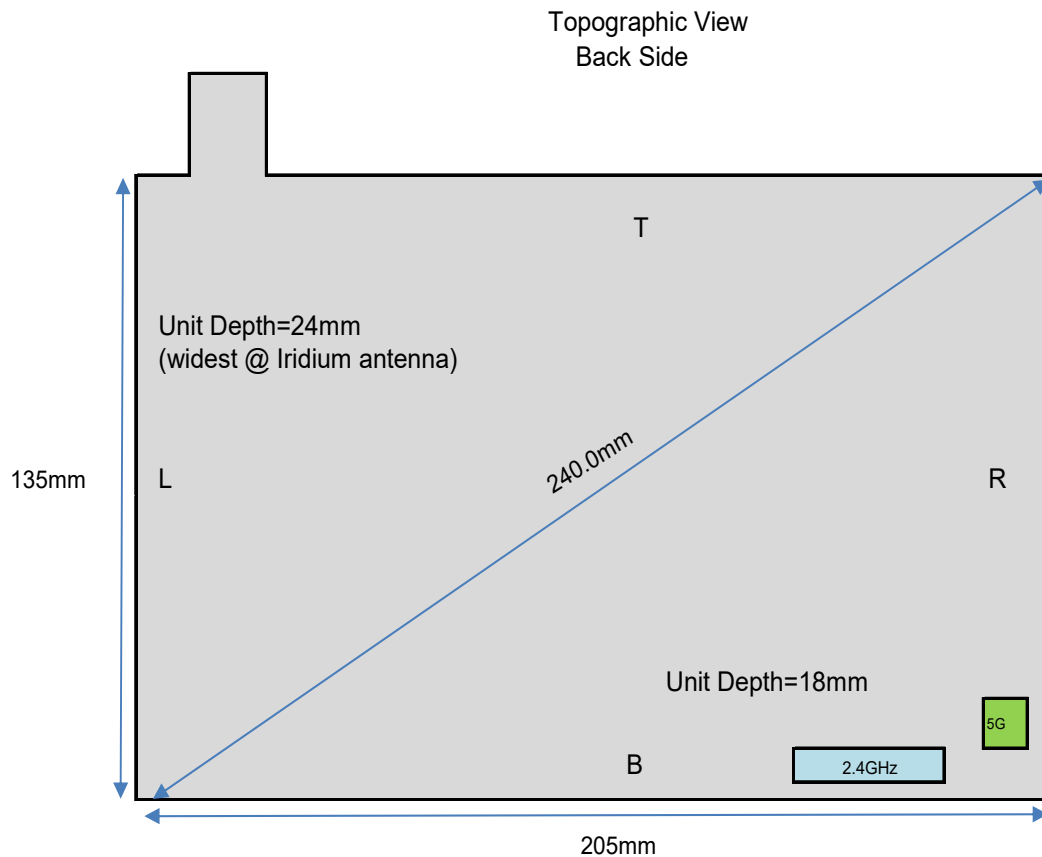
As per KDB 447498 D01V06, where appropriate SAR test exclusion based on antenna test separation distances may be applied.

- 1. When the distance is  $< 50$ mm 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)  

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR}$$
 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 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 | 120.0         | 160.0          | 8.0              | 35.0            | 9.0        |
| 5GHz    | 100.0         | 190.0          | 15.0             | 6.0             | 9.0        |

Table 8.2 Body SAR test Exclusion Workchart

**Body SAR Test Exclusion Workchart:** (  $\leq 3.0$  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)         | 3.00 | 9.00        | 13.60              | 13.00              |
|                   | Maximum rated Power (mW)    | 2.0  | 7.9         | 22.9               | 13.0               |
| Top -Display Side | Separation Distance (mm)    | 9    | 9           | 9                  | 9                  |
|                   | exclusion threshold (ratio) | 0.3  | 1.4         | 5.8                | 3.5                |
|                   | testing required ? (>3)     | No   | No          | Yes                | Yes                |
| Back Side         | Separation Distance (mm)    | 9    | 9           | 9                  | 9                  |
|                   | exclusion threshold (ratio) | 0.3  | 1.4         | 5.8                | 3.5                |
|                   | testing required ? (>3)     | No   | No          | Yes                | Yes                |
| Top Edge          | Separation Distance (mm)    | 120  | 120         | 100                | 100                |
|                   | exclusion threshold (mW)    | 795  | 796         | 566                | 562                |
|                   | testing required ?          | No   | No          | No                 | No                 |
| Left Edge         | Separation Distance (mm)    | 160  | 160         | 190                | 102                |
|                   | exclusion threshold (mW)    | 1195 | 1196        | 1466               | 582                |
|                   | testing required ?          | No   | No          | No                 | No                 |
| Right Edge        | Separation Distance (mm)    | 35   | 35          | 6                  | 6                  |
|                   | exclusion threshold (ratio) | 0.09 | 0.36        | 8.74               | 5.23               |
|                   | testing required ? (>3)     | No   | No          | Yes                | Yes                |
| Bottom Edge       | Separation Distance (mm)    | 8    | 8           | 15                 | 15                 |
|                   | exclusion threshold (ratio) | 0.4  | 1.6         | 3.5                | 2.1                |
|                   | testing required ? (>3)     | No   | No          | Yes                | No                 |

Table 8.2 Extremity SAR test Exclusion Workchart

**Extremity SAR Test Exclusion Workchart: ( $\leq 7.5$  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               |
|                   | <b>Maximum Power (dBm)</b>  | <b>3.00</b> | <b>9.00</b> | <b>13.60</b>       | <b>13.00</b>       |
|                   | Maximum rated Power (mW)    | 2.0         | 7.9         | 22.9               | 20.0               |
| Top -Display Side | Separation Distance (mm)    | 9           | 9           | 9                  | 9                  |
|                   | exclusion threshold (ratio) | 0.3         | 1.4         | 5.8                | 5.4                |
|                   | testing required ? (>7.5)   | No          | No          | No                 | No                 |
| Back Side         | Separation Distance (mm)    | 9           | 9           | 9                  | 9                  |
|                   | exclusion threshold (ratio) | 0.3         | 1.4         | 1.4                | 5.4                |
|                   | testing required ? (>7.5)   | No          | No          | No                 | No                 |
| Top Edge          | Separation Distance (mm)    | 120         | 120         | 100                | 100                |
|                   | exclusion threshold (mW)    | 1988        | 1989        | 1414               | 1405               |
|                   | testing required ?          | No          | No          | No                 | No                 |
| Left Edge         | Separation Distance (mm)    | 160         | 160         | 190                | 102                |
|                   | exclusion threshold (mW)    | 2988        | 2989        | 3664               | 1455               |
|                   | testing required ?          | No          | No          | No                 | No                 |
| Right Edge        | Separation Distance (mm)    | 35          | 35          | 6                  | 6                  |
|                   | exclusion threshold (ratio) | 0.09        | 0.36        | 8.74               | 8.03               |
|                   | testing required ? (>7.5)   | No          | No          | Yes                | Yes                |
| Bottom Edge       | Separation Distance (mm)    | 8           | 8           | 15                 | 15                 |
|                   | exclusion threshold (ratio) | 0.4         | 1.6         | 3.5                | 3.2                |
|                   | testing required ? (>7.5)   | No          | No          | No                 | No                 |

## 9.0 ACCESSORIES EVALUATED

**Table 9.1 Manufacturer's Accessory List**

No accessories evaluated.

## 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                 |               |         |          | Spacing             |              | Conducted Power (dBm) | Measured SAR (1g) |                | SAR Drift (dB) |
|                                                  |         | M/N    | Type                  |                      | Modulation | Configuration      | Antenna ID                  | Battery ID    | Body ID | Audio ID | DUT (mm)            | Antenna (mm) |                       | 100% DC (W/kg)    | 100% DC (W/kg) |                |
| 1-Nov-2021                                       | B1      | A04166 | Hand-Held Transmitter | ch44-5220            | OFDM-6     | Display - Top Side | 20Mhz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 13.6                  | 0.035             | 0.013          | 2.710          |
| 1-Nov-2021                                       | B2      | A04166 | Hand-Held Transmitter | ch44-5220            | OFDM-6     | Back Side          | 20Mhz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 13.6                  | 0.385             | 0.129          | 0.129          |
| 2-Nov-2021                                       | B3      | A04166 | Hand-Held Transmitter | ch44-5220            | OFDM-6     | Right Edge         | 20Mhz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 13.6                  | 0.383             | 0.133          | 0.600          |
| 2-Nov-2021                                       | B4      | A04166 | Hand-Held Transmitter | ch44-5220            | OFDM-6     | Bottom Edge        | 20Mhz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 13.6                  | 0.124             | 0.049          | 0.380          |
| 2-Nov-2021                                       | B5      | A04166 | Hand-Held Transmitter | Ch48-5240            | MCS0       | Back Side          | 20Mhz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 13.49                 | 0.453             | 0.149          | 0.250          |
| 2-Nov-2021                                       | B6      | A04166 | Hand-Held Transmitter | Ch48-5240            | MCS0       | Right Edge         | 20Mhz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 13.49                 | 0.297             | 0.103          | 4.430          |
| 2-Nov-2021                                       | B7      | A04166 | Hand-Held Transmitter | CH 38 -5190          | MCS0       | Right Edge         | 40MHz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 8.48                  | 0.248             | 0.086          | 1.100          |
| 2-Nov-2021                                       | B8      | A04166 | Hand-Held Transmitter | ch42-5210            | MCS0       | Right Edge         | 80MHz                       | WiFi -UNI-1   | n/a     | n/a      | 0                   | 0            | 7.66                  | 0.171             | 0.050          | -0.880         |
| 04-Dec-2021                                      | B50     | A04166 | Hand-Held Transmitter | ch149-5745           | OFDM-6     | Display - Top Side | 20Mhz                       | WiFi-UNI-3    | n/a     | n/a      | 0                   | 0            | 12.86                 | 0.057             | 0.018          | 0.130          |
| 03-Dec-2021                                      | B51     | A04166 | Hand-Held Transmitter | ch149-5745           | OFDM-6     | Back Side          | 20Mhz                       | WiFi-UNI-3    | n/a     | n/a      | 0                   | 0            | 12.86                 | 0.329             | 0.109          | 0.090          |
| 03-Dec-2021                                      | B52     | A04166 | Hand-Held Transmitter | ch149-5745           | OFDM-6     | Right Edge         | 20Mhz                       | WiFi-UNI-3    | n/a     | n/a      | 0                   | 0            | 12.86                 | 0.451             | 0.151          | 4.250          |
| 12-Nov-2021                                      | B200    | A04166 | Hand-Held Transmitter | ch6-2437             | DSSS-1Mbps | Back Side          | 20Mhz                       | WiFi-802.11b  | n/a     | n/a      | 0                   | 0            | 8.38                  | 0.113             | 0.048          | -0.090         |
| 12-Nov-2021                                      | B201    | A04166 | Hand-Held Transmitter | ch6-2437             | DSSS-1Mbps | Display Side       | 20Mhz                       | WiFi-802.11b  | n/a     | n/a      | 0                   | 0            | 8.38                  | 0.027             | 0.014          | -0.190         |
| 12-Nov-2021                                      | B202    | A04166 | Hand-Held Transmitter | ch6-2437             | DSSS-1Mbps | Bottom Edge        | 20Mhz                       | WiFi-802.11b  | n/a     | n/a      | 0                   | 0            | 8.38                  | 0.091             | 0.043          | 0.570          |
| 16-Nov-2021                                      | B203    | A04166 | Hand-Held Transmitter | ch6-2437             | OFDM-6     | Back Side          | 20Mhz                       | WiFi -802.11g | n/a     | n/a      | 0                   | 0            | 8.38                  | 0.125             | 0.053          | -0.630         |
| 16-Nov-2021                                      | B204    | A04166 | Hand-Held Transmitter | ch1-2412             | OFDM-6     | Back Side          | 20Mhz                       | WiFi -802.11g | n/a     | n/a      | 0                   | 0            | 8.6                   | 0.134             | 0.057          | -0.640         |
| 16-Nov-2021                                      | B205    | A04166 | Hand-Held Transmitter | ch11-2462            | OFDM-6     | Back Side          | 20Mhz                       | WiFi -802.11g | n/a     | n/a      | 0                   | 0            | 8.26                  | 0.125             | 0.053          | 0.210          |
| 16-Nov-2021                                      | B206    | A04166 | Hand-Held Transmitter | ch13-2472            | OFDM-6     | Back Side          | 20Mhz                       | WiFi -802.11g | n/a     | n/a      | 0                   | 0            | 8.11                  | 0.111             | 0.046          | 0.210          |
| 07-Dec-2021                                      | B400    | A04166 | Hand-Held Transmitter | Low-1616 MhZ         | FDMA-FM    | Back Side          | 1MHz                        | IRIDIUM       | n/a     | n/a      | 0                   | 0            | 31.54                 | 1.480             | 0.646          | 1.080          |
| 08-Dec-2021                                      | B401    | A04166 | Hand-Held Transmitter | Low-1616 MhZ         | FDMA-FM    | Display Side       | 1MHz                        | IRIDIUM       | n/a     | n/a      | 0                   | 0            | 31.54                 | 0.058             | 0.349          | 0.550          |
| 07-Dec-2021                                      | B402    | A04166 | Hand-Held Transmitter | Low-1616 MhZ         | FDMA-FM    | Left Edge          | 1MHz                        | IRIDIUM       | n/a     | n/a      | 0                   | 0            | 31.54                 | 0.113             | 0.069          | 0.090          |
| 08-Dec-2021                                      | B403    | A04166 | Hand-Held Transmitter | Mid-1621 MhZ         | FDMA-FM    | Back Side          | 1MHz                        | IRIDIUM       | n/a     | n/a      | 0                   | 0            | 31.45                 | 1.370             | 0.622          | 0.660          |
| 08-Dec-2021                                      | B404    | A04166 | Hand-Held Transmitter | High-1626 MhZ        | FDMA-FM    | Back Side          | 1MHz                        | IRIDIUM       | n/a     | n/a      | 0                   | 0            | 31.4                  | 1.250             | 0.596          | 0.120          |
| 07-Dec-2021                                      | B405    | A04166 | Hand-Held Transmitter | Low-1616 MhZ         | FDMA-FM    | Back Side Repeat   | 1MHz                        | IRIDIUM       | n/a     | n/a      | 0                   | 0            | 31.54                 | 1.410             | 0.691          | 0.250          |
| SAR Limit                                        |         |        |                       |                      |            |                    | Spatial Peak                |               |         |          | Body/Extremity      |              | RF Exposure Category  |                   |                |                |
| FCC 47 CFR 2.1093                                |         |        |                       |                      |            |                    | Health Canada Safety Code 6 |               |         |          | 1 & 10 Gram Average |              | 1.6W/kg/4W/kg         |                   |                |                |
|                                                  |         |        |                       |                      |            |                    |                             |               |         |          |                     |              | General Population    |                   |                |                |

## 11.0 SCALING OF MAXIMUM MEASURE SAR

Table 11.1 SAR Scaling – BODY CONFIGURATION

| Scaling of Maximum Measured SAR (1g) |              |                    |            |        |
|--------------------------------------|--------------|--------------------|------------|--------|
| Measured Parameters                  |              | Body Configuration |            |        |
|                                      |              | Iridium            | Wifi       |        |
| Plot ID                              |              | B400               | B52        |        |
| Maximum Measured SAR <sub>M</sub>    |              | 1.480              | 0.451      | (W/kg) |
| Frequency                            |              | 1616               | 5745       | (MHz)  |
| Power Drift                          |              | 1.080 (1)          | 4.250 (1)  | (dB)   |
| Conducted Power                      |              | 31.540             | 12.860     | (dBm)  |
| Fluid Deviation from Target          |              |                    |            |        |
| Δe                                   | Permittivity | -3.76% (2)         | -7.31% (2) |        |
| Δσ                                   | Conductivity | 1.22% (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 <sup>3</sup> ) + (0.009402*f <sup>2</sup> ) - (0.02742*f) - 0.2026 |                 |  | (F.2)               |           |
| Cσ = (0.009804*f <sup>3</sup> ) - (0.08661*f <sup>2</sup> ) + (0.02981*f) + 0.7829    |                 |  | (F.3)               |           |
| f                                                                                     | Frequency (GHz) |  | 1.616               | 5.745     |
|                                                                                       | Ce              |  | -0.226              | -0.199    |
|                                                                                       | Cσ              |  | 0.646               | -0.045    |
|                                                                                       | Ce * Δe         |  | 0.008               | 0.015     |
|                                                                                       | Cσ * Δσ         |  | 0.008               | -0.001    |
|                                                                                       | ΔSAR            |  | 0.016               | 0.014 (%) |

| Manufacturer's Tuneup Tolerance |  |           |        |       |
|---------------------------------|--|-----------|--------|-------|
| Measured Conducted Power        |  | 31.540    | 12.860 | (dBm) |
| Rated Conducted Power           |  | 31.540    | 13.000 | (dBm) |
| ΔP                              |  | 0.000 (4) | -0.140 | (dB)  |

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

| SAR Adjustment for Fluid Sensitivity       |  |       |       |        |
|--------------------------------------------|--|-------|-------|--------|
| SAR <sub>1</sub> = SAR <sub>M</sub> * ΔSAR |  | 1.480 | 0.457 | (W/kg) |

| SAR Adjustment for Tuneup Tolerance        |  |       |       |        |
|--------------------------------------------|--|-------|-------|--------|
| SAR <sub>2</sub> = SAR <sub>1</sub> + [ΔP] |  | 1.480 | 0.472 | (W/kg) |

| SAR Adjustment for Drift                    |  |       |       |        |
|---------------------------------------------|--|-------|-------|--------|
| SAR <sub>3</sub> = SAR <sub>2</sub> + Drift |  | 1.480 | 0.472 | (W/kg) |

| reported SAR                |  |      |      |        |
|-----------------------------|--|------|------|--------|
| FCC/ISED = SAR <sub>3</sub> |  | 1.48 | 0.47 | (W/kg) |

Table 11.2 SAR Scaling – EXTREMITY CONFIGURATION

| Scaling of Maximum Measured SAR (10g) |              |                         |            |            |
|---------------------------------------|--------------|-------------------------|------------|------------|
| Measured Parameters                   |              | Extremity Configuration |            |            |
|                                       |              | Face                    | Body       | Head       |
| Plot ID                               |              |                         | B405       | B52        |
| Maximum Measured SAR <sub>M</sub>     |              |                         | 0.691      | 0.151      |
| Frequency                             |              |                         | 1616       | 5745       |
| Power Drift                           |              |                         | 0.250 (1)  | 4.250 (1)  |
| Conducted Power                       |              |                         | 31.540     | 12.860     |
| Fluid Deviation from Target           |              |                         |            |            |
| Δe                                    | Permittivity |                         | -3.76% (2) | -7.31% (2) |
| Δσ                                    | Conductivity |                         | 1.22% (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 (10g)                                                   |                 | IEC 62209-2 Annex F |        |        |
|---------------------------------------------------------------------------------------|-----------------|---------------------|--------|--------|
| Delta SAR = Ce * Δe + Cσ * Δσ                                                         |                 |                     |        | (F.1)  |
| Ce = (-0.0007854*f <sup>3</sup> ) + (0.009402*f <sup>2</sup> ) - (0.02742*f) - 0.2026 |                 |                     |        | (F.2)  |
| Cσ = (0.009804*f <sup>3</sup> ) - (0.08661*f <sup>2</sup> ) + (0.02981*f) + 0.7829    |                 |                     |        | (F.3)  |
| f                                                                                     | Frequency (GHz) |                     | 1.616  | 5.745  |
| Ce                                                                                    |                 |                     | -0.226 | -0.199 |
| Cσ                                                                                    |                 |                     | 0.646  | -0.045 |
| Ce * Δe                                                                               |                 |                     | 0.008  | 0.015  |
| Cσ * Δσ                                                                               |                 |                     | 0.008  | -0.001 |
| ΔSAR                                                                                  |                 |                     | 0.016  | 0.014  |

| Manufacturer's Tuneup Tolerance |  |  |           |            |
|---------------------------------|--|--|-----------|------------|
| Measured Conducted Power        |  |  | 31.540    | 12.860     |
| Rated Conducted Power           |  |  | 31.540    | 13.000     |
| ΔP                              |  |  | 0.000 (4) | -0.140 (4) |

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

| SAR Adjustment for Fluid Sensitivity       |  |  |       |       |
|--------------------------------------------|--|--|-------|-------|
| SAR <sub>1</sub> = SAR <sub>M</sub> * ΔSAR |  |  | 0.691 | 0.153 |

| SAR Adjustment for Tuneup Tolerance        |  |  |       |       |
|--------------------------------------------|--|--|-------|-------|
| SAR <sub>2</sub> = SAR <sub>1</sub> + [ΔP] |  |  | 0.691 | 0.158 |

| SAR Adjustment for Drift                    |  |  |       |       |
|---------------------------------------------|--|--|-------|-------|
| SAR <sub>3</sub> = SAR <sub>2</sub> + Drift |  |  | 0.691 | 0.158 |

| reported SAR                |  |  |      |      |
|-----------------------------|--|--|------|------|
| FCC/ISED = SAR <sub>3</sub> |  |  | 0.69 | 0.16 |

| NOTES to Table 11.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>(1) Scaling of the Maximum Measured SAR is based on the highest, 100% duty cycle for Face, Body and/or Head including 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 identification of the SAR Measurement Plots in Annex A of this report.</p> <p>NOTE: Some of the scaling factors in Steps 1 through 4 may not apply and are identified by light gray text.</p> |                                                                                                                                                                                                                                                                                                                                          |
| <b>Step 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 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 (+). |
| <b>Step 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 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.                                                                                                                    |
| <b>Step 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 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.                                                                                                                                                                      |
| <b>Step 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 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.                                                                                                                                                                             |
| <b>Step 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 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**

| Wifi & BT Body SAR                   |      |     |          |            |      | Wifi & BT Extremity SAR                    |      |     |          |            |      |
|--------------------------------------|------|-----|----------|------------|------|--------------------------------------------|------|-----|----------|------------|------|
| Plot ID                              | Frq  | ch  | Protocol | Modulation | SAR  | Plot ID                                    | Frq  | ch  | Protocol | Modulation | SAR  |
| B52                                  | 5745 | 149 | UNII-3   | OFDM-6     | 0.47 | B52                                        | 5745 | 149 | UNII-3   | OFDM-6     | 0.16 |
| n/a                                  | 2480 | n/a | BT 3EDR  | 8DPSK      | 0.17 | n/a                                        | 2480 | n/a | BT 3EDR  | 8DPSK      | 0.03 |
| total SAR                            |      |     |          |            | 0.64 | total SAR                                  |      |     |          |            | 0.19 |
| Body 1.6 W/kg - averaged over 1 gram |      |     |          |            |      | Extremity 4.0 W/kg - averaged over 10 gram |      |     |          |            |      |

| Wifi & ANT Body SAR                  |      |     |          |            |      | Wifi & ANT Extremity SAR                   |      |     |          |            |      |
|--------------------------------------|------|-----|----------|------------|------|--------------------------------------------|------|-----|----------|------------|------|
| Plot ID                              | Frq  | ch  | Protocol | Modulation | SAR  | Plot ID                                    | Frq  | ch  | Protocol | Modulation | SAR  |
| B52                                  | 5745 | 149 | UNII-3   | OFDM-6     | 0.47 | B52                                        | 5745 | 149 | UNII-3   | OFDM-6     | 0.16 |
| n/a                                  | 2480 | n/a | ANT      | GFSK       | 0.05 | n/a                                        | 2480 | n/a | ANT      | GFSK       | 0.02 |
| total SAR                            |      |     |          |            | 0.52 | total SAR                                  |      |     |          |            | 0.18 |
| Body 1.6 W/kg - averaged over 1 gram |      |     |          |            |      | 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 simultaneous transmission 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 / min. separation distance, mm] \*  $\sqrt{f(\text{GHz}) / x}$ , where x = 7.5 for 1 gram SAR and x = 18.75 for 10 gram SAR

BT  
 $[2/5] * \sqrt{2.48/7.5} = 0.17$

BT  
 $[2/5] * \sqrt{2.48/18.75} = 0.03$

ANT  
 $[1.2/5] * \sqrt{2.480/7.5} = 0.05$

ANT  
 $[1.2/5] * \sqrt{2.480/18.75} = 0.02$

## 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 /<br>Uncontrolled Exposure <sup>(4)</sup> | Occupational /<br>Controlled Exposure <sup>(5)</sup> |
| <b>Spatial Average<sup>(1)</sup></b><br>(averaged over the whole body)                                                                                                                             |                             | 0.08 W/kg                                                    | 0.4 W/kg                                             |
| <b>Spatial Peak<sup>(2)</sup></b><br>(Head and Trunk averaged over any 1 g of tissue)                                                                                                              |                             | <b>1.6 W/kg</b>                                              | 8.0 W/kg                                             |
| <b>Spatial Peak<sup>(3)</sup></b><br>(Hands/Wrists/Feet/Ankles averaged over 10 g)                                                                                                                 |                             | <b>4.0 W/kg</b>                                              | 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     |                   |                 |                       |                           | Fluid Dielectric | SPC | Test | Task                          |
|-------------|-------------------|-----------------|-----------------------|---------------------------|------------------|-----|------|-------------------------------|
| Date        | Ambient Temp (°C) | Fluid Temp (°C) | Relative Humidity (%) | Barometric Pressure (kPa) |                  |     |      |                               |
| 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             |

### 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.<br>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 additionally evaluated for SAR in accordance with the procedures described in KDB 941225D07V01r02.<br>The Back Side of the device was the highest SAR value for the highest output power channel, and was used as the default position. Additionally 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 .<br>When the reported SAR of the initial test position is $\leq 0.4$ 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.<br><br>Each SAR evaluation was performed with a fully charged battery.                                                                                                        |

### 13.3 DUT Positioning

| DUT Positioning                     |                                                                                                                                                                                                                     |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Positioning</b>                  | 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.                |
| <b>BODY/EXTREMITY Configuration</b> | 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. |
| <b>HEAD Configuration</b>           | This device is not intended to be held to the ear and was not tested in the HEAD configuration.                                                                                                                     |
| <b>FACE Configuration</b>           | This device is not intended to be held to the face and was not tested in the FACE configuration.                                                                                                                    |

## 13.4 General Procedures and Report

| General Procedures and Reporting |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General Procedures               | <p>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 <math>\pm 0.5^{\circ}\text{C}</math>. The Active TSL temperature was maintained to within <math>\pm 2.0^{\circ}\text{C}</math> 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.</p> <p>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 <u>Maximum Distance to Phantom Surface</u> to the fluid surface was performed following the power drift measurement.</p> |
| Reporting                        | <p>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.</p> <p>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 <u>ONLY</u> scaled up, not down. The final results of this scaling is the <u>reported SAR</u> which appears on the Cover Page of this report.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### 13.5 Fluid Dielectric and Systems Performance Check

| Fluid Dielectric and Systems Performance Check |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Fluid Dielectric Measurement Procedure</b>  | <p>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 April Dielectric Property Measurement System. A frequency range of <math>\pm 100\text{MHz}</math> for frequencies <math>&gt; 300\text{MHz}</math> and <math>\pm 50\text{MHz}</math> for frequencies <math>\leq 300\text{MHz}</math> with frequency step size of <math>10\text{MHz}</math> 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 <math>23^{\circ}\text{C}</math> in a <math>300\text{ml}</math> beaker) method. A sample of the TSL is placed in a <math>300\text{ml}</math> beaker and the open-ended coax is submerged approximately <math>8\text{mm}</math> 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 <math>&gt; 5\%</math> in range that the DUT is to be tested. If the adjustments fail to bring the parameters to <math>\leq 5\%</math> but are <math>&lt; 10\%</math>, 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 <math>&gt; 10\%</math> in the DUT test frequency range are not used.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Systems Performance Check</b>               | <p>The fluid dielectric parameters of the Active TSL are entered into the DASY Measurement Server at each of the <math>10\text{MHz}</math> 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 <math>10\text{MHz}</math> step intervals.</p> <p>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 <math>1\text{g}</math> and <math>10\text{g}</math> SAR is measured. The measured <math>1\text{g}</math> and <math>10\text{g}</math> SAR is compared to the <math>1\text{g}</math> and <math>10\text{g}</math> SAR measurements from the validation source's Calibration Certificate. When required, the measured SAR is normalized to <math>1.0\text{W}</math> 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 <math>\leq 10\%</math> of the measured and normalize SAR of the validation source's Calibration Certificate.</p> <p>The fluid dielectric parameters of the Active TSL and SPC are repeated when the Active TSL has been in use for greater than <math>84</math> hours or if the Active TSL temperature has exceed <math>\pm 1^{\circ}\text{C}</math> of the initial fluid analysis.</p> |

### 13.6 Scan Resolution 100MHz to 2GHz

| Scan Resolution 100MHz to 2GHz                                                                                                                                         |                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Maximum distance from the closest measurement point to phantom surface:<br>(Geometric Center of Probe Center)                                                          | $4 \pm 1 \text{ mm}$      |
| Maximum probe angle normal to phantom surface.<br>(Flat Section ELI Phantom)                                                                                           | $5^{\circ} \pm 1^{\circ}$ |
| Area Scan Spatial Resolution $\Delta X, \Delta Y$                                                                                                                      | $15 \text{ mm}$           |
| Zoom Scan Spatial Resolution $\Delta X, \Delta Y$                                                                                                                      | $7.5 \text{ mm}$          |
| Zoom Scan Spatial Resolution $\Delta Z$<br>(Uniform Grid)                                                                                                              | $5 \text{ mm}$            |
| Zoom Scan Volume X, Y, Z                                                                                                                                               | $30 \text{ mm}$           |
| Phantom                                                                                                                                                                | ELI                       |
| Fluid Depth                                                                                                                                                            | $150 \pm 5 \text{ mm}$    |
| An Area Scan with an area extending beyond the device was used to locate the candidate maximas within $2\text{dB}$ of the global maxima.                               |                           |
| A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the $1\text{-gram}$ and $10\text{-gram}$ 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:<br>(Geometric Center of Probe Center)                                        | 4 ± 1 mm   |
| Maximum probe angle normal to phantom surface.<br>(Flat Section ELI Phantom)                                                                         | 5° ± 1°    |
| Area Scan Spatial Resolution $\Delta X, \Delta Y$                                                                                                    | 12 mm      |
| Zoom Scan Spatial Resolution $\Delta X, \Delta Y$                                                                                                    | 5 mm       |
| Zoom Scan Spatial Resolution $\Delta Z$<br>(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:<br>(Geometric Center of Probe Center)                                        | 4 ± 1 mm   |
| Maximum probe angle normal to phantom surface.<br>(Flat Section ELI Phantom)                                                                         | 5° ± 1°    |
| Area Scan Spatial Resolution $\Delta X, \Delta Y$                                                                                                    | 10 mm      |
| Zoom Scan Spatial Resolution $\Delta X, \Delta Y$                                                                                                    | 4 mm       |
| Zoom Scan Spatial Resolution $\Delta Z$<br>(Uniform Grid)                                                                                            | 2 mm       |
| Zoom Scan Volume X, Y, Z                                                                                                                             | 22 mm      |
| Phantom                                                                                                                                              | ELI        |
| Fluid Depth                                                                                                                                          | 100 ± 5 mm |
| An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.                      |            |
| A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR |            |

## 14.0 MEASUREMENT UNCERTAINTIES

Table 14.1 Measurement Uncertainty

| UNCERTAINTY BUDGET FOR DEVICE EVALUATION (IEEE 1528-2013 Table 9)        |                         |             |              |     |                |                |                     |                     |                                          |
|--------------------------------------------------------------------------|-------------------------|-------------|--------------|-----|----------------|----------------|---------------------|---------------------|------------------------------------------|
| Source of Uncertainty                                                    | IEEE<br>1528<br>Section | Toler<br>±% | Prob<br>Dist | Div | c <sub>i</sub> | c <sub>i</sub> | Stand<br>Unct<br>±% | Stand<br>Unct<br>±% | V <sub>i</sub><br>or<br>V <sub>eff</sub> |
| 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 <sup>(2)</sup>                                     | E.2.9                   | 0.0         | R            | √3  | 1              | 1              | 0.0                 | 0.0                 | ∞                                        |
| SAR Power Scaling <sup>(3)</sup>                                         | 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 <sup>(1)</sup>                              |                         |             |              |     |                |                |                     |                     | V <sub>eff</sub> = 1141                  |
| Combined Standard Uncertainty                                            |                         |             | RSS          |     |                |                | 11.1                | 11.0                |                                          |
| Expanded Uncertainty (95% Confidence Interval)                           |                         |             | k=2          |     |                |                | 22.2                | 21.9                |                                          |
| Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 |                         |             |              |     |                |                |                     |                     |                                          |

(1) The Effective Degrees of Freedom is > 30

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

(2) The SAR Value is compensated for Drift

(3) SAR Power Scaling not Required

\* Provided by SPEAG for DASY4

Table 14.2 Calculation of Degrees of Freedom

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

## 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_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon |              |        |        |  |
| FCC_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma   |              |        |        |  |
| Test_e Epsilon of UIM                                             |              |        |        |  |
| Test_s Sigma of UIM                                               |              |        |        |  |
| *****                                                             |              |        |        |  |
| Freq                                                              | FCC_eHFCC_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   |  |

## FLUID DIELECTRIC PARAMETERS

|                   |                    |                    |               |                   |                 |                               |                               |
|-------------------|--------------------|--------------------|---------------|-------------------|-----------------|-------------------------------|-------------------------------|
| <b>Date:</b>      | <b>31 Oct 2021</b> | <b>Fluid Temp:</b> | <b>20.7</b>   | <b>Frequency:</b> | <b>5250MHz</b>  | <b>Tissue:</b>                | <b>Head</b>                   |
| <b>Freq (MHz)</b> |                    | <b>Test_e</b>      | <b>Test_s</b> | <b>Target_e</b>   | <b>Target_s</b> | <b>Deviation Permittivity</b> | <b>Deviation Conductivity</b> |
| 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

**Table 15.2 Fluid Dielectric Parameters 2450MHz HEAD TSL**

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Aprel Laboratory  
Test Result for UIM Dielectric Parameter  
Thu 11/Nov/2021 17:25:34  
Freq Frequency(GHz)  
FCC\_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon  
FCC\_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma  
Test\_e Epsilon of UIM  
Test\_s Sigma of UIM

\*\*\*\*\*

| Freq   | FCC_eHFCC | sHFCC | 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   |

## 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%                  |

**Table 15.3 Fluid Dielectric Parameters 2450MHz HEAD TSL**

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Aprel Laboratory  
Test Result for UIM Dielectric Parameter  
Tue 16/Nov/2021 11:00:46  
Freq Frequency(GHz)  
FCC\_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon  
FCC\_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma  
Test\_e Epsilon of UIM  
Test\_s Sigma of UIM

\*\*\*\*\*

| Freq   | FCC_eHFCC | sHFCC | 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   |

## 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%                  |

**Table 15.4 Fluid Dielectric Parameters 5750MHz HEAD TSL**

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Aprel Laboratory  
Test Result for UIM Dielectric Parameter  
Wed 02/Dec/2021 17:32:54  
Freq Frequency(GHz)  
FCC\_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon  
FCC\_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma  
Test\_e Epsilon of UIM  
Test\_s Sigma of UIM

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| Freq   | FCC_eHFCC | sHFCC | 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   |

## 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%                  |

**Table 15.5 Fluid Dielectric Parameters 1640MHz HEAD TSL**

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Aprel Laboratory  
Test Result for UIM Dielectric Parameter  
Sat 06/Dec/2021 15:02:35  
Freq Frequency(GHz)  
FCC\_eHFCC OET 65 Supplement C (June 2001) Limits for Head Epsilon  
FCC\_sHFCC OET 65 Supplement C (June 2001) Limits for Head Sigma  
Test\_e Epsilon of UIM  
Test\_s Sigma of UIM

\*\*\*\*\*

| Freq   | FCC_eHFCC | sHFCC | 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   |

| 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%                 |

## 16.0 SYSTEM VERIFICATION TEST RESULTS

Table 16.1 System Verification Results 5250MHz HEAD TSL

| System Verification Test Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |                    |                         |                       |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-------------------------|-----------------------|------------------------|
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  | Frequency<br>(MHz) | Validation Source       |                       |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                    | P/N                     | S/N                   |                        |
| 31 Oct 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  | 5250               | D5GHzV2                 | 1031                  |                        |
| Fluid Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Fluid Temp<br>°C | Ambient Temp<br>°C | Ambient Humidity<br>(%) | Forward Power<br>(mW) | Source Spacing<br>(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%                  |
| <p>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.</p> <p>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.</p> <p>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.</p> <p>The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.</p> |                  |                    |                         |                       |                        |

**Table 16.2 System Verification Results 2450MHz HEAD TSL**

| <b>System Verification Test Results</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                    |                         |                       |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-------------------------|-----------------------|------------------------|
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  | Frequency<br>(MHz) | Validation Source       |                       |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                    | P/N                     | S/N                   |                        |
| 11 Nov 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  | 2450               | D2450V2                 | 825                   |                        |
| Fluid Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Fluid Temp<br>°C | Ambient Temp<br>°C | Ambient Humidity<br>(%) | Forward Power<br>(mW) | Source Spacing<br>(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%                 |
| <p>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.</p> <p>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.</p> <p>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.</p> <p>The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.</p> |                  |                    |                         |                       |                        |

**Table 16.3 System Verification Results 2450MHz HEAD TSL**

| <b>System Verification Test Results</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                    |                         |                       |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-------------------------|-----------------------|------------------------|
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  | Frequency<br>(MHz) | Validation Source       |                       |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                    | P/N                     | S/N                   |                        |
| 16 Nov 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  | 2450               | D2450V2                 | 825                   |                        |
| Fluid Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Fluid Temp<br>°C | Ambient Temp<br>°C | Ambient Humidity<br>(%) | Forward Power<br>(mW) | Source Spacing<br>(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%                  |
| <p>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.</p> <p>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.</p> <p>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.</p> <p>The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.</p> |                  |                    |                         |                       |                        |

**Table 16.4 System Verification Results 5750MHz HEAD TSL**

| System Verification Test Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |                    |                         |                       |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-------------------------|-----------------------|------------------------|
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  | Frequency<br>(MHz) | Validation Source       |                       |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                    | P/N                     | S/N                   |                        |
| 03 Dec 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  | 5750               | D5GHzV2                 | 1031                  |                        |
| Fluid Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Fluid Temp<br>°C | Ambient Temp<br>°C | Ambient Humidity<br>(%) | Forward Power<br>(mW) | Source Spacing<br>(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%                 |
| <p>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.</p> <p>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.</p> <p>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.</p> <p>The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.</p> |                  |                    |                         |                       |                        |

**Table 16.5 System Verification Results 1640MHz HEAD TSL**

| System Verification Test Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |                    |                         |                       |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|-------------------------|-----------------------|------------------------|
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  | Frequency<br>(MHz) | Validation Source       |                       |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                    | P/N                     | S/N                   |                        |
| 06 Dec 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  | 1640               | ALS-D-1620-S-2          | 207-00102             |                        |
| Fluid Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Fluid Temp<br>°C | Ambient Temp<br>°C | Ambient Humidity<br>(%) | Forward Power<br>(mW) | Source Spacing<br>(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%                  |
| <p>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.</p> <p>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.</p> <p>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.</p> <p>The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.</p> |                  |                    |                         |                       |                        |

## 17.0 SYSTEM VALIDATION SUMMARY

**Table 17.1 System Validation Summary**

| System Validation Summary |                    |                |              |                      |               |        |                    |              |                    |           |          |
|---------------------------|--------------------|----------------|--------------|----------------------|---------------|--------|--------------------|--------------|--------------------|-----------|----------|
| Frequency<br>(MHz)        | Validation<br>Date | Probe<br>Model | Probe<br>S/N | Validation<br>Source | Source<br>S/N | Tissue | Tissue Dielectrics |              | Validation Results |           |          |
|                           |                    |                |              |                      |               |        | Permittivity       | 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     |

## 18.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 18.1 Measurement System Specifications

| Measurement System Specification                |                                                                                   |
|-------------------------------------------------|-----------------------------------------------------------------------------------|
| <b>Specifications</b>                           |                                                                                   |
| Positioner                                      | Stäubli Unimation Corp. Robot Model: TX90XL                                       |
| Repeatability                                   | +/- 0.035 mm                                                                      |
| No. of axis                                     | 6.0                                                                               |
| <b>Data Acquisition Electronic (DAE) System</b> |                                                                                   |
| <b>Cell Controller</b>                          |                                                                                   |
| Processor                                       | Intel(R) Core(TM) i7-7700                                                         |
| Clock Speed                                     | 3.60 GHz                                                                          |
| Operating System                                | Windows 10 Professional                                                           |
| <b>Data Converter</b>                           |                                                                                   |
| 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 |
| <b>DASY Measurement Server</b>                  |                                                                                   |
| 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                               |
| <b>E-Field Probe</b>                            |                                                                                   |
| 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)                                                         |
| <b>Phantom</b>                                  |                                                                                   |
| Type                                            | ELI Elliptical Planar Phantom                                                     |
| Shell Material                                  | Fiberglass                                                                        |
| Thickness                                       | 2mm +/- .2mm                                                                      |
| Volume                                          | > 30 Liter                                                                        |

| Measurement System Specification                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                          |                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Probe Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                          |                                                                                       |
| Construction:                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Symmetrical design with triangular core;<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, glycol) |    |
| Calibration:                                                                                                                                                                                                                                                                                                                                                                                                                                                                | In air from 10 MHz to 2.5 GHz<br>In head simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy $\pm 8\%$ )                                   |                                                                                       |
| Frequency:                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10 MHz to $> 6$ GHz; Linearity: $\pm 0.2$ dB (30 MHz to 3 GHz)                                                                                           |                                                                                       |
| Directivity:                                                                                                                                                                                                                                                                                                                                                                                                                                                                | $\pm 0.2$ dB in head tissue (rotation around probe axis)<br>$\pm 0.4$ dB in head tissue (rotation normal to probe axis)                                  |                                                                                       |
| Dynamic Range:                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5 $\mu$ W/g to $> 100$ mW/g; Linearity: $\pm 0.2$ dB                                                                                                     |                                                                                       |
| Surface Detect:                                                                                                                                                                                                                                                                                                                                                                                                                                                             | $\pm 0.2$ mm repeatability in air and clear liquids over diffuse reflecting surfaces                                                                     |                                                                                       |
| Dimensions:                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Overall length: 330 mm; Tip length: 16 mm;<br>Body diameter: 12 mm; Tip diameter: 6.8 mm<br>Distance from probe tip to dipole centers: 2.7 mm            |                                                                                       |
| Application:                                                                                                                                                                                                                                                                                                                                                                                                                                                                | General dosimetry up to 3 GHz; Compliance tests of mobile phone                                                                                          | <b>EX3DV4 E-Field Probe</b>                                                           |
| Phantom Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                          |                                                                                       |
| <p>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.</p>                                                                                                                                                                                                                              |                                                                                                                                                          |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                          | <b>ELI Phantom</b>                                                                    |
| Device Positioner Specification                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                          |                                                                                       |
| <p>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 <math>65^\circ</math>. 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.</p> |                                                                                                                                                          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                          | <b>Device Positioner</b>                                                              |

## 19.0 TEST EQUIPMENT LIST

**Table 19.1 Equipment List and Calibration**

| Test Equipment List                         |           |             |                 |                 |
|---------------------------------------------|-----------|-------------|-----------------|-----------------|
| DESCRIPTION                                 | ASSET NO. | SERIAL NO.  | DATE CALIBRATED | CALIBRATION DUE |
| Schmid & Partner DASY 6 System              | -         | -           | -               | -               |
| -DASY Measurement Server                    | 00158     | 1078        | CNR             | CNR             |
| -Robot                                      | 00046     | 599396-01   | CNR             | CNR             |
| -DAE4                                       | 00019     | 353         | 22-Apr-21       | 22-Apr-22       |
| -EX3DV4 E-Field Probe                       | 00213     | 3600        | 20-Apr-21       | 20-Apr-22       |
| -CLA 30 Validation Dipole                   | 00300     | 1005        | 18-Mar-20       | 18-Mar-23       |
| -CLA150 Validation Dipole                   | 00251     | 4007        | 18-Mar-20       | 18-Mar-23       |
| -D450V3 Validation Dipole                   | 00221     | 1068        | 27-Apr-21       | 27-Apr-24       |
| -D750V3 Validation Dipole                   | 00238     | 1061        | 21-Mar-19       | 21-Mar-22       |
| -D835V2 Validation Dipole                   | 00217     | 4D075       | 27-Apr-21       | 27-Apr-24       |
| -D900V2 Validation Dipole                   | 00020     | 54          | 16-Mar-20       | 16-Mar-23       |
| ALS-D-01640-S-2                             | 00299     | 207-00102   | 15-Dec-20       | 15-Dec-23       |
| -D1800V2 Validation Dipole                  | 00222     | 247         | 16-Mar-20       | 16-Mar-23       |
| -D1900V2 Validation Dipole                  | 00218     | 5d107       | 16-Mar-20       | 16-Mar-23       |
| ALS-D-2300-S-2                              | 00328     | 218-00201   | 26-Feb-19       | 26-Feb-22       |
| -D2450V2 Validation Dipole                  | 00219     | 825         | 24-Apr-21       | 24-Apr-24       |
| ALS-D-2600-S-2                              | 00327     | 225-00926   | 26-Feb-19       | 26-Feb-22       |
| -D5GHzV2 Validation Dipole                  | 00126     | 1031        | 27-Apr-21       | 27-Apr-24       |
| ELI Phantom                                 | 00247     | 1234        | CNR             | CNR             |
| SAM Phantom                                 | 00154     | 1033        | CNR             | CNR             |
| HP 85070C Dielectric Probe Kit              | 00033     | none        | CNR             | CNR             |
| Gigatronics 8652A Power Meter               | 00007     | 1835801     | 26-Mar-19       | 26-Mar-22       |
| Gigatronics 80701A Power Sensor             | 00186     | 1837002     | COU             | COU             |
| Gigatronics 80334A Power Sensor             | 00237     | 1837001     | 26-Mar-19       | 26-Mar-22       |
| HP 8753ET Network Analyzer                  | 00134     | US39170292  | 6-Jan-21        | 6-Jan-24        |
| Rohde & Schwarz SMR20 Signal Generator      | 00006     | 100104      | 11-Aug-20       | 11-Aug-23       |
| Amplifier Research 10W1000C Power Amplifier | 00041     | 27887       | CNR             | CNR             |
| Amplifier Research 5S1G4 Power Amplifier    | 00106     | 26235       | CNR             | CNR             |
| Narda Directional Coupler 3020A             | 00064     | -           | CNR             | CNR             |
| Kangaroo VWR Humidity/Thermometer           | 00334     | 192385455   | 5-Aug-19        | 6-Aug-22        |
| Digital Multi Meter DMR-1800                | 00250     | TE182       | 23-Jun-20       | 23-Jun-23       |
| Bipolar Power Supply 6299A                  | 00086     | 1144A02155  | CNR             | CNR             |
| DC-18G 10W 30db Attenuator                  | 00102     | -           | COU             | COU             |
| R&S FSP40 Spectrum Analyzer                 | 00241     | 100500      | 9-Aug-21        | 9-Aug-24        |
| HP 8566B Spectrum Analyzer                  | 00051     | 2747A055100 | 29-Jun-20       | 29-Jun-23       |
| RF Cable-SMA                                | 00311     | -           | CNR             | CNR             |
| HP Calibration Kit                          | 00145     | -           | CNR             | CNR             |

CNR = Calibration Not Required

COU = Calibrate on Use

## 20.0 FLUID COMPOSITION

**Table 20.1 Fluid Composition 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 <sup>(1)</sup> | HEC <sup>(2)</sup> | Bacteriacide <sup>(3)</sup> |
| 52.0                                       | 48.0   | 0.0                 | 0.0                | 0.0                         |

(1) Non-Iodinized

(2) HydroxyEthyl-Cellulose: Sigma-Aldrich P/N 54290-500g

(3) Dow Chemical DOWICIL 75 Antimicrobial Preservative

**Table 20.3 Fluid Composition 1640MHz HEAD TSL**

| Tissue Simulating Liquid (TSL) Composition |        |                     |                    | 1640MHz Head                |
|--------------------------------------------|--------|---------------------|--------------------|-----------------------------|
| Component by Percent Weight                |        |                     |                    |                             |
| Water                                      | Glycol | Salt <sup>(1)</sup> | HEC <sup>(2)</sup> | Bacteriacide <sup>(3)</sup> |
| 47.5                                       | 45.5   | 0.5                 | 0.0                | 0.0                         |

(1) Non-Iodinized

(2) HydroxyEthyl-Cellulose: Sigma-Aldrich P/N 54290-500g

(3) Dow Chemical DOWICIL 75 Antimicrobial Preservative

## 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;  $\sigma = 4.58$  S/m;  $\epsilon_r = 33.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
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

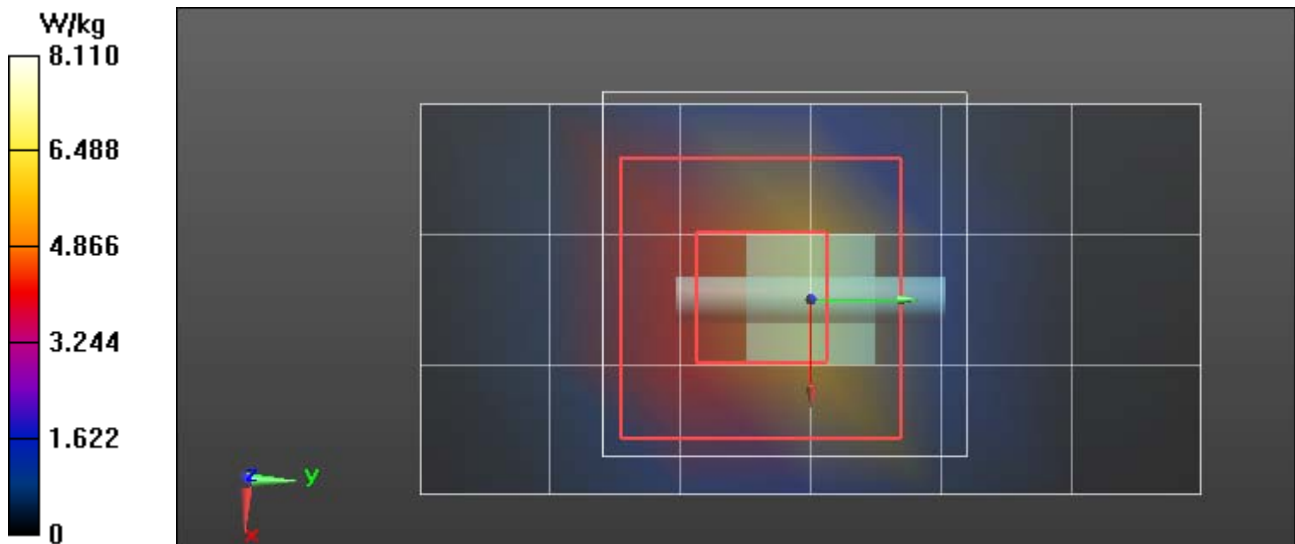
Peak SAR (extrapolated) = 15.8 W/kg

**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;  $\sigma = 1.8$  S/m;  $\epsilon_r = 35.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section

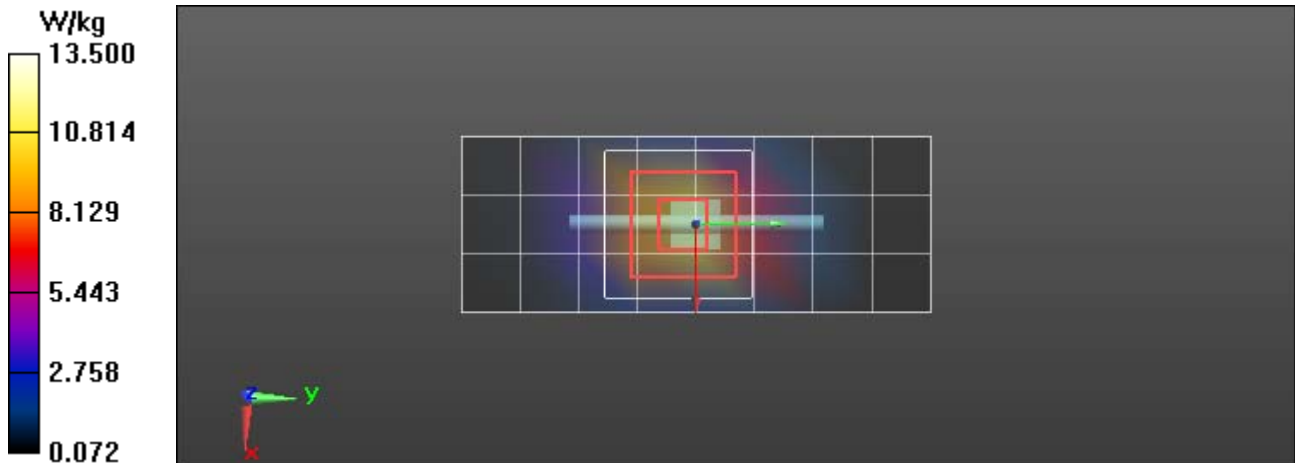
Date/Time: 11/11/2021 5:50:12 PM

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;  $\sigma = 1.84$  S/m;  $\epsilon_r = 35.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section

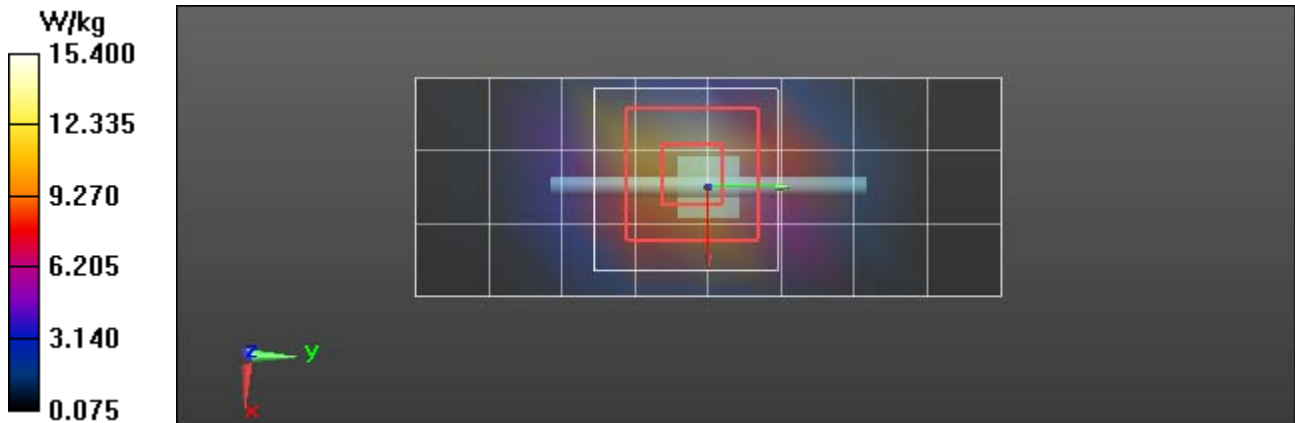
Date/Time: 11/16/2021 11:46:48 AM

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



**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;  $\sigma = 5.33$  S/m;  $\epsilon_r = 32.88$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section

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

DASY5 Configuration:

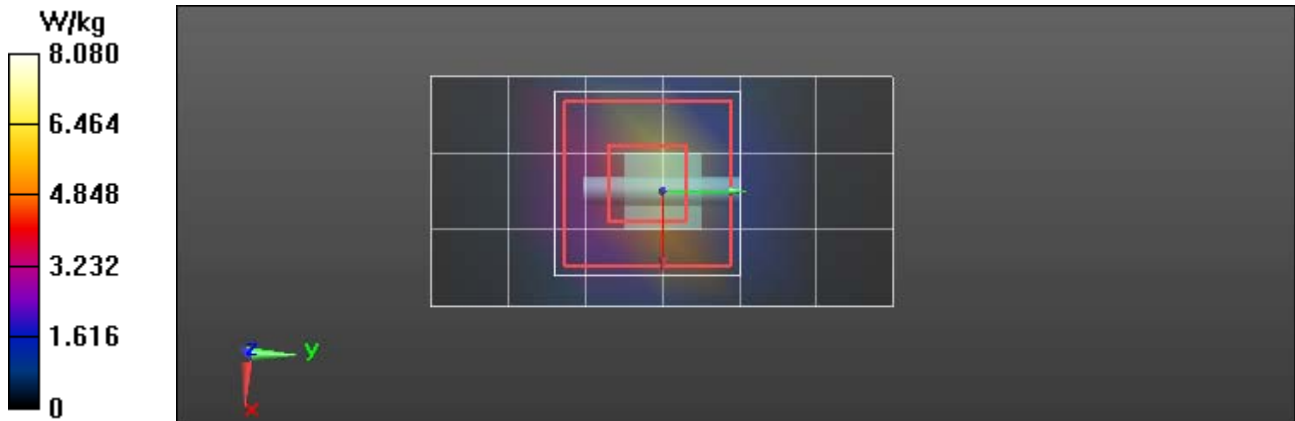
- Probe: EX3DV4 - SN3600; ConvF(4.06, 4.06, 4.06) @ 5750 MHz; Calibrated: 4/28/2021
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 4/22/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax; Serial: 1234
- Measurement SW: DASY52, Version 52.10 (3);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



**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;  $\sigma = 1.26$  S/m;  $\epsilon_r = 38.76$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section

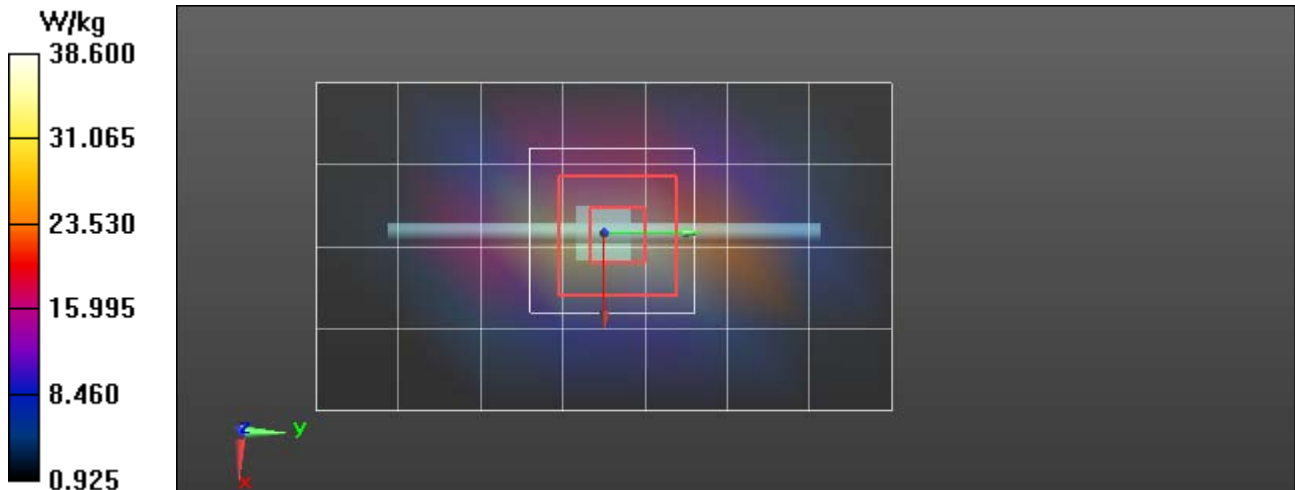
Date/Time: 12/6/2021 5:57:51 PM

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:  
 $dx=15$ mm,  $dy=15$ mm  
 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:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm  
 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 MAXIMUM MEASURED SAR

### Plot B52

**DUT: A04166; Type: Transmitter; Serial: 3374769248**  
**Procedure Name: B52-A04166,Right Edge -P, 5745MHz 6mb,WIFI**

Communication System: UID 0, CW (0); Frequency: 5745 MHz;Duty Cycle: 1:1  
Medium parameters used (interpolated):  $f = 5745$  MHz;  $\sigma = 5.405$  S/m;  $\epsilon_r = 32.82$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section

Date/Time: 12/3/2021 5:17:39 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(4.06, 4.06, 4.06) @ 5745 MHz; Calibrated: 4/28/2021
- 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)

**5750H/B52-A04166,Right Edge -P, 5745MHz 6mb,WIFI/Area Scan (18x7x1):** Measurement grid: dx=10mm, dy=10mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.955 W/kg

**5750H/B52-A04166,Right Edge -P, 5745MHz 6mb,WIFI/Zoom Scan (9x9x6)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.809 V/m; Power Drift = 4.25 dB

Peak SAR (extrapolated) = 1.92 W/kg

**SAR(1 g) = 0.451 W/kg; SAR(10 g) = 0.151 W/kg**

Smallest distance from peaks to all points 3 dB below = 8.8 mm

Ratio of SAR at M2 to SAR at M1 = 49.5%

[Info: Interpolated medium parameters used for SAR evaluation.](#)

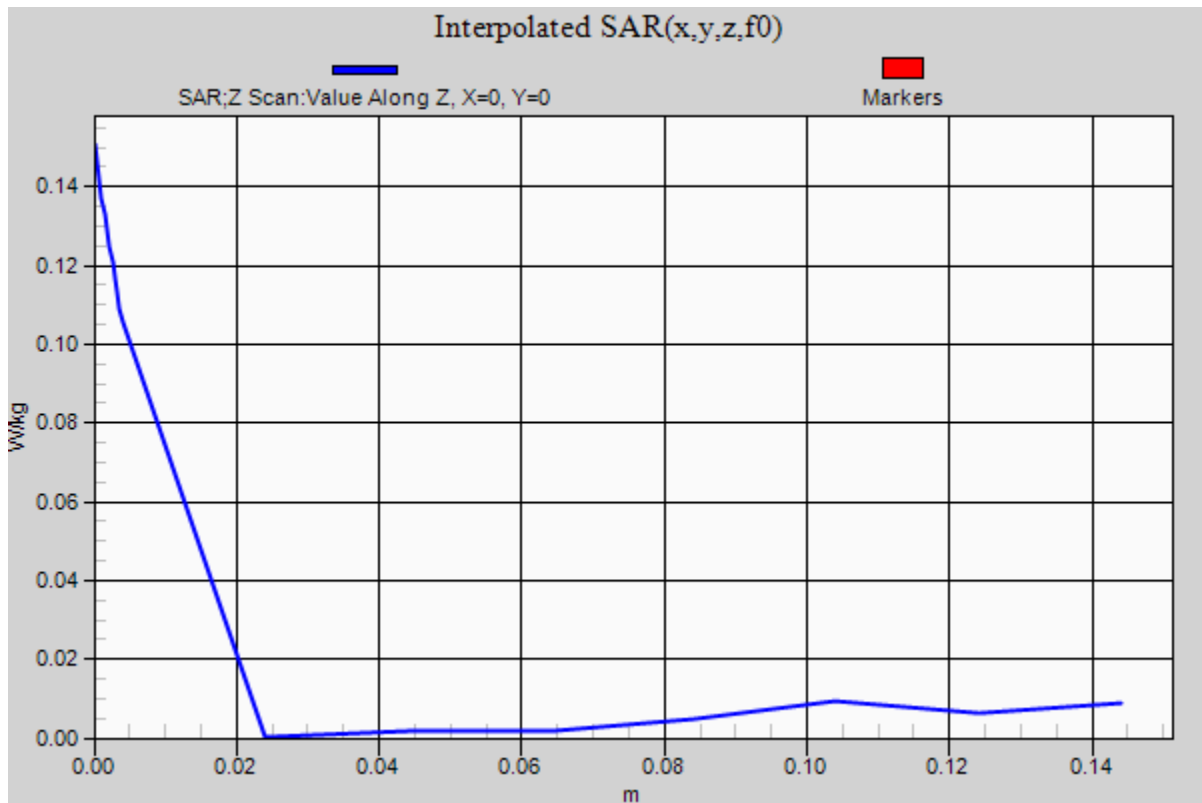
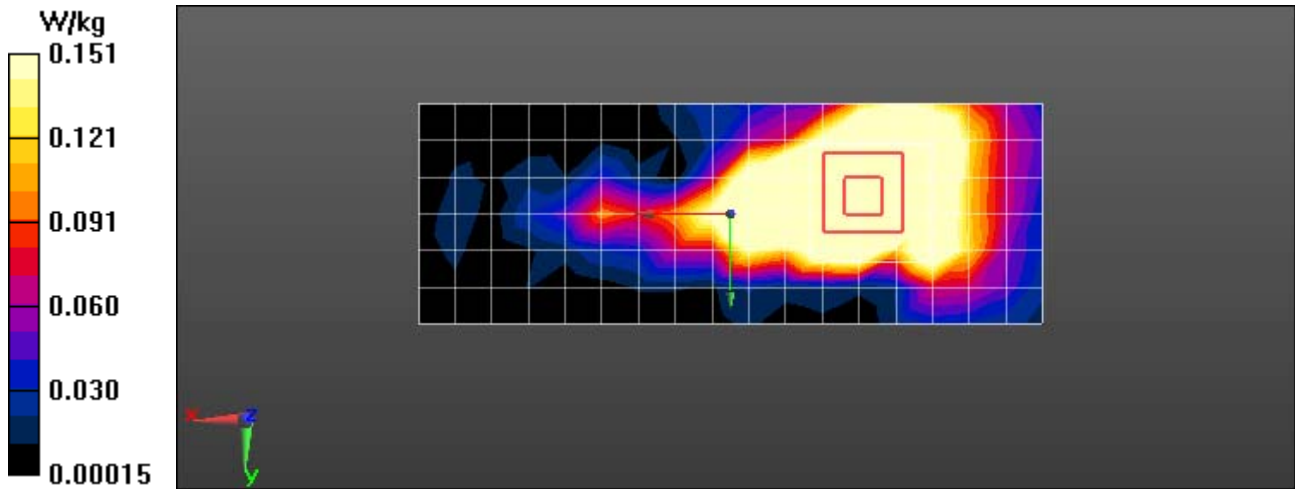
Maximum value of SAR (measured) = 1.06 W/kg

**5750H/B52-A04166,Right Edge -P, 5745MHz 6mb,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, 3.050) [mm]

Maximum value of SAR (interpolated) = 0.151 W/kg



## Plot B400

**DUT: A04166; Type: Transmitter; Serial: 3374769248**

**Procedure Name: B400-A04166, Back Side - Reduced, 1616MHz 15mm**

Communication System: UID 0, CW (0); Frequency: 1616 MHz; Duty Cycle: 1:10.7498

Medium parameters used (interpolated):  $f = 1616$  MHz;  $\sigma = 1.246$  S/m;  $\epsilon_r = 38.706$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Date/Time: 12/7/2021 1:44:27 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(7.31, 7.31, 7.31) @ 1616 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/B400-A04166, Back Side - Reduced, 1616MHz 15mm/Area Scan (13x8x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.954 W/kg

**1640H/B400-A04166, Back Side - Reduced, 1616MHz 15mm/Zoom Scan (9x9x6)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.867 V/m; Power Drift = 1.08 dB

Peak SAR (extrapolated) = 7.30 W/kg

**SAR(1 g) = 1.48 W/kg; SAR(10 g) = 0.646 W/kg**

Smallest distance from peaks to all points 3 dB below = 4 mm

Ratio of SAR at M2 to SAR at M1 = 45.8%

[Info: Interpolated medium parameters used for SAR evaluation.](#)

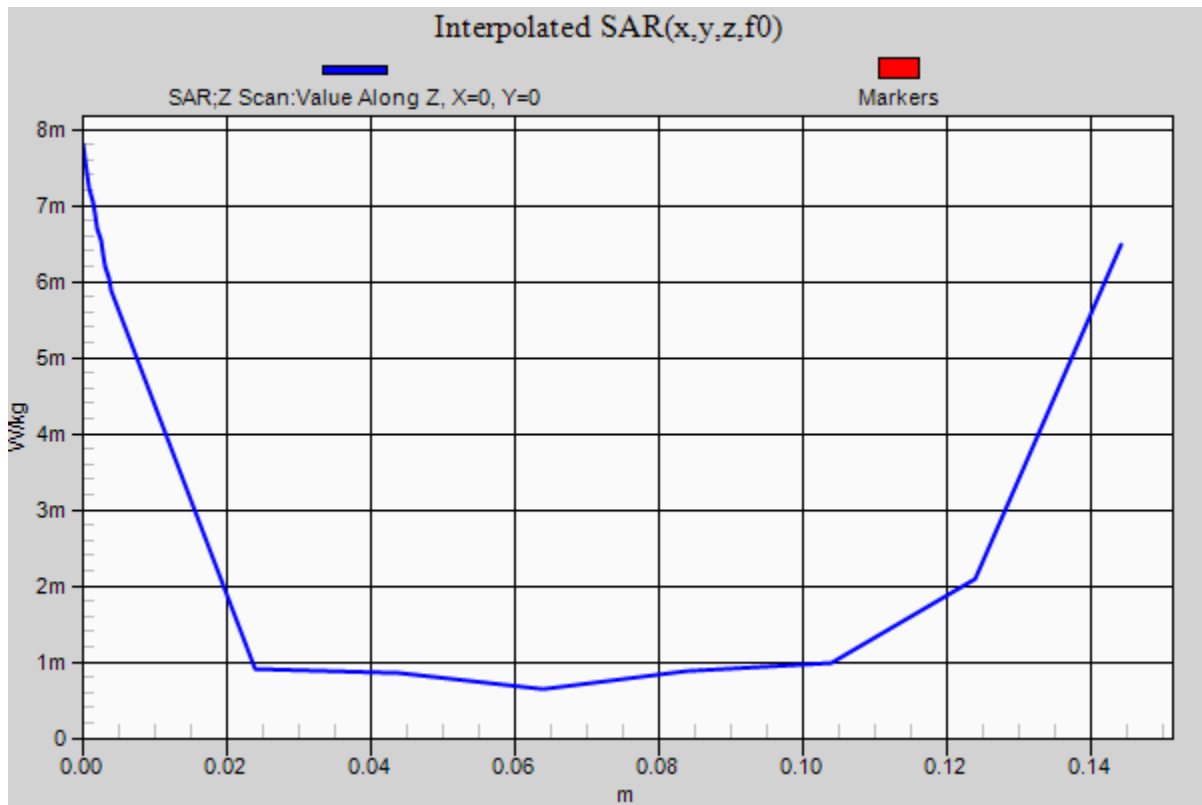
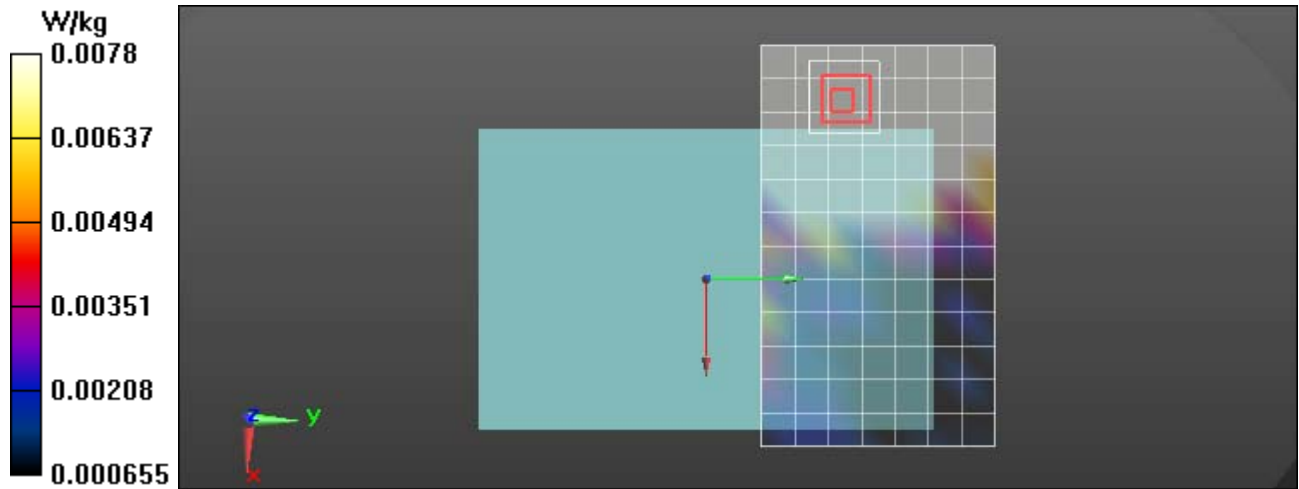
Maximum value of SAR (measured) = 3.49 W/kg

**1640H/B400-A04166, Back Side - Reduced, 1616MHz 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, 10.64) [mm]

Maximum value of SAR (interpolated) = 0.00780 W/kg



## Plot B405

**DUT: A04166; Type: Transmitter; Serial: 3374769248**

**Procedure Name: B405-A04166, Back Side - Reduced, 1616MHz 15mm Repeat SAR msmt**

Communication System: UID 0, CW (0); Frequency: 1616 MHz; Duty Cycle: 1:10.7498

Medium parameters used (interpolated):  $f = 1616$  MHz;  $\sigma = 1.246$  S/m;  $\epsilon_r = 38.706$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Date/Time: 12/8/2021 3:18:23 PM

DASY5 Configuration:

- Probe: EX3DV4 - SN3600; ConvF(7.31, 7.31, 7.31) @ 1616 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/B405-A04166, Back Side - Reduced, 1616MHz 15mm Repeat SAR msmt/Area Scan (7x7x1):** Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.942 W/kg

**1640H/B405-A04166, Back Side - Reduced, 1616MHz 15mm Repeat SAR msmt/Zoom Scan (9x9x6)/Cube 0:**

Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 11.57 V/m; Power Drift = 0.25 dB

Peak SAR (extrapolated) = 5.88 W/kg

**SAR(1 g) = 1.41 W/kg; SAR(10 g) = 0.691 W/kg**

Smallest distance from peaks to all points 3 dB below = 3.2 mm

Ratio of SAR at M2 to SAR at M1 = 40.7%

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 3.34 W/kg

**1640H/B405-A04166, Back Side - Reduced, 1616MHz 15mm Repeat SAR msmt/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, 18.84) [mm]

Maximum value of SAR (interpolated) = 0.0118 W/kg

