



|                            |               |
|----------------------------|---------------|
| Test Report Serial Number: | 45461509 R2.0 |
| Test Report Date:          | 28 May 2019   |
| Project Number:            | 1439          |

## SAR Test Report - New Certification

Applicant:



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

| Maximum Reported 10g SAR |               |      |      |
|--------------------------|---------------|------|------|
| FCC                      | Extremity DTS | 0.36 | W/kg |
| ISED                     | Extremity DTS | 0.40 |      |
| General Pop. Limit:      |               | 4.00 |      |

FCC ID:

**IPH-03559**

Product Model Number / HVIN

**A03559**

ISED Registration Number

**1792A-03559**

Product Name / PMN

**A03559**

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



IC Registration 3874A-1



FCC Registration: CA3874

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## 1.0 DOCUMENT CONTROL

|                            |                                       |                 |                          |
|----------------------------|---------------------------------------|-----------------|--------------------------|
| <b>Samples Tested By:</b>  | Trevor Whillock                       |                 |                          |
| <b>Report Prepared By:</b> | Trevor Whillock                       |                 |                          |
| <b>Report Reviewed By:</b> | Ben Hewson                            |                 |                          |
| <b>Report Issue Number</b> | <b>Description</b>                    | <b>By</b>       | <b>Report Issue Date</b> |
| R0.0                       | Draft                                 | Trevor Whillock | 16 May 2019              |
| R1.0                       | Initial Release                       | Trevor Whillock | 21 May 2019              |
| R2.0                       | Appendix E Revision- Page Orientation | Trevor Whillock | 28 May 2019              |

## 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>Device Identifier(s):</b>                 | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; padding: 2px;"><b>FCC ID:</b></td> <td style="padding: 2px;"><b>IPH-03559</b></td> </tr> <tr> <td style="padding: 2px;"><b>IC:</b></td> <td style="padding: 2px;"><b>1792A-03559</b></td> </tr> </table> | <b>FCC ID:</b> | <b>IPH-03559</b> | <b>IC:</b> | <b>1792A-03559</b> |
| <b>FCC ID:</b>                               | <b>IPH-03559</b>  |                |                  |            |                    |
| <b>IC:</b>                                   | <b>1792A-03559</b>  |                |                  |            |                    |
| <b>Type of Equipment:</b>                    | Digital Transmission System (DTS) FCC Part 15, RSS 247<br>Low Power Communication Device Transmitter (DXX) FCC Part 15  |                |                  |            |                    |
| <b>Device Model(s) / HVIN:</b>               | A03559  |                |                  |            |                    |
| <b>Device Marketing Name / PMN:</b>          | A03559  |                |                  |            |                    |
| <b>Test Sample Serial No.:</b>               | T/A Sample - Identical Prototype  |                |                  |            |                    |
| <b>Transmit Frequency Range:</b>             | WiFi: 2412 - 2462 MHz<br>BT/BLE/ANT: 2402 - 2480 MHz<br>NFC: 13.56 MHz  |                |                  |            |                    |
| <b>Number of Channels:</b>                   | See Section 8.0   |                |                  |            |                    |
| <b>Manuf. Max. Avg Rated Output Power:</b>   | WiFi 2.4GHz: 802.11b:18.78 dBm Avg./ 802.11g:16.82 dBm Avg.<br>/ 802.11n:16.84 dBm avg.<br>BT:GFSK: 9.75 dBm Avg. / PI/4-DQPSK: 9.62 dBm Avg.<br>BLE: GMSK: 1.33 dBm Avg.<br>ANT: GFSK: 2.36 dBm Avg.   |                |                  |            |                    |
| <b>Modulation:</b>                           | WiFi 802.11b/g/n: DSSS, OFDM, MCS0-7<br>BT: GFSK, PI/4-DQPSK<br>BLE:GMSK<br>ANT:GFSK  |                |                  |            |                    |
| <b>Duty Cycle:</b>                           | WiFi: 100% (Setting 0) / BT:9.52%   |                |                  |            |                    |
| <b>DUT Power Source:</b>                     | 5V USB, Internal Li-ion battery   |                |                  |            |                    |
| <b>Deviation(s) from standard/procedure:</b> | None  |                |                  |            |                    |
| <b>Modification of DUT:</b>                  | None  |                |                  |            |                    |

### 3.0 SCOPE OF EVALUATION

The A03559, FCC ID: IPH-03559 ISEDC ID: 1792A-03559, is a wrist-worn transceiver that is capable of operating in the 2.4GHz WiFi and Bluetooth frequency bands with an additional NFC feature that operates at a fixed frequency of 13.56MHz. 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 IEEE 1528, IEC 62209-2, FCC KDB 865646, 447498, 248227 and RSS 102.

## 4.0 NORMATIVE REFERENCES

| <b>Normative References*</b>  |  |
|---|--|
| ANSI / ISO 17025:2017   | General Requirements for competence of testing and calibration laboratories  |
| FCC CFR Title 47 Part 2<br>Title 47:<br>Part 2.1093:                                | Code of Federal Regulations<br>Telecommunication<br>Radiofrequency Radiation Exposure Evaluation: Portable Devices   |
| Health Canada<br>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<br>RSS-102 Issue 5: | Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)  |
| IEEE International Committee on Electromagnetic Safety<br>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<br>IEC 62209-2 2010                                      | Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 2   |
| FCC KDB<br>KDB 865664 D01v01r04   | SAR Measurement Requirements for 100MHz to 6GHz  |
| FCC KDB<br>KDB 447498 D01v06  | Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies  |
| FCC KDB<br>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>A03559   |  |
| <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<br>Industry Canada RSS-102 Issue 5<br>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 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>May 15th & 16th, 2019   |  |

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.

|   |   |
|---|---|
| <p>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.</p> |  |
|   | <p>Trevor Whillock<br/>Test Lab Engineer<br/>Celltech Labs Inc.</p>                   |
|   | <p>21 May 2019<br/>Date</p>   |

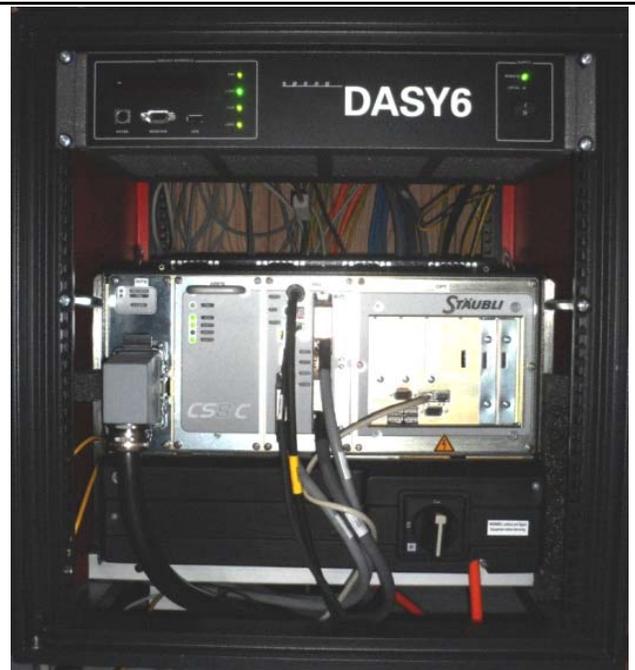
## 6.0 SAR MEASUREMENT SYSTEM

### SAR Measurement System

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



**DASY 6 SAR System with SAM Phantom**



**DASY 6 Measurement Controller**

**7.0 RF CONDUCTED POWER MEASUREMENT**

Table 7.0 Conducted Power Measurements

| Conducted Power Measurements |                 |                      |                   |                 |            |                        |             |            |         |
|------------------------------|-----------------|----------------------|-------------------|-----------------|------------|------------------------|-------------|------------|---------|
| Channel                      | Frequency (MHz) | Measured Power (dBm) | Rated Power (dBm) | Rated Power (W) | Delta (dB) | SAR Test Channel (Y/N) | Mode        | Modulation |         |
| 1                            | 2412            | 18.71                | 18.78             | 0.08            | -0.07      | Y                      | WLAN 2.4G   | DSS-1Mbps  | 802.11b |
| 2                            | 2417            | 18.71                | 18.78             | 0.08            | -0.07      | -                      |             | DSS-1Mbps  |         |
| 3                            | 2422            | 18.71                | 18.78             | 0.08            | -0.07      | -                      |             | DSS-1Mbps  |         |
| 4                            | 2427            | 18.70                | 18.78             | 0.08            | -0.08      | -                      |             | DSS-1Mbps  |         |
| 5                            | 2432            | 18.74                | 18.78             | 0.08            | -0.04      | -                      |             | DSS-1Mbps  |         |
| 6                            | 2437            | 18.78                | 18.78             | 0.08            | 0.00       | Y                      |             | DSS-1Mbps  |         |
| 7                            | 2442            | 18.66                | 18.78             | 0.08            | -0.12      | -                      |             | DSS-1Mbps  |         |
| 8                            | 2447            | 18.66                | 18.78             | 0.08            | -0.12      | -                      |             | DSS-1Mbps  |         |
| 9                            | 2452            | 18.62                | 18.78             | 0.08            | -0.16      | -                      |             | DSS-1Mbps  |         |
| 10                           | 2457            | 18.56                | 18.78             | 0.08            | -0.22      | -                      |             | DSS-1Mbps  |         |
| 11                           | 2462            | 18.60                | 18.78             | 0.08            | -0.18      | Y                      |             | DSS-1Mbps  |         |
| 1                            | 2412            | 18.67                | 18.78             | 0.08            | -0.11      | -                      | DSS-2Mbps   | 802.11g    |         |
|                              |                 | 18.69                | 18.78             | 0.08            | -0.09      | -                      | DSS-5.5Mbps |            |         |
|                              |                 | 18.55                | 18.78             | 0.08            | -0.23      | -                      | DSS-11Mbps  |            |         |
|                              |                 | 13.48                | 16.82             | 0.05            | -3.34      | -                      | OFDM-6Mbps  |            |         |
|                              |                 | 13.58                | 16.82             | 0.05            | -3.24      | -                      | OFDM-54Mbps |            |         |
|                              |                 | 11.59                | 16.84             | 0.05            | -5.25      | -                      | MCS-0       |            | 802.11n |
|                              |                 | 11.67                | 16.84             | 0.05            | -5.17      | -                      | MCS-7       |            |         |
| 6                            | 2437            | 18.78                | 18.78             | 0.08            | 0.00       | -                      | DSS-2Mbps   | 802.11b    |         |
|                              |                 | 18.78                | 18.78             | 0.08            | 0.00       | -                      | DSS-5.5Mbps |            |         |
|                              |                 | 18.65                | 18.78             | 0.08            | -0.13      | -                      | DSS-11Mbps  |            |         |
|                              |                 | 16.82                | 16.82             | 0.05            | 0.00       | -                      | OFDM-6Mbps  |            | 802.11g |
|                              |                 | 16.75                | 16.82             | 0.05            | -0.07      | -                      | OFDM-54Mbps |            |         |
|                              |                 | 16.76                | 16.84             | 0.05            | -0.08      | -                      | MCS-0       |            | 802.11n |
|                              |                 | 16.84                | 16.84             | 0.05            | 0.00       | -                      | MCS-7       |            |         |
| 11                           | 2462            | 18.50                | 18.78             | 0.08            | -0.28      | -                      | DSS-2Mbps   | 802.11b    |         |
|                              |                 | 18.50                | 18.78             | 0.08            | -0.28      | -                      | DSS-5.5Mbps |            |         |
|                              |                 | 18.39                | 18.78             | 0.08            | -0.39      | -                      | DSS-11Mbps  |            |         |
|                              |                 | 13.20                | 16.82             | 0.05            | -3.62      | -                      | OFDM-6Mbps  |            | 802.11g |
|                              |                 | 13.25                | 16.82             | 0.05            | -3.57      | -                      | OFDM-54Mbps |            |         |
|                              |                 | 11.50                | 16.84             | 0.05            | -5.34      | -                      | MCS-0       |            | 802.11n |
|                              |                 | 11.58                | 16.84             | 0.05            | -5.26      | -                      | MCS-7       |            |         |

**Table 7.1 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) | Mode       | Modulation     |
| 2                            | 2402            | 9.75                 | 9.75              | 0.01            | 0.00       | Y                      | BT/BLE/ANT |                |
| 41                           | 2441            | 9.52                 | 9.75              | 0.01            | -0.23      | -                      |            |                |
| 80                           | 2480            | 9.45                 | 9.75              | 0.01            | -0.30      | -                      |            | BT(GFSK)       |
| 2                            | 2402            | 9.62                 | 9.62              | 0.01            | 0.00       | -                      |            | BT(PI/4-DQPSK) |
|                              |                 | 1.33                 | 1.33              | 0.001           | 0.00       | -                      |            | BLE(GMSK)      |
|                              |                 | 2.36                 | 2.36              | 0.002           | 0.00       | -                      |            | ANT(GFSK)      |

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

## 8.0 NUMBER OF TEST CHANNELS ( $N_c$ ) AND CONFIGURATIONS

This device is a wrist-worn device and was evaluated for extremity SAR. Although the intended use is to be wrist-worn with the back side of the device in contact with the human skin, the device was additionally evaluated to the worst case setup configuration leveraged from a previous EU evaluation of the same model series, report reference 45461494 R1.0. The Front side (Screen) of the device was found to be the worst case setup configuration and produced the highest SAR.

### WiFi SAR Evaluation:

SAR was evaluated in DSS mode with a sample rate of 1Mbps at a 100% duty cycle (setting 0). The power level setting selected was specified by the manufacture to be the max output power and produce the most conservative SAR.

As per FCC KDB 24827, the required 802.11 test channels are Ch1, Ch6 and Ch 11. Based on evaluated SAR levels of the highest Middle band frequency or highest output channels; SAR test reduction methodology was applied to reduce the total number of required test channels and exclude Ch 1 and Ch 11 from SAR test evaluation.

When applicable, SAR test reduction methods may be utilized.

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

- When the reported SAR of the highest measured maximum output power channel is  $\leq$  to 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- When the reported SAR is  $>$  0.8 W/kg, SAR is required for that exposure configuration using the next highest output power channel. When any reported SAR is  $>$  1.2 W/Kg, SAR is required for the third channel.

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

Therefore; Ch 1 and Ch 11 was not required for evaluation in any exposure configuration.

### 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

- When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 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 13.1 for details.

**BT/BLE/ANT SAR Test Evaluation:**

Bluetooth was evaluated for SAR at a transmit duty cycle of 9.52% in the worst-case configuration from the WiFi test evaluation. The duty cycle cannot be altered in test mode or by the user. A measurement Crest factor of 10.5 was used by the SAR measurement server. The measured SAR in Table 10.0 is the post-processed SAR adjusted by the Crest Factor.

**General SAR Test Reduction Considerations**

As per KDB 447498D01 4.4.1,

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid band or highest output power channel is:

c)  $\leq 0.4\text{W/kg}$  or  $1.0\text{W/kg}$ , for 1-g or 10-g respectively, when the transmission band is  $\geq 200\text{MHz}$

BLE/ANT was not evaluated for SAR.

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

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

**NFC:**

The RFID transmitter is a low power communication device transmitter and does not require standalone SAR evaluation. Simultaneous transmission evaluation with it and the 802.11b/g/n or BT 802.15 is not required

## 9.0 ACCESSORIES EVALUATED

Table 9.0 Accessories Evaluated

| Manufacturer's Accessory List |                            |                           |                              |                           |
|-------------------------------|----------------------------|---------------------------|------------------------------|---------------------------|
| Test Report ID Number         | Manufacturer's Part Number | Description               | SAR <sup>(3)</sup> Evaluated | SAR <sup>(4)</sup> Tested |
| <b>B1</b>                     | 010-12740-00               | Black Silicone Wrist Band | <b>Y</b>                     | <b>Y</b>                  |
| <b>B2</b>                     | 010-12863-08               | Metal Wrist Band          | <b>Y</b>                     | <b>Y</b>                  |
| <b>P1</b>                     | 362-00087-00               | AC Adapter                | <b>n/a</b>                   | <b>n/a</b>                |
| <b>P2</b>                     | 010-12491-01               | Charging Cable            | <b>n/a</b>                   | <b>n/a</b>                |

## 10.0 SAR MEASUREMENT SUMMARY

Table 10.0: Measured Results

| Measured SAR Results (10g) - BODY(FCC/ISED)    |           |           |            |                                    |            |             |            |                  |                    |                 |              |                            |                               |                   |  |
|--|-----------|-----------|------------|------------------------------------|------------|-------------|------------|------------------|--------------------|-----------------|--------------|----------------------------|-------------------------------|-------------------|--|
| Date   | Plot ID # | DUT Model | Test Type  | Test Freq.<br>(MHz)                | Modulation | Accessories |            |                  |                    | DUT Spacing     |              | Meas. Cond. Power<br>(dBm) | Measured SAR<br>10g<br>(W/kg) | SAR Drift<br>(dB) |  |
|  |           |           |            |                                    |            | Antenna ID  | Battery ID | Body ID          | Audio ID           | DUT (mm)        | Antenna (mm) |                            |                               |                   |  |
|  |           |           |            |                                    |            |             |            |                  |                    |                 |              |                            |                               |                   |  |
| <b>Extremity SAR<br/>WiFi &amp; BT 2.4 GHz</b> |           |           |            |                                    |            |             |            |                  |                    |                 |              |                            |                               |                   |  |
| 15 May 2019                                    | B1        | A03559    | BODY-Back  | 2437                               | DSS-1Mbps  | n/a         | n/a        | B1               | n/a                | 0               | 0            | 18.78                      | 0.200                         | -0.050            |  |
| 16 May 2019                                    | B2        | A03559    | BODY-Back  | 2437                               | DSS-1Mbps  | n/a         | n/a        | B2               | n/a                | 0               | 0            | 18.78                      | 0.223                         | -0.070            |  |
| 16 May 2019                                    | B3        | A03559    | BODY-Front | 2437                               | DSS-1Mbps  | n/a         | n/a        | B2               | n/a                | 0               | 0            | 18.78                      | 0.357                         | -0.450            |  |
| 16 May 2019                                    | B4        | A03559    | BODY-Front | 2402                               | BT-GFSK    | n/a         | n/a        | B2               | n/a                | 0               | 0            | 9.75                       | 0.004                         | 2.900             |  |
| <b>FCC 47 CFR 2.1093</b>                       |           |           |            | <b>Health Canada Safety Code 6</b> |            |             |            | <b>Extremity</b> | <b>10g Average</b> | <b>4.0 W/kg</b> |              | <b>General Population</b>  |                               |                   |  |

Reference Section 8.0 for details

\*Per KDB 248227 D01 5.2.1(a);

Testing of other required test channels is not required when the reported 1-g or 10g SAR for the mid-band or highest output power channel is  $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively.

\*\*Per KDB 447498D01 4.4.1(c)

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid band or highest output power channel is:

$\leq 0.4$ W/kg or 1.0W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$ Mh

## 11.0 SCALING OF MAXIMUM MEASURED SAR

**Table 11.0 SAR Scaling**

| Scaling of Maximum Measured SAR <sup>(1)</sup>    |                           |             |                          |                        |                          |                     |                           |
|---|---------------------------|-------------|--------------------------|------------------------|--------------------------|---------------------|---------------------------|
| Plot ID   | Configuration             | Freq        | Measured Fluid Deviation |                        | Measured Conducted Power | Measured Drift      | Measured SAR (10g)        |
|   |                           | (MHz)       | Permittivity             | Conductivity           | (dBm)                    | (dB)                | (W/kg)                    |
| B3  | BODY-Front Side           | 2437        | -1.31%                   | -1.39%                 | 18.8                     | -0.450              | 0.357                     |
| Step 1  |                           |             |                          |                        |                          |                     |                           |
| Fluid Sensitivity Adjustment                      |                           |             |                          |                        |                          |                     |                           |
| Plot ID   | Scale Factor              |             | x                        | Measured SAR           |                          | =                   | Step 1 Adjusted SAR (10g) |
|   | (%)                       |             |                          | (W/kg)                 | (W/kg)                   |                     |                           |
| B3  | n/a                       |             | x                        | 0.193                  |                          | =                   | 0.357                     |
| Step 2  |                           |             |                          |                        |                          |                     |                           |
| Manufacturer's Tune-Up Tolerance                  |                           |             |                          |                        |                          |                     |                           |
| Plot ID   | Measured Conducted Power  | Rated Power |                          | Delta                  | +                        | Step 1 Adjusted SAR | Step 2 Adjusted SAR (10g) |
|   | (dBm)                     | (dBm)       |                          | (dB)                   |                          | (W/kg)              | (W/kg)                    |
| B3  | 18.8                      | 18.8        |                          | 0.0                    | +                        | 0.357               | 0.357                     |
| Step 3 (ISED)                                     |                           |             |                          |                        |                          |                     |                           |
| Drift Adjustment                                  |                           |             |                          |                        |                          |                     |                           |
| Plot ID   | Measured Drift            |             | +                        | Step 2 Adjusted SAR    |                          | =                   | Step 3 Adjusted SAR (10g) |
|   | (dB)                      |             |                          | (W/kg)                 | (W/kg)                   |                     |                           |
| B3  | -0.450                    |             | +                        | 0.357                  |                          | =                   | 0.396                     |
| Step 4 (FCC)                                      |                           |             |                          |                        |                          |                     |                           |
| Simultaneous Transmission - Bluetooth and/or WiFi |                           |             |                          |                        |                          |                     |                           |
| Plot ID   | Rated Output Power (Pmax) | Freq        | Separation Distance      | Estimated SAR SAR      | +                        | Step 2 Adjusted SAR | Step 4 Adjusted SAR (10g) |
|   | (mW)                      | (MHz)       | (mm)                     | (W/kg)                 |                          | (W/kg)              | (W/kg)                    |
| B3  | n/a                       | n/a         | 0                        | n/a                    | +                        | 0.357               | 0.357                     |
| Step 5  |                           |             |                          |                        |                          |                     |                           |
| Reported SAR                                      |                           |             |                          |                        |                          |                     |                           |
| Plot ID   | FCC                       |             |                          | ISED                   |                          |                     |                           |
|   | From Steps 1 and 2        |             |                          | From Steps 1 through 3 |                          |                     |                           |
|   | 1g SAR (W/kg)             |             |                          | 1g SAR (W/kg)          |                          |                     |                           |
| B3  | 0.357                     |             |                          | 0.396                  |                          |                     |                           |

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

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \times [\sqrt{f(\text{GHz})}] \leq 7.5 \text{ for 10-g SAR}$$

$$[(1.72)/(5)] \times [\sqrt{2.402}] = 0.542 \leq 7.5$$

Where:

max. power of channel, including tune-up tolerance, mW = 1.72mW  
 min. test separation distance, mm = 5mm  
 f(GHz) = 2.402 GHz

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

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

The RFID transmitter is a low power communication device transmitter and does not require standalone SAR evaluation. Simultaneous transmission evaluation with it and the 802.11b/g/n or BT 802.15 is not required

| NOTES to Table 11.0  |   |
|--|---|
| (1) Scaling of the Maximum Measured SAR is based on the highest, 100% duty cycle, Face, Body and/or Head SAR measured of ALL test channels, configurations and accessories used during THIS evaluation. The Measured Fluid Deviation parameters apply only to deviation of the tissue equivalent fluids used at the frequencies which produced the highest measured SAR. The Measured Conducted Power applies to the Conducted Power measured at the frequencies producing the highest Face and Body SAR. The Measured Drift is the SAR drift associated with that specific SAR measurement. The Reported SAR is the accumulation of all SAR Adjustments from the applicable Steps 1 through 4. The Plot ID is for identification of the SAR Measurement Plots in Annex A of this report.<br>NOTE: Some of the scaling factors in Steps 1 through 4 may not apply and are identified by light gray text. |   |
| <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 9.1 will be shown and will indicate the SAR scaling factor in percent (%). SAR is MULTIPLIED by this scaling factor only when the scaling factor is positive (+). |
| <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.  |

|   |   |
|---|---|
| <p>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.</p> | <br><b>Trevor Whillock</b><br><b>Test Lab Engineer</b><br><b>Celltech Labs Inc.</b><br><br><b>21 May 2019</b><br><b>Date</b> |
|---|---|

## 12.0 SAR EXPOSURE LIMITS

Table 12.0 Exposure Limits

| SAR RF EXPOSURE LIMITS   |                             |  |  |
|--|-----------------------------|--|--|
| FCC 47 CFR§2.1093  | Health Canada Safety Code 6 | General Population /<br>Uncontrolled Exposure <sup>(4)</sup> | Occupational /<br>Controlled Exposure <sup>(5)</sup> |
| Spatial Average <sup>(1)</sup><br>(averaged over the whole body)   |                             | 0.08 W/kg  | 0.4 W/kg   |
| Spatial Peak <sup>(2)</sup><br>(Head and Trunk averaged over any 1 g of tissue)  |                             | 1.6 W/kg   | 8.0 W/kg   |
| Spatial Peak <sup>(3)</sup><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

#### 13.0 Day Log

| DAY LOG     |                 |               |                |          |       | Fluid Dielectric | SPC | Test |
|-------------|-----------------|---------------|----------------|----------|-------|------------------|-----|------|
| Date        | Ambient Temp °C | Fluid Temp °C | Pressure (kPa) | Humidity | TSL   |                  |     |      |
| 14 May 2019 | 23              | 23.3          | 101.0          | 29%      | 2450B | X                | X   |      |
| 15 May 2019 | 23              | 22.9          | 101.5          | 27%      | 2450B |                  |     | X *  |
| 16 May 2019 | 23              | 23.1          | 100.4          | 29%      | 2450B |                  |     | **   |

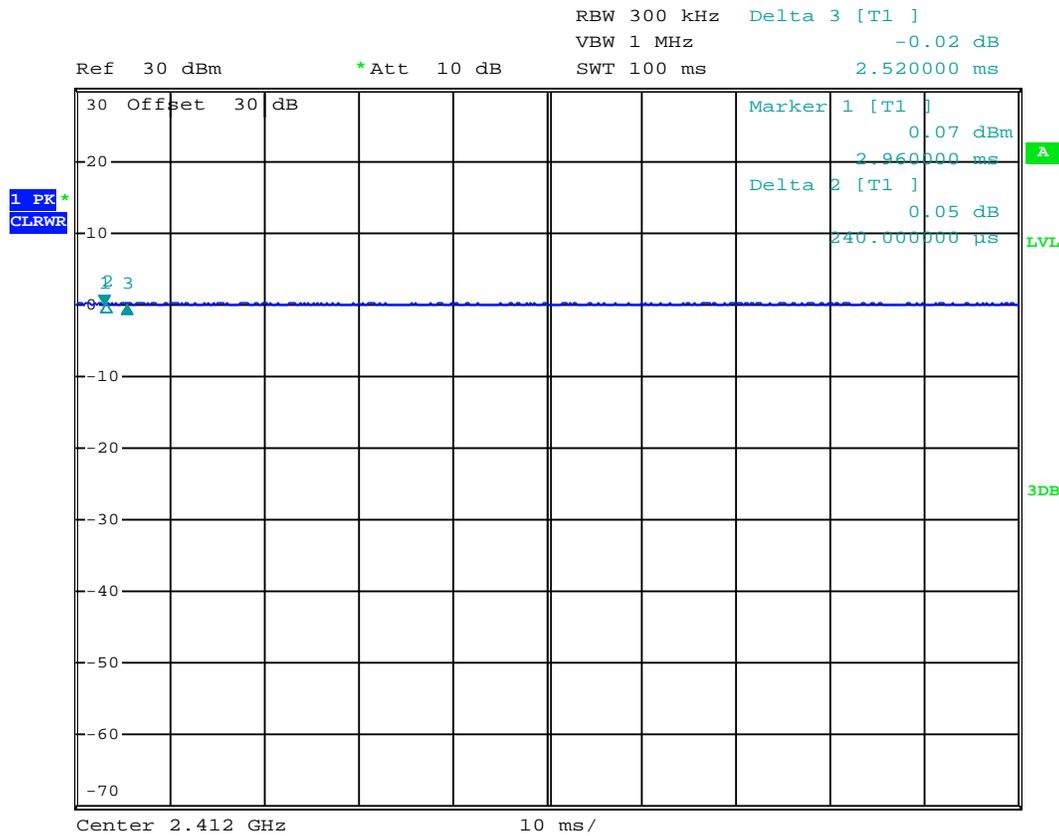
\*Per 1528 Test series was started within 24 hours of Fluid Parameter Measurement

\*\*Per 1528 Test series was completed within a 48 hr period

### 13.1 DUT Setup and Configuration

| DUT Setup and Configuration |  |
|-----------------------------|--|
| 1                           | The DUT was evaluated for SAR in accordance with the procedures described in IEEE 1528, FCC KDB 865646, 248277 and RSS-102. The device was evaluated at a phantom separation distance of 0mm.  |
| 2                           | <p>2.4GHz 802.11g/n OFDM SAR Test Exclusion</p> <p>As Per KDB 248277 D01v02r02 - 5.2.2,<br/>           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 <math>\leq 1.2</math> W/kg.</p> <p>Maximum 802.11g/n OFDM specified power(POFDM)= 16.84 dBm<br/>           Maximum 802.11b DSSS specified power (PDSSS)= 18.78 dBm<br/>           Ratio OFDM/DSSS power = -1.94 dBm(64.0%)<br/>           Highest reported* SAR (SARMAX)= 0.440 W/kg</p> <p><math>POFDM/PDSSS \times SARMAX = .290W/kg \leq 1.2</math> W/kg</p> <p>Since the ratio of the ODFM/DSSS specified power is less than one (0dB), the reported SAR would not exceed 1.2W/kg</p> <p>*The reported SAR in this case is the measured SAR adjusted for fluid sensitivity.</p> |
| 3                           | The Device was capable of transmitting at various modulations, data rates and duty cycles. The Conducted Power was highest when measured in DSS Mode-1Mbps at 100% Duty cycle(setting 0) than any other configuration in the 2.4GHz Band. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer.   |
| 4                           | Bluetooth was evaluated for SAR in GFSK mode with a transmit duty cycle of 9.52% in the worst-case configuration from the WiFi test evaluation. The Duty cycle could not be altered in test mode or by the user. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer.  |
| 5                           | Each SAR evaluation was performed with a fully charged battery.  |

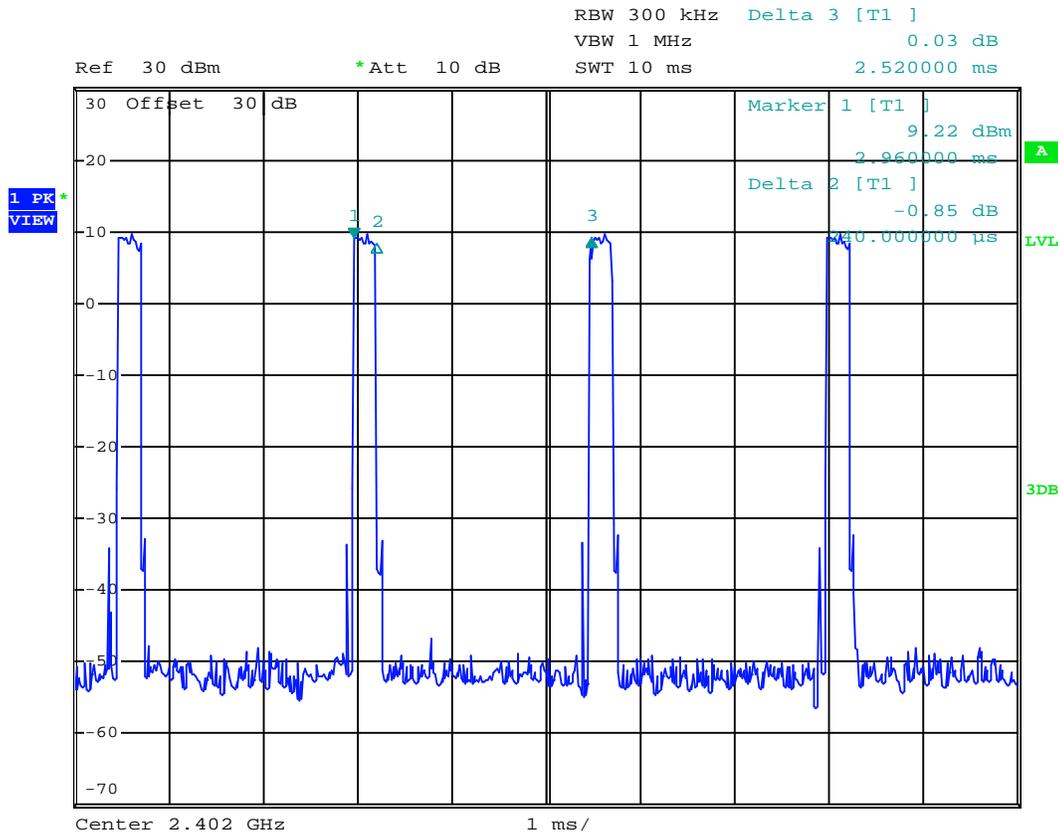
### 13.2 Duty Cycle Evaluation – 2.4GHz WiFi



Date: 16.MAY.2019 11:13:52

DSS mode at 1Mbps was found to be the worst case test mode for 2.4GHZ WiFi. The transmit Duty cycle was 100%, test (Setting 0) as indicated in the above plot. This duty cycle cannot be altered by the user. A measurement Crest factor of 1 was used by the SAR measurement server. The measured SAR in Table 10.0 is the post-processed SAR adjusted by the Crest Factor.

### 13.3 Duty Cycle Evaluation – 2.4GHz Bluetooth



Date: 16.MAY.2019 11:07:39

GFSK mode was found to be the worst case test mode for 2.4GHz Bluetooth. The transmit Duty cycle was 9.52%, as indicated in the above plot. This duty cycle cannot be altered by the user. A measurement Crest factor of 10.5 was used by the SAR measurement server. The measured SAR in Table 10.0 is the post-processed SAR adjusted by the Crest Factor.

### 13.4 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>FACE Configuration</b>      | This device is not intended to be held to the face and was not tested in the FACE configuration.   |
| <b>BODY 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's accessory to the phantom surface. |
| <b>HEAD Configuration</b>      | This device is not intended to be held to the ear and was not tested in the HEAD configuration.  |
| <b>Limb Worn Configuration</b> | The DUT was positioned with the back side directly against the phantom surface with the strap opened to allow direct contact or 0mm of the DUT and watch band to the phantom surface.  |

### 13.5 General Procedures and Report

| General Procedures and Reporting |   |
|----------------------------------|---|
| <b>General Procedures</b>        | <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 <i>Maximum Distance to Phantom Surface</i> to the fluid surface was performed following the power drift measurement.</p> |
| <b>Reporting</b>                 | <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>   |

### 13.6 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 300ml beaker) method. A sample of the TSL is placed in a 300ml beaker and the open-ended coax is submerged approximately 8mm below the fluid surface in the approximate center of the beaker. A check of the setup is made to ensure no air is trapped under the open-ended coax. The sample of TSL is measured and compared to the FCC KDB 865664 targets for HEAD or BODY for the entire fluid measurement range. Fluid adjustment are made if the dielectric parameters are <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 1g and 10g SAR is measured. The measured 1g and 10g SAR is compared to the 1g and 10g SAR measurements from the validation source's Calibration Certificate. When required, the measured SAR is normalized to 1.0W and compared to the normalized SAR indicated on the validation source's Calibration Certificate. The SPC is considered valid when the measured and normalized SAR is <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 84 hours or if the Active TSL temperature has exceed <math>\pm 1^\circ\text{C}</math> of the initial fluid analysis.</p> |

### 13.7 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)  | <b><math>4 \pm 1 \text{ mm}</math></b>   |
| Maximum probe angle normal to phantom surface.<br>(Flat Section ELI Phantom)   | <b><math>5^\circ \pm 1^\circ</math></b>  |
| Area Scan Spatial Resolution $\Delta X, \Delta Y$  | <b>15 mm</b>                             |
| Zoom Scan Spatial Resolution $\Delta X, \Delta Y$  | <b>7.5 mm</b>                            |
| Zoom Scan Spatial Resolution $\Delta Z$<br>(Uniform Grid)  | <b>5 mm</b>                              |
| Zoom Scan Volume X, Y, Z   | <b>30 mm</b>                             |
| Phantom  | <b>ELI</b>                               |
| Fluid Depth  | <b><math>150 \pm 5 \text{ mm}</math></b> |
| 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 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 ΔX, ΔY  | 12 mm      |
| Zoom Scan Spatial Resolution ΔX, ΔY  | 5 mm       |
| Zoom Scan Spatial Resolution ΔZ<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 |            |

### 13.9 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 ΔX, ΔY  | 10 mm      |
| Zoom Scan Spatial Resolution ΔX, ΔY  | 4 mm       |
| Zoom Scan Spatial Resolution ΔZ<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 14.0 Measurement Uncertainty**

| UNCERTAINTY BUDGET FOR DEVICE EVALUATION (IEEE 1528-2013 Table 9)               |                   |          |            |     |                |                |               |                          |                                    |
|---|-------------------|----------|------------|-----|----------------|----------------|---------------|--------------------------|------------------------------------|
| Source of Uncertainty   | IEEE 1528 Section | Toler ±% | Prob Dist  | Div | c <sub>i</sub> | c <sub>i</sub> | Stand Unct ±% | Stand Unct ±%            | V <sub>i</sub> or 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                                 |
| <b>Effective Degrees of Freedom<sup>(1)</sup></b>                               |                   |          |            |     |                |                |               | <b>V<sub>eff</sub> =</b> | <b>1141</b>                        |
| <b>Combined Standard Uncertainty</b>  |                   |          | <b>RSS</b> |     |                |                | <b>11.1</b>   | <b>11.0</b>              |                                    |
| <b>Expanded Uncertainty (95% Confidence Interval)</b>                           |                   |          | <b>k=2</b> |     |                |                | <b>22.2</b>   | <b>21.9</b>              |                                    |
| <b>Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003</b> |                   |          |            |     |                |                |               |                          |                                    |

(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 14.1 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 15.0 Fluid Dielectric Parameters 2450MHz BODY TSL**

```

*****
Aprel Laboratory
Test Result for UIM Dielectric Parameter
Tue 14/May/2019 15:18:05
Freq      Frequency(GHz)
FCC_eH FCC Bulletin 65 Supplement C ( June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
*****

```

| Freq   | FCC_eB | FCC_sB | Test_e | Test_s |
|--------|--------|--------|--------|--------|
| 2.3500 | 52.83  | 1.85   | 52.69  | 1.81   |
| 2.3600 | 52.82  | 1.86   | 52.32  | 1.84   |
| 2.3700 | 52.81  | 1.87   | 52.51  | 1.83   |
| 2.3800 | 52.79  | 1.88   | 52.36  | 1.83   |
| 2.3900 | 52.78  | 1.89   | 52.23  | 1.86   |
| 2.4000 | 52.77  | 1.90   | 52.36  | 1.87   |
| 2.4100 | 52.75  | 1.91   | 52.22  | 1.86   |
| 2.4200 | 52.74  | 1.92   | 52.29  | 1.87   |
| 2.4300 | 52.73  | 1.93   | 52.14  | 1.91   |
| 2.4400 | 52.71  | 1.94   | 51.98  | 1.91   |
| 2.4500 | 52.70  | 1.95   | 51.99  | 1.95   |
| 2.4600 | 52.69  | 1.96   | 51.90  | 1.96   |
| 2.4700 | 52.67  | 1.98   | 52.06  | 1.96   |
| 2.4800 | 52.66  | 1.99   | 52.21  | 1.98   |
| 2.4900 | 52.65  | 2.01   | 52.08  | 1.99   |
| 2.5000 | 52.64  | 2.02   | 51.80  | 2.03   |
| 2.5100 | 52.62  | 2.04   | 52.03  | 2.02   |
| 2.5200 | 52.61  | 2.05   | 51.82  | 2.03   |
| 2.5300 | 52.60  | 2.06   | 51.87  | 2.05   |
| 2.5400 | 52.59  | 2.08   | 51.55  | 2.06   |
| 2.5500 | 52.57  | 2.09   | 51.57  | 2.06   |

### FLUID DIELECTRIC PARAMETERS

| Date:      | 14 May 2019 | Fluid Temp: | 23.3     | Frequency: | 2450MHz                | Tissue:                | Body   |
|------------|-------------|-------------|----------|------------|------------------------|------------------------|--------|
| Freq (MHz) | Test_e      | Test_s      | Target_e | Target_s   | Deviation Permittivity | Deviation Conductivity |        |
| 2350.0000  |             | 52.6900     | 1.8100   | 52.8300    | 1.85                   | -0.27%                 | -2.16% |
| 2360.0000  |             | 52.3200     | 1.8400   | 52.8200    | 1.86                   | -0.95%                 | -1.08% |
| 2370.0000  |             | 52.5100     | 1.8300   | 52.8100    | 1.87                   | -0.57%                 | -2.14% |
| 2380.0000  |             | 52.3600     | 1.8300   | 52.7900    | 1.88                   | -0.81%                 | -2.66% |
| 2390.0000  |             | 52.2300     | 1.8600   | 52.7800    | 1.89                   | -1.04%                 | -1.59% |
| 2400.0000  |             | 52.3600     | 1.8700   | 52.7700    | 1.90                   | -0.78%                 | -1.58% |
| 2402.0000  | *           | 52.3320     | 1.8680   | 52.7660    | 1.90                   | -0.82%                 | -1.79% |
| 2410.0000  |             | 52.2200     | 1.8600   | 52.7500    | 1.91                   | -1.00%                 | -2.62% |
| 2412.0000  | *           | 52.2340     | 1.8620   | 52.7480    | 1.91                   | -0.97%                 | -2.62% |
| 2420.0000  |             | 52.2900     | 1.8700   | 52.7400    | 1.92                   | -0.85%                 | -2.60% |
| 2430.0000  |             | 52.1400     | 1.9100   | 52.7300    | 1.93                   | -1.12%                 | -1.04% |
| 2437.0000  | *           | 52.0280     | 1.9100   | 52.7160    | 1.94                   | -1.31%                 | -1.39% |
| 2440.0000  |             | 51.9800     | 1.9100   | 52.7100    | 1.94                   | -1.38%                 | -1.55% |
| 2450.0000  |             | 51.9900     | 1.9500   | 52.7000    | 1.95                   | -1.35%                 | 0.00%  |
| 2460.0000  |             | 51.9000     | 1.9600   | 52.6900    | 1.96                   | -1.50%                 | 0.00%  |
| 2462.0000  | *           | 51.9320     | 1.9600   | 52.6860    | 1.96                   | -1.43%                 | -0.20% |
| 2470.0000  |             | 52.0600     | 1.9600   | 52.6700    | 1.98                   | -1.16%                 | -1.01% |
| 2472.0000  | *           | 52.0900     | 1.9640   | 52.6680    | 1.98                   | -1.10%                 | -0.91% |
| 2480.0000  |             | 52.2100     | 1.9800   | 52.6600    | 1.99                   | -0.85%                 | -0.50% |
| 2490.0000  |             | 52.0800     | 1.9900   | 52.6500    | 2.01                   | -1.08%                 | -1.00% |
| 2500.0000  |             | 51.8000     | 2.0300   | 52.6400    | 2.02                   | -1.60%                 | 0.50%  |
| 2510.0000  |             | 52.0300     | 2.0200   | 52.6200    | 2.04                   | -1.12%                 | -0.98% |
| 2520.0000  |             | 51.8200     | 2.0300   | 52.6100    | 2.05                   | -1.50%                 | -0.98% |
| 2530.0000  |             | 51.8700     | 2.0500   | 52.6000    | 2.06                   | -1.39%                 | -0.49% |
| 2540.0000  |             | 51.5500     | 2.0600   | 52.5900    | 2.08                   | -1.98%                 | -0.96% |
| 2550.0000  |             | 51.5700     | 2.0600   | 52.5700    | 2.09                   | -1.90%                 | -1.44% |

\*Channel Frequency Tested

## 16.0 SYSTEM VERIFICATION TEST RESULTS

**Table 16.0 System Verification Results 2450MHz BODY TSL**

| <b>System Verification Test Results</b>  |                  |                    |                         |                       |                        |
|--|------------------|--------------------|-------------------------|-----------------------|------------------------|
| Date   |                  | Frequency<br>(MHz) | Validation Source       |                       |                        |
|  |                  |                    | P/N                     | S/N                   |                        |
| 14 May 2019  |                  | 2450               | D2450V2                 | 825                   |                        |
| Fluid Type   | Fluid Temp<br>°C | Ambient Temp<br>°C | Ambient Humidity<br>(%) | Forward Power<br>(mW) | Source Spacing<br>(mm) |
| Body   | 23.3             | 23                 | 29%                     | 250                   | 10                     |
| Fluid Parameters   |                  |                    |                         |                       |                        |
| Permittivity   |                  |                    | Conductivity            |                       |                        |
| Measured   | Target           | Deviation          | Measured                | Target                | Deviation              |
| 51.99  | 52.70            | -1.35%             | 1.95                    | 1.95                  | 0.00%                  |
| Measured SAR   |                  |                    |                         |                       |                        |
| 1 gram   |                  |                    | 10 gram                 |                       |                        |
| Measured   | Target           | Deviation          | Measured                | Target                | Deviation              |
| 12.40  | 12.80            | -3.13%             | 5.73                    | 6.05                  | -5.29%                 |
| Measured SAR Normalized to 1.0W  |                  |                    |                         |                       |                        |
| 1 gram   |                  |                    | 10 gram                 |                       |                        |
| Normalized   | Target           | Deviation          | Normalized              | Target                | Deviation              |
| 49.60  | 50.70            | -2.17%             | 22.92                   | 23.80                 | -3.70%                 |
| <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 17.0 System Validation Summary

| System Validation Summary |                 |             |           |                   |            |        |                    |              |                    |           |          |
|---------------------------|-----------------|-------------|-----------|-------------------|------------|--------|--------------------|--------------|--------------------|-----------|----------|
| Frequency (MHz)           | Validation Date | Probe Model | Probe S/N | Validation Source | Source S/N | Tissue | Tissue Dielectrics |              | Validation Results |           |          |
|                           |                 |             |           |                   |            |        | Permittivity       | Conductivity | Sensitivity        | Linearity | Isotropy |
| 30                        | 24-Sep-18       | EX3DV4      | 3600      | CLA-30            | 1005       | Head   | 50.15              | 0.72         | Pass               | Pass      | Pass     |
| 150                       | 27-Jun-18       | EX3DV4      | 3600      | CLA-150           | 4007       | Body   | 66.48              | 0.79         | Pass               | Pass      | Pass     |
| 150                       | 11-Jul-18       | EX3DV4      | 3600      | CLA-150           | 4007       | Head   | 51.51              | 0.81         | Pass               | Pass      | Pass     |
| 450                       | 08-May-17       | EX3DV4      | 3600      | D450V3            | 1068       | Body   | 54.65              | 0.95         | Pass               | Pass      | Pass     |
| 450                       | 16-May-17       | EX3DV4      | 3600      | D450V3            | 1068       | Head   | 43.70              | 0.83         | Pass               | Pass      | Pass     |
| 835                       | 03-May-18       | EX3DV4      | 3600      | D835V2            | 4d075      | Body   | 53.31              | 1.00         | Pass               | Pass      | Pass     |
| 835                       | 19-May-17       | EX3DV4      | 3600      | D835V2            | 4d075      | Head   | 42.01              | 0.89         | Pass               | Pass      | Pass     |
| 900                       | 08-May-18       | EX3DV4      | 3600      | D900V2            | 045        | Body   | 54.46              | 1.10         | Pass               | Pass      | Pass     |
| 900                       | 02-Aug-17       | EX3DV4      | 3600      | D900V2            | 045        | Head   | 39.10              | 0.93         | Pass               | Pass      | Pass     |
| 1640                      | 06-May-18       | EX3DV4      | 3600      | 1620-S-2          | 207-00102  | Body   | 39.87              | 1.27         | Pass               | Pass      | Pass     |
| 1640                      | 07-May-18       | EX3DV4      | 3600      | 1620-S-2          | 207-00102  | Head   | 39.87              | 1.27         | Pass               | Pass      | Pass     |
| 1800                      | 21-Jul-17       | EX3DV4      | 3600      | D1800V2           | 247        | Body   | 54.77              | 1.53         | Pass               | Pass      | Pass     |
| 1800                      | 18-Jul-17       | EX3DV4      | 3600      | D1800V2           | 247        | Head   | 40.70              | 1.33         | Pass               | Pass      | Pass     |
| 2450                      | 05-Apr-19       | EX3DV4      | 3600      | D2450V2           | 825        | Body   | 51.55              | 1.90         | Pass               | Pass      | Pass     |
| 2450                      | 02-Apr-19       | EX3DV4      | 3600      | D2450V2           | 825        | Head   | 36.58              | 1.85         | Pass               | Pass      | Pass     |
| 5250                      | 24-Jul-18       | EX3DV4      | 3600      | D5GHzV2           | 1031       | Body   | 46.42              | 5.69         | Pass               | Pass      | Pass     |
| 5250                      | 24-Jul-18       | EX3DV4      | 3600      | D5GHzV2           | 1031       | Head   | 35.96              | 4.99         | Pass               | Pass      | Pass     |
| 5750                      | 25-Jul-18       | EX3DV4      | 3600      | D5GHzV2           | 1031       | Body   | 47.10              | 5.60         | Pass               | Pass      | Pass     |

## 18.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 18.0 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<br>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  | SAM 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 SAM 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>SAM 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 19.0 Equipment List and Calibration**

| Test Equipment List                         |           |            |                 |                 |
|---|-----------|------------|-----------------|-----------------|
| DESCRIPTION                                 | ASSET NO. | SERIAL NO. | DATE CALIBRATED | CALIBRATION DUE |
| Schmid & Partner DASY 6 System              | -         | -          | -               | -               |
| -DASY Measurement Server                    | 00158     | 1078       | CNR             | CNR             |
| -Robot                                      | 00046     | 599396-01  | CNR             | CNR             |
| -DAE4                                       | 00019     | 353        | 19-Mar-19       | 19-Mar-20       |
| -EX3DV4 E-Field Probe                       | 00213     | 3600       | 26-Mar-19       | 26-Mar-20       |
| -CLA 30 Validation Dipole                   | 00300     | 1005       | 23-Nov-17       | 23-Nov-20       |
| -CLA 150 Validation Dipole                  | 00251     | 4007       | 27-Apr-17       | 27-Apr-20       |
| -D450V3 Validation Dipole                   | 00221     | 1068       | 23-Apr-18       | 23-Apr-21       |
| -D750V3 Validation Dipole                   | 00238     | 1061       | 19-Mar-19       | 19-Mar-22       |
| -D835V2 Validation Dipole                   | 00217     | 4D075      | 20-Apr-18       | 20-Apr-21       |
| -D900V2 Validation Dipole                   | 00020     | 54         | 24-Apr-17       | 24-Apr-20       |
| -D1640/1620-S-2 Validation Dipole           | 00299     | 207-00102  | 07-Nov-17       | 07-Nov-20       |
| -D2450V2 Validation Dipole*                 | 00219     | 825        | 24-Apr-18       | 24-Apr-21       |
| -D5GHzV2 Validation Dipole                  | 00126     | 1031       | 26-Apr-18       | 26-Apr-21       |
| ELI Phantom                                 | 00247     | -          | 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             | 00248     | 1833687    | 26-Mar-19       | 26-Mar-22       |
| Gigatronics 80334A Power Sensor             | 00237     | 1837001    | 26-Mar-19       | 26-Mar-22       |
| HP 8753ET Network Analyzer                  | 00134     | US39170292 | 29-Dec-17       | 29-Dec-20       |
| Rohde & Schwarz SMR20 Signal Generator      | 00006     | 100104     | 29-May-17       | 29-May-20       |
| 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             |
| Traceable VWR Thermometer                   | 00291     | -          | 19-Nov-16       | 19-Nov-19       |
| Traceable VWR Jumbo Humidity/Thermometer    | 00295     | 170120555  | 17-Feb-17       | 17-Feb-20       |
| DC-18G 10W 30db Attenuator                  | 00102     | -          | COU             | COU             |
| R&S FSP40 Spectrum Analyzer                 | 00241     | 100500     | 15-May-18       | 15-May-21       |
| RF Cable-SMA                                | 00311     | -          | CNR             | CNR             |
| HP Calibration Kit                          | 00145     | -          | 10-Feb-17       | 10-Feb-20       |

CNR = Calibration Not Required

SB=Stand By

COU = Calibrate on Use

\* Per KDB 865664 3.2.2; Supporting documentation is included in the report for validation dipoles exceeding the recommended annual calibration cycle.

When applicable, reference Appendix F

## 20.0 FLUID COMPOSITION

Table 20.0 Fluid Composition 2450MHz BODY TSL

| Tissue Simulating Liquid (TSL) Composition |        |                     |                    |                             |
|--|--------|---------------------|--------------------|-----------------------------|
| Component by Percent Weight                |        |                     |                    |                             |
| Water                                      | Glycol | Salt <sup>(1)</sup> | HEC <sup>(2)</sup> | Bacteriacide <sup>(3)</sup> |
| 69.98                                      | 30.0   | 0.02                | 0.0                | 0.0                         |

(1) Non-Iodized

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

(3) Dow Chemical Dowicil 75 Antimicrobial Preservative

## APPENDIX A – SYSTEM VERIFICATION PLOTS

Date/Time: 5/14/2019 4:19:12 PM

Test Laboratory: Celltech Labs

**SPC-2450B May 14 2019**

**DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:825**

Communication System: UID 0, CW (0); Communication System Band: FullSpan (0.0 - 6000.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1

Medium: TSL\_2450B[14MY19]

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.95$  S/m;  $\epsilon_r = 51.99$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

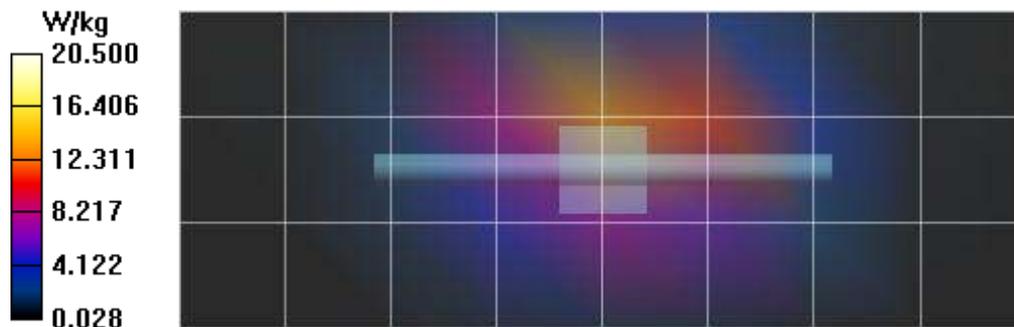
- Probe: EX3DV4 - SN3600; ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019, ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019, ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019;
  - Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection),  $z = -1.5, 31.0, 151.0$
- Electronics: DAE4 Sn353; Calibrated: 3/19/2019
- Phantom: Twin-SAM V4.0 (30deg probe tilt); Type: QD 000 P40 CC;
- DASYS5 52.10.1(1476);

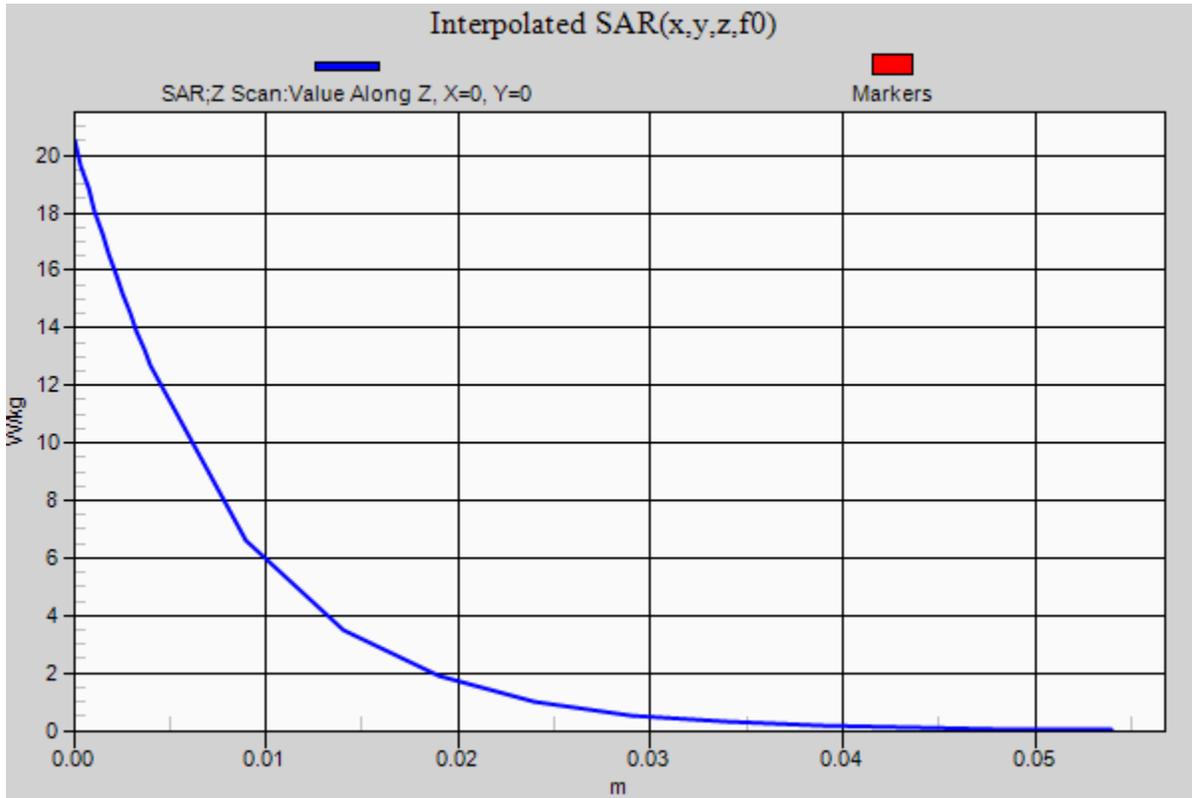
**Frequency: 2450 MHz**

**SPC/SPC 2450B Input=250mW, Target=12.8W/kg/Area Scan (4x9x1):** Measurement grid: dx=12mm, dy=12mm  
Maximum value of SAR (measured) = 13.2 W/kg

**SPC/SPC 2450B Input=250mW, Target=12.8W/kg/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 80.77 V/m; Power Drift = 0.04 dB  
Peak SAR (extrapolated) = 25.4 W/kg  
**SAR(1 g) = 12.4 W/kg; SAR(10 g) = 5.73 W/kg**  
Maximum value of SAR (measured) = 14.2 W/kg

**SPC/SPC 2450B Input=250mW, Target=12.8W/kg/Z Scan (1x1x22):** Measurement grid: dx=20mm, dy=20mm, dz=5mm  
Penetration depth = 7.921 (7.673, 8.024) [mm]  
Maximum value of SAR (interpolated) = 20.5 W/kg





## APPENDIX B – MEASUREMENT PLOTS OF MAXIMUM MEASURED SAR

### Plot B3

Date/Time: 5/16/2019 8:32:07 AM

Test Laboratory: Celltech Labs

**Garmin A03559-2450B May 16 2019**

**DUT: A03559; Type: Wrist-Worn Transmitter;**

Communication System: UID 10012 - CAB, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2437 MHz; Communication System PAR: 1.87 dB; PMF: 1.04833

Medium: TSL\_2450B[14MY19]

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.91$  S/m;  $\epsilon_r = 52.028$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019, ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019, ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019;
  - Modulation Compensation: PMR for UID 10012 - CAB, Calibrated: 3/26/2019
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection),  $z = -1.5, 31.0, 151.0$
- Electronics: DAE4 Sn353; Calibrated: 3/19/2019
- Phantom: Twin-SAM V4.0 (30deg probe tilt); Type: QD 000 P40 CC;
- DASYS 52.10.1(1476);

**Frequency: 2437 MHz**

**2450B/B3 A03559, Body-Front, 2437 MHz, Metal Band-WIFI/Area Scan (8x8x1):** Measurement grid: dx=12mm, dy=12mm

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

Maximum value of SAR (measured) = 0.776 W/kg

**2450B/B3 A03559, Body-Front, 2437 MHz, Metal Band-WIFI/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.55 V/m; Power Drift = -0.45 dB

Peak SAR (extrapolated) = 1.54 W/kg

**SAR(1 g) = 0.792 W/kg; SAR(10 g) = 0.357 W/kg**

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

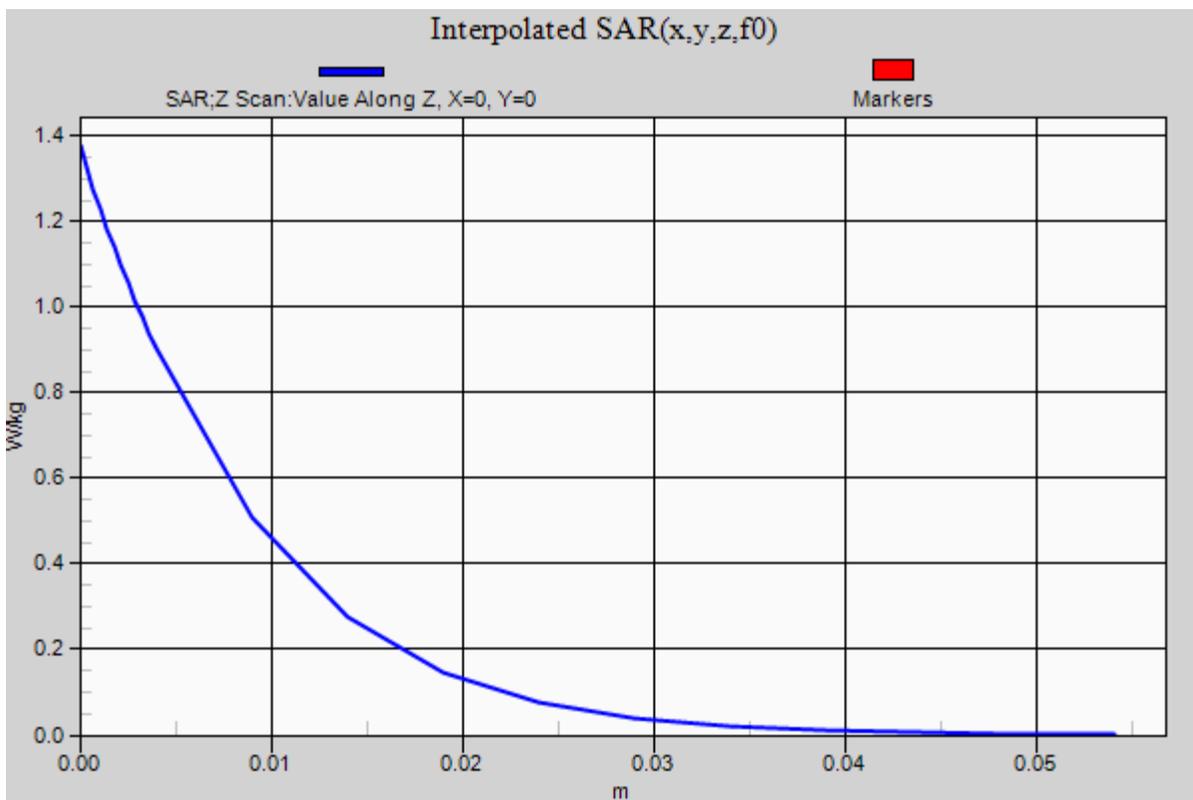
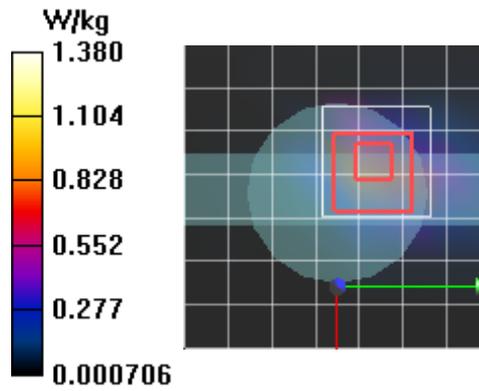
Maximum value of SAR (measured) = 0.937 W/kg

**2450B/B3 A03559, Body-Front, 2437 MHz, Metal Band-WIFI/Z Scan (1x1x22):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

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

Penetration depth = 8.255 (8.763, 7.941) [mm]

Maximum value of SAR (interpolated) = 1.38 W/kg



**Plot B4**

Date/Time: 5/16/2019 10:16:02 AM

Test Laboratory: Celltech Labs

**Garmin A03559-2450B May 16 2019**

**DUT: A03559; Type: Wrist-Worn Transmitter;**

Communication System: UID 10030 - CAA, IEEE 802.15.1 Bluetooth (GFSK, DH1); Communication System Band: ISM 2.4 GHz Band (2400.0 - 2483.5 MHz); Frequency: 2402 MHz; Communication System PAR: 5.3 dB; PMF: 1.83865

Medium: TSL\_2450B[14MY19]

Medium parameters used (interpolated):  $f = 2402$  MHz;  $\sigma = 1.868$  S/m;  $\epsilon_r = 52.332$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019, ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019, ConvF(6.49, 6.49, 6.49); Calibrated: 3/26/2019;
  - Modulation Compensation: PMR for UID 10030 - CAA, Calibrated: 3/26/2019
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection),  $z = -1.5, 31.0, 151.0$
- Electronics: DAE4 Sn353; Calibrated: 3/19/2019
- Phantom: Twin-SAM V4.0 (30deg probe tilt); Type: QD 000 P40 CC;
- DASYS2 52.10.1(1476);

**Frequency: 2402 MHz**

**2450B/B4 A03559, Body-Front, 2402 MHz, Metal Band-BT/Area Scan (8x8x1):** Measurement grid: dx=12mm, dy=12mm

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

Maximum value of SAR (measured) = 0.0134 W/kg

**2450B/B4 A03559, Body-Front, 2402 MHz, Metal Band-BT/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.694 V/m; Power Drift = 2.90 dB

Peak SAR (extrapolated) = 0.0200 W/kg

**SAR(1 g) = 0.010 W/kg; SAR(10 g) = 0.00387 W/kg**

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

Maximum value of SAR (measured) = 0.0123 W/kg

**2450B/B4 A03559, Body-Front, 2402 MHz, Metal Band-BT/Z Scan (1x1x22):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

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

Penetration depth = 6.875 (7.962, 4.237) [mm]

Maximum value of SAR (interpolated) = 0.0212 W/kg

