| | |
|---|---|
| Test Report Serial Number: | 45461376-R1.1 |
| Test Report Date: | 17 March 2017 |
| Project Number: | 1367 |

# SAR Test Report - New Certification

Applicant:

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

| Maximum Reported 10g SAR | | | |
|---|---|---|---|
| FCC | Hand | 0.078 | W/kg |
| ISED | Hand | 0.083 | |
| General Pop. Limit: | | 4.00 | |

FCC ID: **IPH-A3119-00**

Product Model Number / HVIN: **012-03119-00**

ISED Registration Number: **1792A-A311900**

Product Name / PMN: **Fenix 5**

In Accordance With:

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

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

Approved By:

**Ben Hewson, President**
Celltech Labs Inc.
21-364 Lougheed Rd.
Kelowna, BC, V1X 7R8
Canada

Test Lab Certificate: 2470.01

IC Registration 3874A-1

FCC Registration: 714830

## Table of Contents



## 1.0 DOCUMENT CONTROL

| | |
|---|---|
| **Tested By:** | **Jasmeet Gill** |
| **Prepared By:** | **Jasmeet Gill** |
| **Reviewed By:** | **Ben Hewson** |

| Issue Number | Description | By | Issue Date |
|---|---|---|---|
| 1.0 | Initial Release | Jasmeet Gill | 08 March 2017 |
| 1.1 | Metal Band Evaluation Added | Jasmeet Gill | 17 March 2017 |

## 2.0 NORMATIVE REFERENCES

| Normative References* | |
|---|---|
| ANSI / ISO 17025:2005 | 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 Guidane for IEEE 802.11 (WiFI) Transmitters |
| * When the issue number or issue date is omitted, the latest version is assumed. | |

## 3.0 CLIENT AND DEVICE INFORMATION

| Client Information | |
|---|---|
| **Applicant Name** | Garmin International Inc. |
| **Applicant Address** | 1200 East 151 St |
| | Olathe, KS, 66062 |
| | USA |
| **DUT Information** | |
| **Device Identifier(s):** | **FCC ID:** IPH-A3119-00 |
| | **ISED:** 1792A-A311900 |
| **Type of Equipment:** | Wireless Wrist-Worn GPS Device |
| **Device Model(s) / HVIN:** | Fenix 5 |
| **Device Marketing Name / PMN:** | Fenix 5 |
| **Test Sample Serial No.:** | T/A Sample - Identical Prototype |
| **Transmit Frequency Range:** | BLE: 2402-2480 MHz |
| | WiFi: 2412-2462 MHz |
| **Number of Channels:** | n/a |
| **Manuf. Max. Rated Output Power:** | BLE/ANT: 4dBm, WiFi: 23.5dBm |
| **Modulation:** | DSSS, OFDM, GFSK, CW |
| **Duty Cycle:** | 100% |
| **DUT Power Source:** | 5V USB, Internal Li-ion battery |
| **Deviation(s) from standard/procedure:** | None |
| **Modification of DUT:** | None |

## 4.0 STATEMENT OF COMPLIANCE

This measurement report demonstrates that the:

| Applicant: | Model / HVIN: |
|---|---|
| **Garmin International Inc.** | **012-03119-00** |

complies with the SAR (Specific Absorption Rate) RF exposure requirements and limits specified in the following:

| Standard(s): | Measurement Procedure(s): |
|---|---|
| **FCC 47 CFR §2.1093** | **FCC KDB 865664, FCC KDB 447498, FCC KDB 643646** |
| **Health Canada's Safety Code 6** | **Industry Canada RSS-102 Issue 5** |
| | **IEEE Standard 1528-2013, IEC 62209-2** |

Use Group:

☐ **Occupational / Controlled** ☒ **General Population / Uncontrolled**

Reason for Issue:

**New Certification**

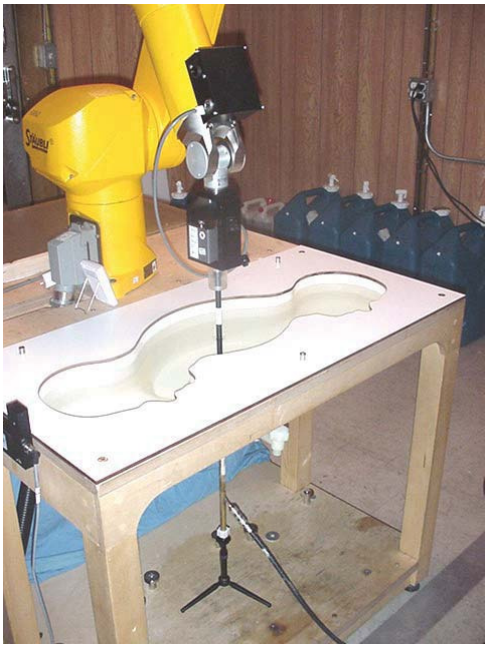
A description of the device, operating configuration, detailed summary of the test results, methodology and procedures used during this evaluation, equipment used and the various provisions of the rules are included within this test report.

## 5.0 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 DASY4 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 DASY4 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 DASY4 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 4 SAR System with SAM Phantom


DASY 4 Measurement Controller

## 6.0 RF CONDUCTED POWER MEASUREMENT

Table 6.0

**Conducted Power Measurements**

| Channel | Frequency (MHz) | Measured Power (dBm) | Rated Power (dBm) | Rated Power (W) | Delta (dBm) | SAR Test Channel (Y/N) |
|---|---|---|---|---|---|---|
| 1 | 2412 | 23.08 | 23.50 | 0.22 | -0.42 | Y |
| 6 | 2437 | 22.83 | 23.50 | 0.21 | -0.67 | Y |
| 11 | 2462 | 22.64 | 23.50 | 0.22 | -0.86 | Y |

**Notes:**

The Conducted Power of the DUT was measured at the antenna port, the unit was tested at 100% duty cycle transmit.

## 7.0 NUMBER OF TEST CHANNELS ($N_C$)

As per FCC KDB 248277, the required 802.11 test channels are Ch1, Ch6 and Ch 11

NOTE: These transmitters are not capable of simultaneous transmission. The 802.15 is rated at 4dBm and is below the threshold for standalone SAR evaluation.

## 8.0 ACCESSORIES EVALUATED

Table 8.0

**Manufacturer's Accessory List**

| Test Report ID Number | Manufacturer's Par Number | Description | UDC Group[1] | Type II Group[2] | SAR[3] Evaluated | SAR[4] Tested |
|---|---|---|---|---|---|---|
| T1 | 320-01D69-00 | Ca-Assy. Universal Charger | n/a | n/a | N | N |
| B1 | 013-00649-00 | Metal Watch Band,SUS,Kestrel | n/a | n/a | Y | Y |

# 9.0 SAR MEASUREMENT SUMMARY

**Table 9.0**

| 2450 Band Wifi - Fenix 5 BODY SAR Evaluation Results (FCC/IC) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Model | | Plot # | Freq | Accessories | | DUT Spacing | | Measured SAR 10g (W/kg) | SAR Drift |
| | M/N | Type | | | | | DUT | ANT | Duty Cycle | |
| | | | | (MHz) | Body | Audio | (mm) | (mm) | 100% | (dB) |
| 28 Feb 2017 | 5 | Fenix | B1 | 2412 | n/a | n/a | 0 | 0 | 0.038 | -0.414 |
| 28 Feb 2017 | 5 | Fenix | B2 | 2437 | n/a | n/a | 0 | 0 | 0.050 | -0.297 |
| 01 Mar 2017 | 5 | Fenix | B3 | 2462 | n/a | n/a | 0 | 0 | 0.063 | -0.293 |
| SAR LIMIT(S) | | | | | Body | | Spatial Peak | | RF Exposure Category | |
| FCC 47 CFR 2.1093 | | Health Canada Safety Code 6 | | | 4.0 W/kg | | 10g average | | General Population | |

**Table 9.1**

| 2450 Band Wifi- Fenix 5 w/ Metal Band BODY SAR Evaluation Results (FCC/IC) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Model | | Plot # | Freq | Accessories | | DUT Spacing | | Measured SAR 10g (W/kg) | SAR Drift |
| | M/N | Type | | | | | DUT | ANT | Duty Cycle | |
| | | | | (MHz) | Body | Audio | (mm) | (mm) | 100% | (dB) |
| 16 Mar 2017 | 5 | Fenix | B4 | 2412 | B1 | n/a | 0 | 0 | 0.034 | -0.190 |
| 16 Mar 2017 | 5 | Fenix | B5 | 2437 | B1 | n/a | 0 | 0 | 0.051 | -0.080 |
| 16 Mar 2017 | 5 | Fenix | B6 | 2462 | B1 | n/a | 0 | 0 | 0.052 | -0.251 |
| SAR LIMIT(S) | | | | | Body | | Spatial Peak | | RF Exposure Category | |
| FCC 47 CFR 2.1093 | | Health Canada Safety Code 6 | | | 4.0 W/kg | | 10g average | | General Population | |

# 10.0 SCALING OF MAXIMUM MEASURE SAR

Table 10.0

## Scaling of Maximum Measured SAR (1)

| Plot ID | Configuration | Freq (MHz) | Measured Fluid Deviation Permittivity | Measured Fluid Deviation Conductivity | Measured Conducted Power (dBm) | Measured Drift (dB) | Measured SAR (10g) (W/kg) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| B3 | Body | 2462 | -1.83% | 7.51% | 22.6 | -0.293 | 0.063 |

**Step 1**

Fluid Sensitivity Adjustment

| Plot ID | Scale Factor (%) | | Measured SAR (W/kg) | | Step 1 Adjusted SAR (10g) (W/kg) |
|---|---|---|---|---|---|
| | 1.000% | x | | = | 0.000 |
| B3 | 2.220% | x | 0.063 | = | 0.064 |

**Step 2**

Manufacturer's Tune-Up Tolerance

| Plot ID | Measured Conducted Power (dBm) | Rated Power (dBm) | Delta (dB) | | Step 1 Adjusted SAR (W/kg) | | Step 2 Adjusted SAR (10g) (W/kg) |
|---|---|---|---|---|---|---|---|
| | | | | + | 0.000 | = | 0.000 |
| B3 | 22.6 | 23.5 | -0.86 | + | 0.064 | = | 0.078 |

**Step 3**

Simultaneous Transmission - Bluetooth and/or WiFi

| Plot ID | Rated Output Power (Pmax) (mW) | Freq (MHz) | Separation Distance (mm) | Estimated SAR (W/kg) | | Step 2 Adjusted SAR (W/kg) | | Step 3 Adjusted SAR (10g) (W/kg) |
|---|---|---|---|---|---|---|---|---|
| | | | | 0.000 | + | 0.000 | = | 0.000 |
| B3 | 4 | 2480 | 5 | 0.000 | + | 0.078 | = | 0.078 |

**Step 4**

Drift Adjustment

| Plot ID | Measured Drift (dB) | | Step 3 Adjusted SAR (W/kg) | | Step 4 Adjusted SAR (10g) (W/kg) |
|---|---|---|---|---|---|
| | | + | 0.000 | = | 0.000 |
| B3 | -0.293 | + | 0.078 | = | 0.083 |

**Step 5**

Reported SAR

| Plot ID | FCC From Steps 1 through 3 10g SAR (W/kg) | IC From Steps 1 through 4 10g SAR (W/kg) |
|---|---|---|
| | 0.000 | 0.000 |
| B3 | 0.078 | 0.083 |

| NOTES to Table 10.0 |
|---|
| (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 indentification of the SAR Measurement Plots in Annex A of this report. NOTE: Some of the scaling factors in Steps 1 through 4 may not apply and are identified by light gray text. |
| **Step 1** |
| Per IEC-62209-1 and FCC KDB 865664. Scaling required only when Measured Fluid Deviation is greater than 5%. If the Measured Fluid Deviation is greater than 5%, Table 10.1 will be shown and will indicate the SAR scaling factor in percent (%). SAR is MULTIPLIED by this scaling factor only when the scaling factor is positive (+). |
| **Step 2** |
| Per KDB 447498. Scaling required only when the difference (Delta) between the Measured Conducted Power and the Manufacturer's Rated Conducted Power is (-) Negative. The absolute value of Delta is ADDED to the SAR. |
| **Step 3** |
| Per KDB 447498 4.3.2. The SAR, either measured or calculated, of ANY and ALL simultaneous transmitters must be added together and includes all contributors. |
| **Step 4** |
| Per IEC 62209-1. Scaling required only when Measured Drift is (-) Negative. The absolute value of Measured Drift is added to Reported or Simultaneous Reported SAR. |
| **Step 5** |
| The Reported SAR is the Maximum Final Adjusted Cumulative SAR from the applicable Steps 1 through 4 and are reported on Page 1 of this report. |

**Table 10.1**

**Fluid Sensitivity Calculation (10g)**

**Delta SAR = Ce * Delta Er + C(sigma)*Delta Sigma**

| Frequency (GHz) | Plot ID |
|---|---|
| **2.462** | **B3** |
| Ce | -0.1595 |
| Cσ | 0.2569 |
| Δ E | -1.83% |
| Δσ | 7.51% |
| **ΔSAR** | **2.22%** |
| **Scale Factor Is Positive. Scaling Required** | |

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.

Jasmeet Gill
Test Lab Engineer
Celltech Labs Inc.

17 March 2017
Date

## 11.0 SAR EXPOSURE LIMITS

**Table 11.0**

| SAR RF EXPOSURE LIMITS | | | |
|---|---|---|---|
| FCC 47 CFR§2.1093 | Health Canada Safety Code 6 | General Population / Uncontrolled Exposure(4) | Occupational / Controlled Exposure(5) |
| **Spatial Average(1)** **(averaged over the whole body)** | | 0.08 W/kg | 0.4 W/kg |
| **Spatial Peak(2)** **(Head and Trunk averaged over any 1 g of tissue)** | | 1.6 W/kg | **8.0 W/kg** |
| **Spatial Peak(3)** **(Hands/Wrists/Feet/Ankles averaged over 10 g)** | | 4.0 W/kg | 20.0 W/kg |
| (1) The Spatial Average value of the SAR averaged over the whole body. | | | |
| (2) The Spatial Peak value of the SAR averaged over any 1 gram of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time. | | | |
| (3) The Spatial Peak value of the SAR averaged over any 10 grams of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time. | | | |
| (4) Uncontrolled environments are defined as locations where there is potential exposure to individuals who have no knowledge or control of their potential exposure. | | | |
| (5) Controlled environments are defined as locations where there is potential exposure to individuals who have knowledge of their potential exposure and can exercise control over their exposure. | | | |

## 12.0 DETAILS OF SAR EVALUATION

| EVALUATION DETAILS | |
|---|---|
| 1 | The DUT was evaluated for SAR in accordance with the procedures described in IEEE 1528, FCC KDB 865646 and RSS-102. |
| 2 | The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer. The device was capable of transmitting in Continuous Wave (CW) and was testing in an unmodulated continuous transmit mode at 100% duty cycle. |
| 3 | Each SAR evaluations were performed while plugged into a USB Charger |
| 4 | The fluid temperature remained within +/-2°C from the time of the fluid dielectric parameter measurement to the completion of the SAR evaluation. |
| 5 | The fluid temperature remained within +/-0.5°C throughout the test day. |

| SCAN PROCEDURE | |
|---|---|
| Maximum distance from the closest measurement point to phantom surface. | 4 ± 1mm |
| Maximum probe angle normal to phantom surface. | $5^{o}$ ± $1^{o}$ |
| Area Scan Spatial Resolution ΔX, ΔY | 12mm |
| Zoom Scan Spatial Resolution ΔX, ΔY | 5mm |
| Zoom Scan Spatial Resolution ΔZ | 5mm |
| Zoom Scan Volume X, Y, Z | 30mm x 30mm x 30mm |
| Phantom | ELI |
| Fluid Depth | 150mm |
| 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-averge SAR | |

## 13.0 MEASUREMENT UNCERTAINTIES

**Table 13.0**

**UNCERTAINTY BUDGET FOR DEVICE EVALUATION (IEEE 1528-2013 Table 9)**

| Uncertainty Component | IEEE 1528 Section | Uncertainty Value ±% | Probability Distribution | Divisor | ci 1g | ci 10g | Uncertainty Value ±% (1g) | Uncertainty Value ±% (10g) | $V_i$ or $V_{eff}$ |
|---|---|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | | | |
| Probe Calibration* | E.2.1 | 6.6 | Normal | 1 | 1 | 1 | 6.60 | 6.60 | ∞ |
| Axial Isotropy* | E.2.2 | 4.7 | Rectangular | 1.732050808 | 0.7 | 0.7 | 1.9 | 1.9 | ∞ |
| Hemispherical Isotropy* | E.2.2 | 9.6 | Rectangular | 1.732050808 | 0.7 | 0.7 | 3.9 | 3.9 | ∞ |
| Boundary Effect* | E.2.3 | 8.3 | Rectangular | 1.732050808 | 1 | 1 | 4.8 | 4.8 | ∞ |
| Linearity* | E.2.4 | 4.7 | Rectangular | 1.732050808 | 1 | 1 | 2.7 | 2.7 | ∞ |
| System Detection Limits* | E.2.4 | 1.0 | Rectangular | 1.732050808 | 1 | 1 | 0.6 | 0.6 | ∞ |
| Modulation Response | E.2.5 | 4.0 | Rectangular | 1.732050808 | 1 | 1 | 2.3 | 2.3 | ∞ |
| Readout Electronics* | E.2.6 | 1.0 | Normal | 1 | 1 | 1 | 1.0 | 1.0 | ∞ |
| Response Time* | E.2.7 | 0.8 | Rectangular | 1.732050808 | 1 | 1 | 0.5 | 0.5 | ∞ |
| Integration Time* | E.2.8 | 1.4 | Rectangular | 1.732050808 | 1 | 1 | 0.8 | 0.8 | ∞ |
| RF Ambient Conditions - Noise | E.6.1 | 0.0 | Rectangular | 1.732050808 | 1 | 1 | 0.0 | 0.0 | ∞ |
| RF Ambient Conditions - Reflection | E.6.1 | 0.0 | Rectangular | 1.732050808 | 1 | 1 | 0.0 | 0.0 | ∞ |
| Probe Positioner Mechanical Tolerance* | E.6.2 | 0.4 | Rectangular | 1.732050808 | 1 | 1 | 0.2 | 0.2 | ∞ |
| Probe Positioning wrt Phantom Shell* | E.6.3 | 2.9 | Rectangular | 1.732050808 | 1 | 1 | 1.7 | 1.7 | ∞ |
| Extrapolation, interpolation & integration algorithms for max. SAR evaluation* | E.5 | 3.9 | Rectangular | 1.732050808 | 1 | 1 | 2.3 | 2.3 | ∞ |
| **Test Sample Related** | | | | | | | | | |
| Test Sample Positioning | E.4.2 | 0.3 | Normal | 1 | 1 | 1 | 0.3 | 0.3 | 5 |
| Device Holder Uncertainty* | E.4.1 | 3.6 | Normal | 1 | 1 | 1 | 3.6 | 3.6 | ∞ |
| SAR Drift Measurement** | E.2.9 | 0.0 | Rectangular | 1.732050808 | 1 | 1 | 0.0 | 0.0 | ∞ |
| SAR Scaling*** | E.6.5 | 2.0 | Rectangular | 1.732050808 | 1 | 1 | 1.2 | 1.2 | ∞ |
| **Phantom and Tissue Parameters** | | | | | | | | | |
| Phantom Uncertainty* | E.3.1 | 4.0 | Rectangular | 1.732050808 | 1 | 1 | 2.3 | 2.3 | ∞ |
| SAR Correction Uncertainty | E.3.2 | 1.2 | Normal | 1 | 1 | 0.84 | 1.2 | 1.0 | ∞ |
| Liquid Conductivity (measurement) | E.3.3 | 6.8 | Normal | 1 | 0.78 | 0.71 | 5.3 | 4.8 | 10 |
| Liquid Permittivity (measurement) | E.3.3 | 5.3 | Normal | 1 | 0.23 | 0.26 | 1.2 | 1.4 | 10 |
| Liquid Conductivity (Temperature) | E.3.2 | 0.1 | Rectangular | 1.732050808 | 0.78 | 0.71 | 0.1 | 0.0 | ∞ |
| Liquid Permittivity Temperature) | E.3.2 | 0.0 | Rectangular | 1.732050808 | 0.23 | 0.26 | 0.0 | 0.0 | ∞ |
| **Effective Degrees of Freedom(1)** | | | | | | | | $V_{eff}$ = | 873.2 |
| **Combined Standard Uncertainty** | | | **RSS** | | | | **12.59** | **12.40** | |
| **Expanded Uncertainty (95% Confidence Interval)** | | | **k=2** | | | | **25.18** | **24.80** | |

**Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003**

(1) The Effective Degrees of Freedom is > 30 therefore a coverage factor of k=2 represents an approximate confidence level of 95%.

* Provided by SPEAG

**Table 13.1**

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

## 14.0 FLUID DIELECTRIC PARAMETERS

**********

Aprel Laboratory
Test Result for UIM Dielectric Parameter
Tue 28/Feb/2017 10:36:20
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 | 52.36 | 1.96 |
| 2.3600 | 52.82 | 1.86 | 52.07 | 1.95 |
| 2.3700 | 52.81 | 1.87 | 52.06 | 1.98 |
| 2.3800 | 52.79 | 1.88 | 51.97 | 2.00 |
| 2.3900 | 52.78 | 1.89 | 52.04 | 2.01 |
| 2.4000 | 52.77 | 1.90 | 51.92 | 2.01 |
| 2.4100 | 52.75 | 1.91 | 52.11 | 2.04 |
| 2.4200 | 52.74 | 1.92 | 52.00 | 2.05 |
| 2.4300 | 52.73 | 1.93 | 51.75 | 2.07 |
| 2.4400 | 52.71 | 1.94 | 51.77 | 2.09 |
| 2.4500 | 52.70 | 1.95 | 51.92 | 2.12 |
| 2.4600 | 52.69 | 1.96 | 51.74 | 2.10 |
| 2.4700 | 52.67 | 1.98 | 51.97 | 2.13 |
| 2.4800 | 52.66 | 1.99 | 51.83 | 2.12 |
| 2.4900 | 52.65 | 2.01 | 51.54 | 2.17 |
| 2.5000 | 52.64 | 2.02 | 51.64 | 2.18 |
| 2.5100 | 52.62 | 2.04 | 51.68 | 2.18 |
| 2.5200 | 52.61 | 2.05 | 51.59 | 2.19 |
| 2.5300 | 52.60 | 2.06 | 51.62 | 2.20 |
| 2.5400 | 52.59 | 2.08 | 51.37 | 2.23 |
| 2.5500 | 52.57 | 2.09 | 51.59 | 2.24 |

**Table 14.0**

## FLUID DIELECTRIC PARAMETERS

| Date: | 28 Feb 2017 | Fluid Temp: | 23 | Frequency: | 2450MHz | Tissue: | Body |
|---|---|---|---|---|---|---|---|

| Freq (MHz) | | Test_e | Test_s | Target_e | Target_s | Deviation Permittivity | Deviation Conductivity |
|---|---|---|---|---|---|---|---|
| 2350.0000 | | 52.3600 | 1.9600 | 52.8300 | 1.85 | -0.89% | 5.95% |
| 2360.0000 | | 52.0700 | 1.9500 | 52.8200 | 1.86 | -1.42% | 4.84% |
| 2370.0000 | | 52.0600 | 1.9800 | 52.8100 | 1.87 | -1.42% | 5.88% |
| 2380.0000 | | 51.9700 | 2.0000 | 52.7900 | 1.88 | -1.55% | 6.38% |
| 2390.0000 | | 52.0400 | 2.0100 | 52.7800 | 1.89 | -1.40% | 6.35% |
| 2400.0000 | | 51.9200 | 2.0100 | 52.7700 | 1.90 | -1.61% | 5.79% |
| 2410.0000 | | 52.1100 | 2.0400 | 52.7500 | 1.91 | -1.21% | 6.81% |
| 2412.0000 | * | 52.0880 | 2.0420 | 52.7480 | 1.91 | -1.25% | 6.80% |
| 2420.0000 | | 52.0000 | 2.0500 | 52.7400 | 1.92 | -1.40% | 6.77% |
| 2430.0000 | | 51.7500 | 2.0700 | 52.7300 | 1.93 | -1.86% | 7.25% |
| 2437.0000 | * | 51.7640 | 2.0840 | 52.7160 | 1.94 | -1.81% | 7.59% |
| 2440.0000 | | 51.7700 | 2.0900 | 52.7100 | 1.94 | -1.78% | 7.73% |
| 2450.0000 | | 51.9200 | 2.1200 | 52.7000 | 1.95 | -1.48% | 8.72% |
| 2460.0000 | | 51.7400 | 2.1000 | 52.6900 | 1.96 | -1.80% | 7.14% |
| 2462.0000 | * | 51.7860 | 2.1060 | 52.6860 | 1.96 | -1.71% | 7.23% |
| 2470.0000 | | 51.9700 | 2.1300 | 52.6700 | 1.98 | -1.33% | 7.58% |
| 2472.0000 | * | 51.9420 | 2.1280 | 52.6680 | 1.98 | -1.38% | 7.37% |
| 2480.0000 | | 51.8300 | 2.1200 | 52.6600 | 1.99 | -1.58% | 6.53% |
| 2490.0000 | | 51.5400 | 2.1700 | 52.6500 | 2.01 | -2.11% | 7.96% |
| 2500.0000 | | 51.6400 | 2.1800 | 52.6400 | 2.02 | -1.90% | 7.92% |
| 2510.0000 | | 51.6800 | 2.1800 | 52.6200 | 2.04 | -1.79% | 6.86% |
| 2520.0000 | | 51.5900 | 2.1900 | 52.6100 | 2.05 | -1.94% | 6.83% |
| 2530.0000 | | 51.6200 | 2.2000 | 52.6000 | 2.06 | -1.86% | 6.80% |
| 2540.0000 | | 51.3700 | 2.2300 | 52.5900 | 2.08 | -2.32% | 7.21% |
| 2550.0000 | | 51.5900 | 2.2400 | 52.5700 | 2.09 | -1.86% | 7.18% |

*Channel Frequency Tested

**********

Aprel Laboratory
Test Result for UIM Dielectric Parameter
Wed 15/Mar/2017 15:26:44
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 | 49.24 | 1.82 |
| 2.3600 | 52.82 | 1.86 | 49.36 | 1.82 |
| 2.3700 | 52.81 | 1.87 | 49.22 | 1.83 |
| 2.3800 | 52.79 | 1.88 | 49.26 | 1.84 |
| 2.3900 | 52.78 | 1.89 | 49.24 | 1.84 |
| 2.4000 | 52.77 | 1.90 | 49.14 | 1.88 |
| 2.4100 | 52.75 | 1.91 | 49.19 | 1.85 |
| 2.4200 | 52.74 | 1.92 | 49.18 | 1.90 |
| 2.4300 | 52.73 | 1.93 | 49.14 | 1.94 |
| 2.4400 | 52.71 | 1.94 | 49.10 | 1.95 |
| 2.4500 | 52.70 | 1.95 | 49.24 | 1.97 |
| 2.4600 | 52.69 | 1.96 | 49.28 | 1.96 |
| 2.4700 | 52.67 | 1.98 | 49.17 | 1.95 |
| 2.4800 | 52.66 | 1.99 | 48.99 | 1.98 |
| 2.4900 | 52.65 | 2.01 | 48.67 | 2.00 |
| 2.5000 | 52.64 | 2.02 | 48.86 | 1.99 |
| 2.5100 | 52.62 | 2.04 | 48.72 | 2.00 |
| 2.5200 | 52.61 | 2.05 | 48.72 | 2.04 |
| 2.5300 | 52.60 | 2.06 | 48.85 | 2.07 |
| 2.5400 | 52.59 | 2.08 | 48.81 | 2.08 |
| 2.5500 | 52.57 | 2.09 | 48.97 | 2.10 |

**Table 14.1**

## FLUID DIELECTRIC PARAMETERS

| Date: | 15 Mar 2017 | Fluid Temp: | 23.2 | Frequency: | 2450MHz | Tissue: | Body |
|---|---|---|---|---|---|---|---|

| Freq (MHz) | | Test_e | Test_s | Target_e | Target_s | Deviation Permittivity | Deviation Conductivity |
|---|---|---|---|---|---|---|---|
| 2350.0000 | | 49.2400 | 1.8200 | 52.8300 | 1.85 | -6.80% | -1.62% |
| 2360.0000 | | 49.3600 | 1.8200 | 52.8200 | 1.86 | -6.55% | -2.15% |
| 2370.0000 | | 49.2200 | 1.8300 | 52.8100 | 1.87 | -6.80% | -2.14% |
| 2380.0000 | | 49.2600 | 1.8400 | 52.7900 | 1.88 | -6.69% | -2.13% |
| 2390.0000 | | 49.2400 | 1.8400 | 52.7800 | 1.89 | -6.71% | -2.65% |
| 2400.0000 | | 49.1400 | 1.8800 | 52.7700 | 1.90 | -6.88% | -1.05% |
| 2410.0000 | | 49.1900 | 1.8500 | 52.7500 | 1.91 | -6.75% | -3.14% |
| 2412.0000 | * | 49.1880 | 1.8600 | 52.7480 | 1.91 | -6.75% | -2.72% |
| 2420.0000 | | 49.1800 | 1.9000 | 52.7400 | 1.92 | -6.75% | -1.04% |
| 2430.0000 | | 49.1400 | 1.9400 | 52.7300 | 1.93 | -6.81% | 0.52% |
| 2437.0000 | * | 49.1120 | 1.9470 | 52.7160 | 1.94 | -6.84% | 0.52% |
| 2440.0000 | | 49.1000 | 1.9500 | 52.7100 | 1.94 | -6.85% | 0.52% |
| 2450.0000 | | 49.2400 | 1.9700 | 52.7000 | 1.95 | -6.57% | 1.03% |
| 2460.0000 | | 49.2800 | 1.9600 | 52.6900 | 1.96 | -6.47% | 0.00% |
| 2462.0000 | * | 49.2580 | 1.9580 | 52.6860 | 1.96 | -6.51% | -0.31% |
| 2470.0000 | | 49.1700 | 1.9500 | 52.6700 | 1.98 | -6.65% | -1.52% |
| 2472.0000 | * | 49.1340 | 1.9560 | 52.6680 | 1.98 | -6.71% | -1.31% |
| 2480.0000 | | 48.9900 | 1.9800 | 52.6600 | 1.99 | -6.97% | -0.50% |
| 2490.0000 | | 48.6700 | 2.0000 | 52.6500 | 2.01 | -7.56% | -0.50% |
| 2500.0000 | | 48.8600 | 1.9900 | 52.6400 | 2.02 | -7.18% | -1.49% |
| 2510.0000 | | 48.7200 | 2.0000 | 52.6200 | 2.04 | -7.41% | -1.96% |
| 2520.0000 | | 48.7200 | 2.0400 | 52.6100 | 2.05 | -7.39% | -0.49% |
| 2530.0000 | | 48.8500 | 2.0700 | 52.6000 | 2.06 | -7.13% | 0.49% |
| 2540.0000 | | 48.8100 | 2.0800 | 52.5900 | 2.08 | -7.19% | 0.00% |
| 2550.0000 | | 48.9700 | 2.1000 | 52.5700 | 2.09 | -6.85% | 0.48% |

*Channel Frequency Tested

## 15.0 SYSTEM VERIFICATION TEST RESULTS

**Table 15.0**

**System Verification Test Results**

| Date | Frequency (MHz) | Fluid Type | Fluid Temp °C | Ambient Temp °C | Ambient Humidity (%) | Forward Power (mW) | Dipole Spacing (mm) | Validation Source P/N | Validation Source S/N |
|---|---|---|---|---|---|---|---|---|---|
| 28-Feb-17 | 2450 | Body | 23 | 20 | 12% | 250 | 10 | D2450V2 | 825 |

| SAR | | | | | | Fluid Parameters | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 gram | | | 10 gram | | | Permittivity | | | Conductivity | | |
| Measured | Target | Deviation | Measured | Target | Deviation | Measured | Target | Deviation | Measured | Target | Deviation |
| 12 | 13 | -7.69% | 5.57 | 6.05 | -7.93% | 51.92 | 52.7 | -1.48% | 2.12 | 1.95 | 8.72% |

Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEEE 1528-2013, FCC KDB 846224 and IEC 62209-1.
The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.
The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value

**Table 15.0**

**System Verification Test Results**

| Date | Frequency (MHz) | Fluid Type | Fluid Temp °C | Ambient Temp °C | Ambient Humidity (%) | Forward Power (mW) | Dipole Spacing (mm) | Validation Source P/N | Validation Source S/N |
|---|---|---|---|---|---|---|---|---|---|
| 15-Mar-17 | 2450 | Body | 23.2 | 23 | 21% | 250 | 10 | D2450V2 | 825 |

| SAR | | | | | | Fluid Parameters | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 gram | | | 10 gram | | | Permittivity | | | Conductivity | | |
| Measured | Target | Deviation | Measured | Target | Deviation | Measured | Target | Deviation | Measured | Target | Deviation |
| 12.6 | 13 | -3.08% | 5.8 | 6.05 | -4.13% | 49.2 | 52.7 | -6.57% | 1.97 | 1.95 | 1.03% |

Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEEE 1528-2013, FCC KDB 846224 and IEC 62209-1.

The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.

The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value

# 16.0 MEASUREMENT SYSTEM SPECIFICATIONS

**Table 16.0**

| Measurement System Specification | |
|---|---|
| **Specifications** | |
| **Positioner** | Stäubli Unimation Corp. Robot Model: RX60L |
| **Repeatability** | 0.02 mm |
| **No. of axis** | 6 |
| **Data Acquisition Electronic (DAE) System** | |
| **Cell Controller** | |
| **Processor** | AMD Athlon XP 2400+ |
| **Clock Speed** | 2.0 GHz |
| **Operating System** | Windows XP Professional |
| **Data Converter** | |
| **Features** | Signal Amplifier, multiplexer, A/D converter, and control logic |
| **Software** | Measurement Software: DASY4, V4.7 Build 80 |
| | Postprocessing Software: SEMCAD, V1.8 Build 186 |
| **Connecting Lines** | Optical downlink for data and status info., Optical uplink for commands and clock |
| **DASY4 Measurement Server** | |
| **Function** | Real-time data evaluation for field measurements and surface detection |
| **Hardware** | PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM |
| **Connections** | COM1, COM2, DAE, Robot, Ethernet, Service Interface |
| **E-Field Probe** | |
| **Model** | EX3DV4 |
| **Serial No.** | 3600 |
| **Construction** | Triangular core fiber optic detection system |
| **Frequency** | 10 MHz to 6 GHz |
| **Linearity** | ±0.2 dB (30 MHz to 3 GHz) |
| **Phantom** | |
| **Type** | ELI |
| **Shell Material** | Fiberglass |
| **Thickness** | 2mm +/- .2mm |
| **Volume** | > 30 Liter |

**Table 16.1**

## Measurement System Specification (Continued)

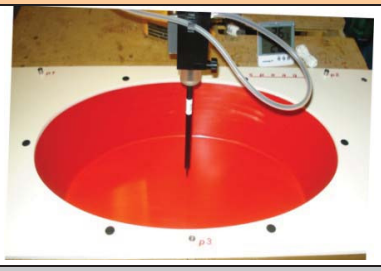
### Probe Specification

| | |
|---|---|
| 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<br>and 1.8 GHz (accuracy ± 8%) |
| Frequency: | 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz) |
| Directivity: | ± 0.2 dB in head tissue (rotation around probe axis)<br>± 0.4 dB in head tissue (rotation normal to probe axis) |
| Dynamic Range: | 5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB |
| Surface Detect: | ± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces |
| Dimensions: | Overall length: 330 mm; Tip length: 16 mm;<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 |

**EX3DV4 E-Field Probe**

### Phantom Specification

The ELI V5.0 phantom is an elliptical planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEEE 1528-2013, IEC 62209-1 and IEC 62209-2.



**ELI Phantom**

### Device Positioner Specification

The DASY4 device positioner has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of $65^{O}$. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

**Device Positioner**

## 17.0 TEST EQUIPMENT LIST

**Table 17.0**

**Test Equipment List**

| DESCRIPTION | ASSET NO. | SERIAL NO. | DATE CALIBRATED | CALIBRATION INTERVAL |
|---|---|---|---|---|
| Schmid & Partner DASY4 System | - | - | - | - |
| -DASY4 Measurement Server | 00158 | 1078 | CNR | CNR |
| -Robot | 00046 | 599396-01 | CNR | CNR |
| -DAE4 | 00019 | 353 | 20 April 2016 | Annual |
| -EX3DV6 E-Field Probe | 00213 | 3600 | 27 April 2016 | Annual |
| -CLA150 Validation Source | 00251 | 4007 | 24 Jan 2016 | Triennial |
| -D835V2 Validation Dipole | 00217 | 4D075 | 23 April 2015 | Triennial |
| -D450V3 Validation Dipole | 00221 | 1068 | 21 April 2015 | Triennial |
| ELI Phantom | 00247 | - | CNR | CNR |
| HP 85070C Dielectric Probe Kit | 00033 | none | CNR | CNR |
| Gigatronics 8652A Power Meter | 00110 | 1835801 | 29 Feb 2016 | Triennial |
| Gigatronics 80701A Power Sensor | 00248 | 1833687 | 29 Feb 2016 | Triennial |
| HP 8753ET Network Analyzer | 00134 | US39170292 | 22 Oct 2014 | Triennial |
| Rohde & Schwarz SMR20 Signal Generator | 00006 | 100104 | 8 May 2014 | Triennial |
| Amplifier Research 5S1G4 Power Amplifier | 00106 | 26235 | CNR | CNR |

CNR = Calibration Not Required

## 18.0 FLUID COMPOSITION

| Table 18.0 | | | 2450MHz Body | |
|---|---|---|---|---|
| **Tissue Simulating Liquid (TSL) Composition** | | | | |
| **Component by Percent Weight** | | | | |
| **Water** | **Glycol** | **Salt(1)** | **HEC(2)** | **Bacteriacide(3)** |
| 69.98 | 30.0 | 0.02 | 0.0 | 0.0 |

(1) Non-Iodinized
(2) **H**ydroxy**E**thyl-**C**ellulose: Sigma-Aldrich P/N 54290-500g
(3) Dow Chemical Dowicil 75 Antimicrobial Perservative

## APPENDIX A – SYSTEM VERIFICATION PLOTS

Date/Time: 28/02/2017 10:33:44 AM

Test Laboratory: Celltech Labs

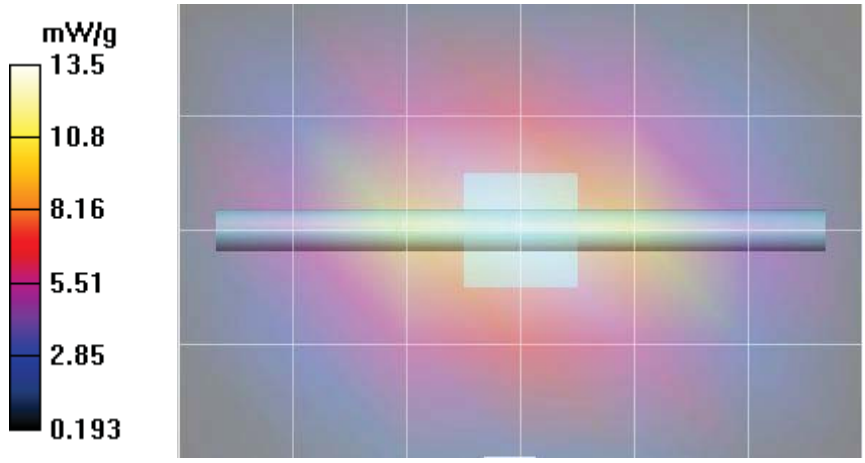
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 825; Calibrated: 25/04/2012
Program Name: 2450MHz Body SPC

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; $\sigma$ = 2.12 mho/m; $\varepsilon_r$ = 51.9; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

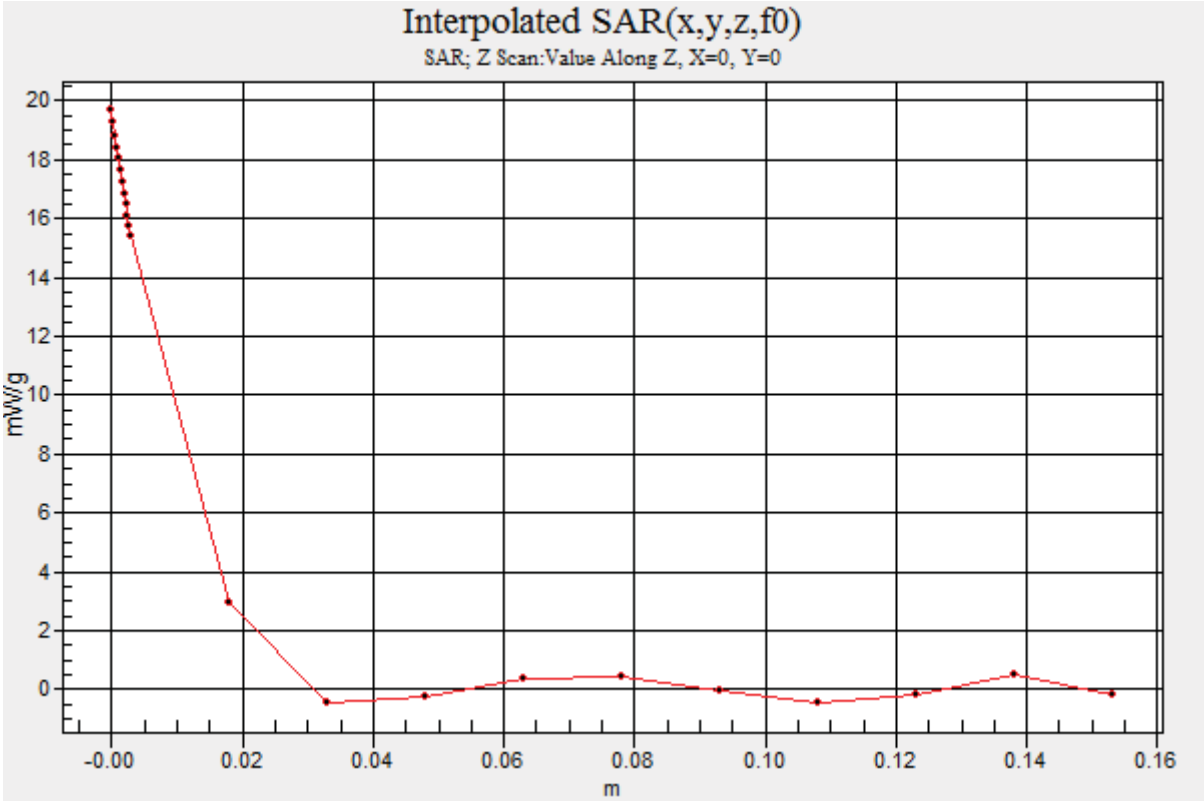
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**2450MHz Body Dipole d=10mm P=250mW TS=[11.7][13.0][14.3]/Area Scan (5x7x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.5 mW/g

**2450MHz Body Dipole d=10mm P=250mW TS=[11.7][13.0][14.3]/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 96.1 V/m; Power Drift = -0.091 dB
Peak SAR (extrapolated) = 24.8 W/kg
**SAR(1 g) = 12 mW/g; SAR(10 g) = 5.57 mW/g**
Maximum value of SAR (measured) = 13.6 mW/g




Interpolated SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
20
18
16
14
12
10
8
6
4
2
0
-0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date/Time: 15/03/2017 2:09:52 PM

Test Laboratory: Celltech Labs

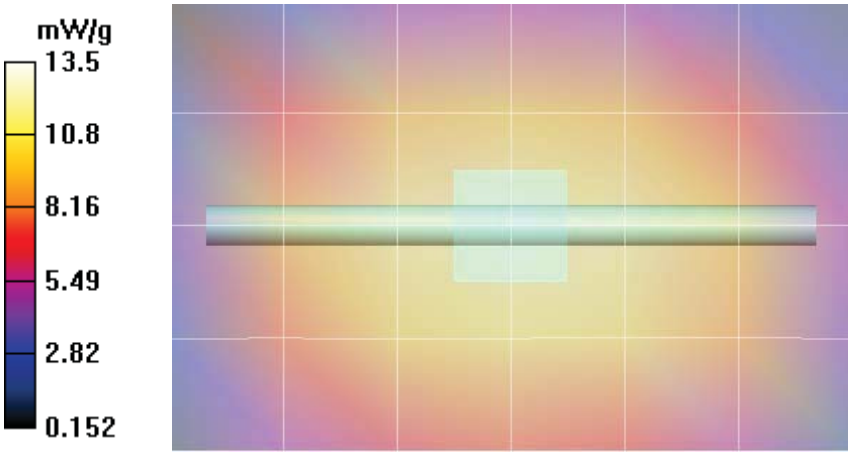
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 825; Calibrated: 25/04/2012
Program Name: 2450MHz Body SPC

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 49.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

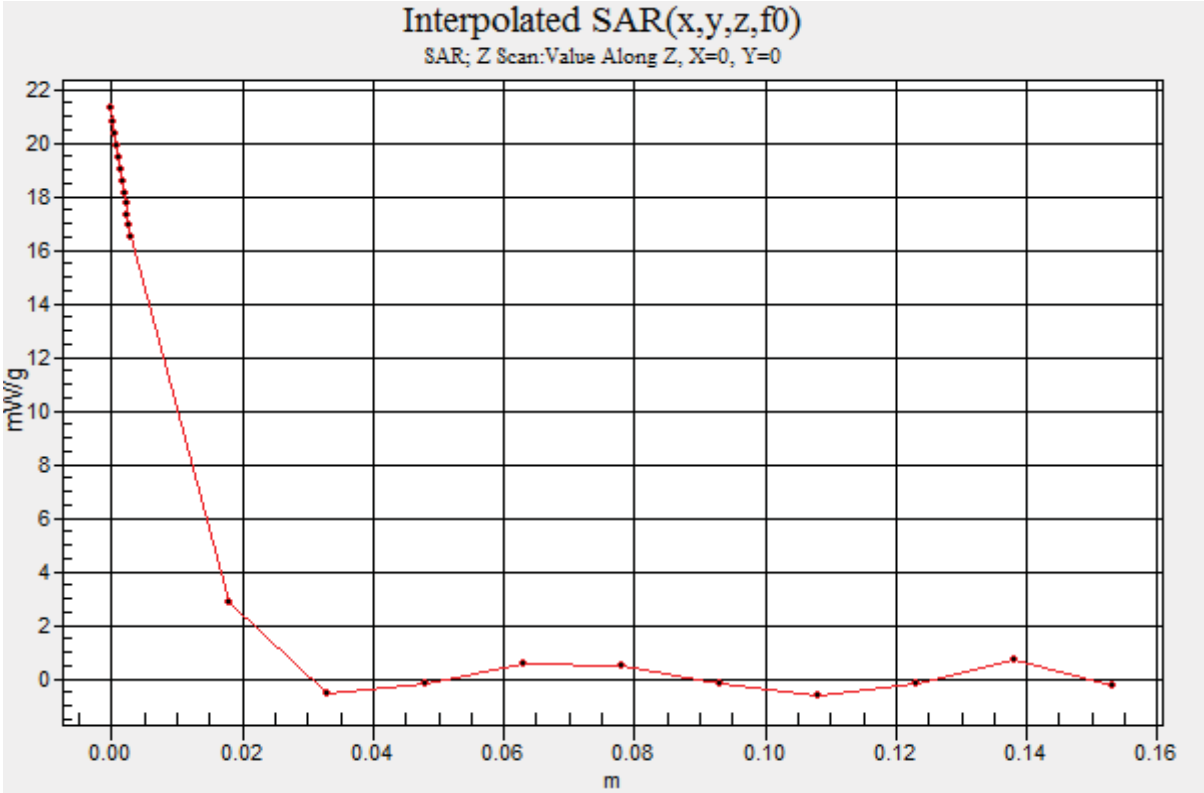
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**2450MHz Body Dipole d=10mm P=250mW TS=[11.7][13.0][14.3]/Area Scan (5x7x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.5 mW/g

**2450MHz Body Dipole d=10mm P=250mW TS=[11.7][13.0][14.3]/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 89.2 V/m; Power Drift = 0.136 dB
Peak SAR (extrapolated) = 26.0 W/kg
**SAR(1 g) = 12.6 mW/g; SAR(10 g) = 5.8 mW/g**
Maximum value of SAR (measured) = 14.2 mW/g





# APPENDIX B – MEASUREMENT PLOTS OF MAXIMUMUM MEASURED SAR

## Plot B1

Date/Time: 28/02/2017 2:07:13 PM

Test Laboratory: Celltech Labs

DUT: Fenix 5/5s; Type: Sports Watch;
Program Name: 2450MHz Body

Communication System: CW; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; $\sigma$ = 2.04 mho/m; $\varepsilon_r$ = 52.1; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

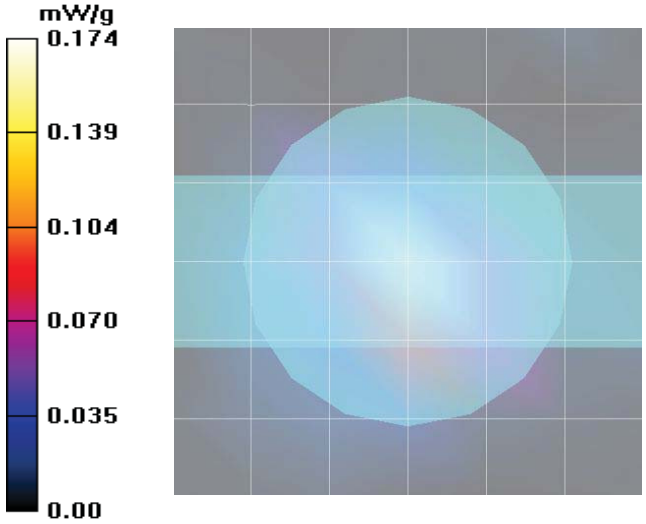
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**B1 Fenix 5 2412 MHz Body 2/Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.174 mW/g

**B1 Fenix 5 2412 MHz Body 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.62 V/m; Power Drift = -0.414 dB
Peak SAR (extrapolated) = 0.277 W/kg
**SAR(1 g) = 0.109 mW/g; SAR(10 g) = 0.038 mW/g**

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.147 mW/g



## Plot B2

Date/Time: 28/02/2017 3:46:21 PM

Test Laboratory: Celltech Labs

DUT: Fenix 5/5s; Type: Sports Watch;
Program Name: 2450MHz Body

Communication System: CW; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; $\sigma$ = 2.08 mho/m; $\varepsilon_r$ = 51.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

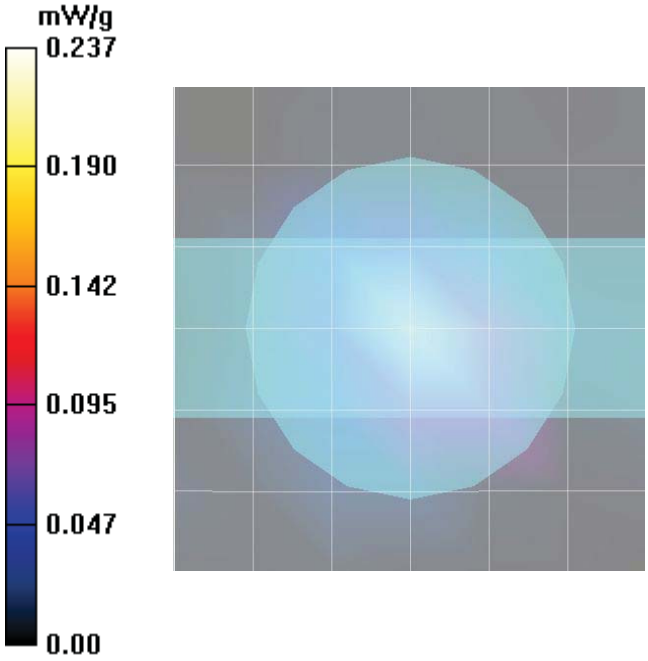
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**B2 Fenix 5 2437 MHz Body/Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.237 mW/g

**B2 Fenix 5 2437 MHz Body/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.5 V/m; Power Drift = -0.297 dB
Peak SAR (extrapolated) = 0.355 W/kg
**SAR(1 g) = 0.140 mW/g; SAR(10 g) = 0.050 mW/g**

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.198 mW/g



## Plot B3

Date/Time: 01/03/2017 11:01:39 AM

Test Laboratory: Celltech Labs

DUT: Fenix 5/5s; Type: Sports Watch;
Program Name: 2450MHz Body

Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; $\sigma$ = 2.11 mho/m; $\varepsilon_r$ = 51.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

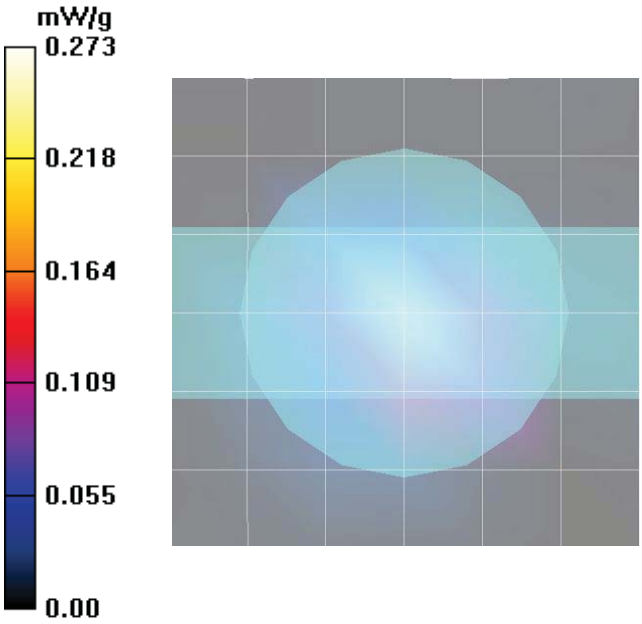
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**B3 Fenix 5 2462 MHz Body/Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

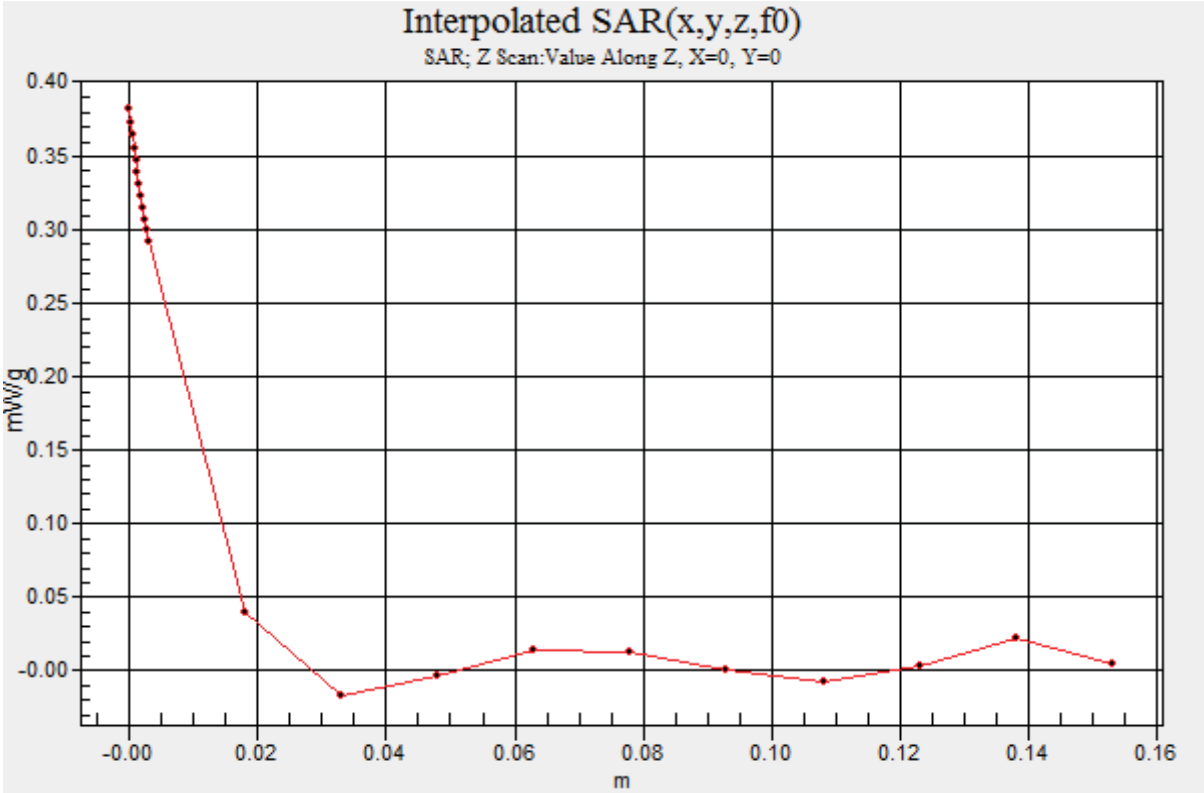
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.273 mW/g

**B3 Fenix 5 2462 MHz Body/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.6 V/m; Power Drift = -0.293 dB
Peak SAR (extrapolated) = 0.669 W/kg
**SAR(1 g) = 0.187 mW/g; SAR(10 g) = 0.063 mW/g**

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.242 mW/g





## Plot B4

Date/Time: 16/03/2017 11:16:23 AM

Test Laboratory: Celltech Labs

DUT: Fenix 5/5s; Type: Sports Watch;
Program Name: 2450MHz Body

Communication System: CW; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; $\sigma$ = 1.86 mho/m; $\varepsilon_r$ = 49.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

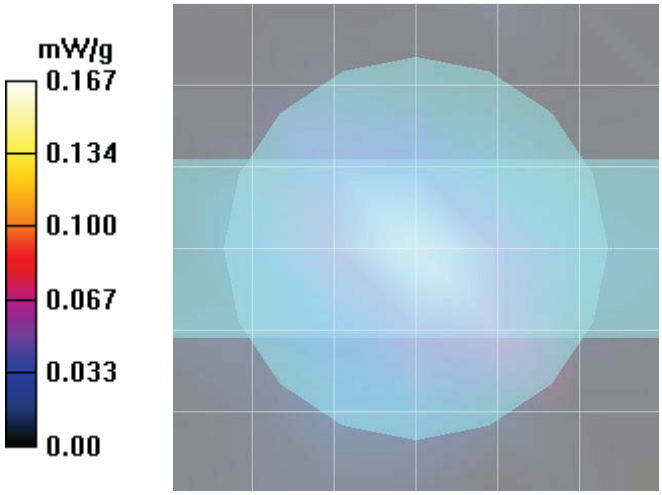
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**B4 Fenix 5 2412 MHz Body,metal band/Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.167 mW/g

**B4 Fenix 5 2412 MHz Body,metal band/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.1 V/m; Power Drift = -0.190 dB
Peak SAR (extrapolated) = 0.245 W/kg
**SAR(1 g) = 0.097 mW/g; SAR(10 g) = 0.034 mW/g**

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.142 mW/g



## Plot B5

Date/Time: 16/03/2017 9:08:22 AM

Test Laboratory: Celltech Labs

DUT: Fenix 5/5s; Type: Sports Watch;
Program Name: 2450MHz Body

Communication System: CW; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; $\sigma$ = 1.95 mho/m; $\varepsilon_r$ = 49.1; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

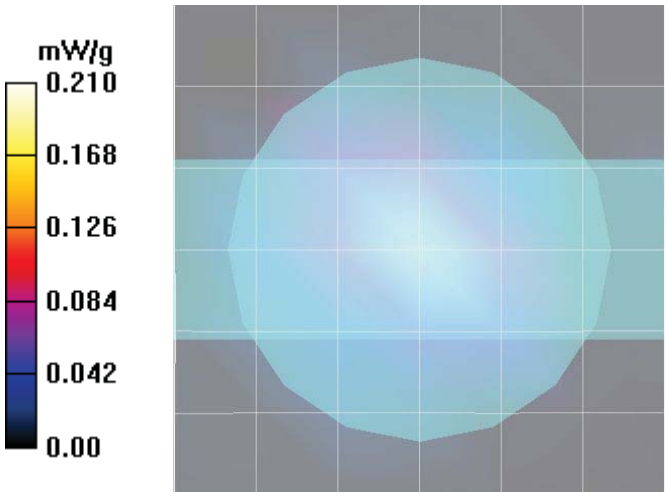
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**B5 Fenix 5 2437 MHz Body,metal band/Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

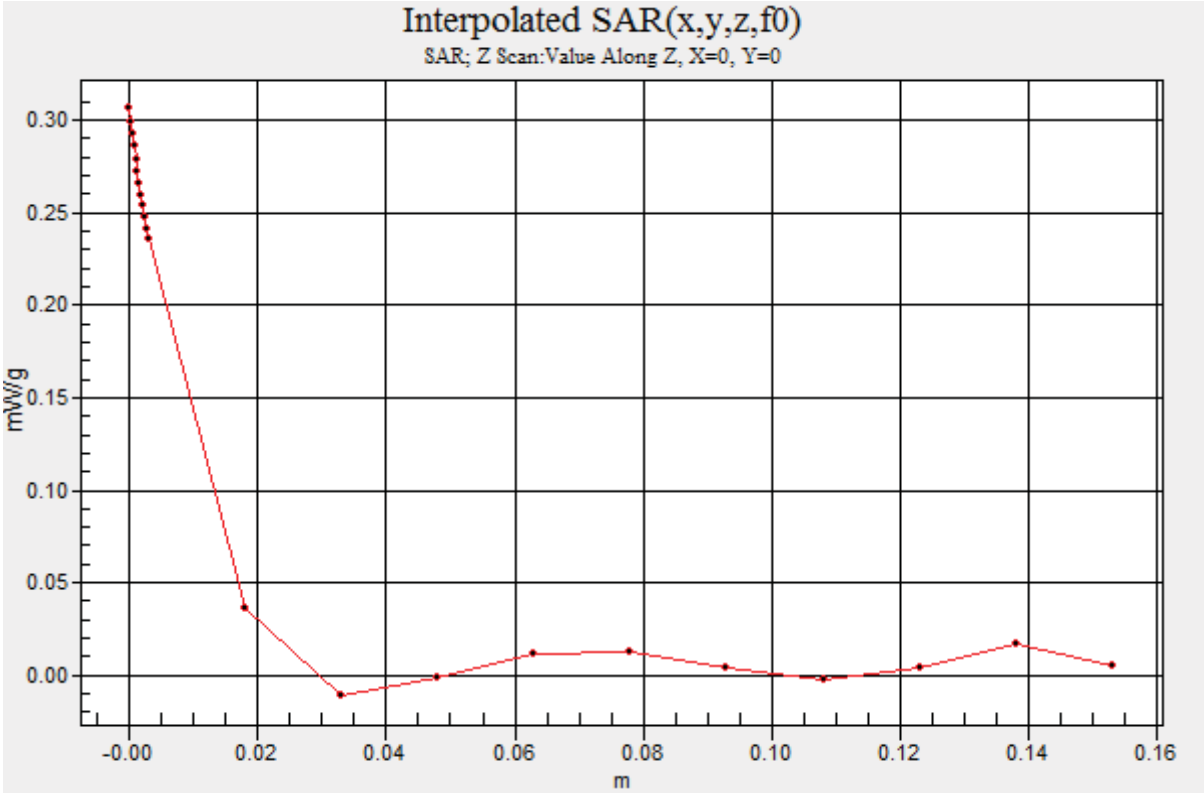
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.210 mW/g

**B5 Fenix 5 2437 MHz Body,metal band/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.2 V/m; Power Drift = -0.080 dB
Peak SAR (extrapolated) = 0.531 W/kg
**SAR(1 g) = 0.148 mW/g; SAR(10 g) = 0.051 mW/g**

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.191 mW/g





## Plot B6

Date/Time: 16/03/2017 12:58:47 PM

Test Laboratory: Celltech Labs

DUT: Fenix 5/5s; Type: Sports Watch;
Program Name: 2450MHz Body

Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; $\sigma$ = 1.96 mho/m; $\varepsilon_r$ = 49.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

**B6 Fenix 5 2462 MHz Body,metal band 2/Area Scan (7x7x1):** Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.213 mW/g

**B6 Fenix 5 2462 MHz Body,metal band 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.0 V/m; Power Drift = -0.251 dB
Peak SAR (extrapolated) = 0.367 W/kg
**SAR(1 g) = 0.146 mW/g; SAR(10 g) = 0.052 mW/g**

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.194 mW/g