

## SAR Compliance Test Report

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |                                                                        |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------------------------------------------------------|
| <b>Date of Report</b>                                   | 14/06/2018                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Client's Contact person:</b>   | Gordon Smith                                                           |
| <b>Number of pages:</b>                                 | 28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Responsible Test engineer:</b> | Kirsi Kyllönen                                                         |
| <b>Testing laboratory:</b>                              | <b>Verkotan Oy</b><br>Elektroniikkatie 17<br>90590 Oulu<br>Finland                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Client:</b>                    | <b>7HUGS LABS</b><br>29 bd Romain Rolland<br>92120 Montrouge<br>France |
| <b>Tested device</b>                                    | Sevenhugs Smart Remote                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                   |                                                                        |
| <b>Related reports:</b>                                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   |                                                                        |
| <b>Testing has been carried out in accordance with:</b> | <p><b>47CFR §2.1093</b><br/>Radiofrequency Radiation Exposure Evaluation: Portable Devices</p> <p><b>FCC published RF exposure KDB procedures</b></p> <p><b>IEEE 1528 - 2013</b><br/>IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Technique</p> <p><b>RSS-102</b><br/>Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)</p> |                                   |                                                                        |
| <b>Documentation:</b>                                   | The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory                                                                                                                                                                                                                                                                                                                                                       |                                   |                                                                        |
| <b>Test Results:</b>                                    | <p><b>The EUT complies with the requirements in respect of all parameters subject to the test.</b></p> <p>The test results relate only to devices specified in this document</p>                                                                                                                                                                                                                                                                                                                  |                                   |                                                                        |

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For the contents:

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## 1. SUMMARY OF SAR TEST REPORT

### 1.1 Test Details

#### Device under Test (DUT):

|                                      |                                                            |
|--------------------------------------|------------------------------------------------------------|
| <b>Product:</b>                      | Sevenhugs Smart Remote                                     |
| <b>Manufacturer:</b>                 | 7HUGS LABS                                                 |
| <b>Serial Number:</b>                | 908E614AB4FE620139, C07C604AB4FE620139, D07C604AB4FE620139 |
| <b>FCC ID Number:</b>                | 2AEVC-SR1A                                                 |
| <b>IC ID Number:</b>                 | 20292-SR1A                                                 |
| <b>Model:</b>                        | SR1A                                                       |
| <b>DUT Number:</b>                   | 22901, 22899, 22900                                        |
| <b>Battery Type used in testing:</b> | Integrated battery                                         |
| <b>Portable/ Mobile device</b>       | Portable                                                   |
| <b>State of the Sample</b>           | Production sample                                          |

#### Testing information:

|                                  |                                              |
|----------------------------------|----------------------------------------------|
| <b>Testing Performed:</b>        | 6.6.2018                                     |
| <b>Notes:</b>                    | -                                            |
| <b>Document ID:</b>              | FCC SAR report_Sevenhugs_ID2850_140618 .docx |
| <b>Temperature °C</b>            | 22±2 / Controlled                            |
| <b>Humidity RH%</b>              | 20±20 / Controlled                           |
| <b>Measurement performed by:</b> | Kirsi Kyllönen                               |

### 1.2 Maximum Results

#### 1.2.1 Standalone SAR

The maximum reported\* SAR value for Body-worn configuration with 5 mm separation distance for transmitting systems are shown in a table below. The device conforms to the requirements of the standards when the maximum reported SAR value is less than or equal to the limit. The SAR limit specified in FCC 47 CFR part 2 (2.1093) and RSS-102 for Body is SAR<sub>1g</sub> 1.6 W/kg.

| Modes of Operation | Equipment Class | Highest Reported* SAR <sub>1g</sub> (W/kg) in Body-Worn Condition, 5mm separation | Result |
|--------------------|-----------------|-----------------------------------------------------------------------------------|--------|
| 2.4 GHz WLAN       | DTS             | 0.46                                                                              | PASS   |
| BT/BLE             | DTS             | 0.07                                                                              | PASS   |

\* Reported SAR Values are scaled to maximum theoretical output power.

#### 1.2.2 Power density

The device conforms the radiofrequency radiation exposure limits when the calculated power density value is less than or equal to the limit.

| Modes of Operation                                | Power Density, S<br>[mW/cm <sup>2</sup> ] | FCC Power Density Limit<br>[mW/cm <sup>2</sup> ] | Result |
|---------------------------------------------------|-------------------------------------------|--------------------------------------------------|--------|
| IEEE802.15.4 UWB positioning 6489 MHz<br>6489 MHz | 0.0004                                    | 1.0                                              | Pass   |

| Modes of Operation                                | Power Density, S<br>[mW/m <sup>2</sup> ] | ISED Power Density Limit<br>[W/m <sup>2</sup> ] | Result |
|---------------------------------------------------|------------------------------------------|-------------------------------------------------|--------|
| IEEE802.15.4 UWB positioning 6489 MHz<br>6489 MHz | 0.0044                                   | 10                                              | Pass   |

### 1.2.1 Simultaneous Transmission

| Highest Simultaneous Transmission SAR                        | Highest Reported SAR <sub>1g</sub> (W/kg) in Body-Worn Condition, 5mm separation | Result |
|--------------------------------------------------------------|----------------------------------------------------------------------------------|--------|
| 2.4 GHz WLAN +<br>Bluetooth +<br>UWB positioning at 3494 MHz | 0.47                                                                             | PASS   |

| Simultaneous Transmission Evaluation, UWB positioning at 6489 MHz                                                                                        | Highest SUM | Result |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------|
| (2.4 GHz WLAN SAR/ SAR requirement)<br>+<br>(Bluetooth SAR/ SAR requirement)<br>+<br>(UWB positioning 6489 MHz Power density/ Power density requirement) | 0.29        | PASS   |

### 1.2.3 Maximum Drift

|                                   |          |
|-----------------------------------|----------|
| Maximum Drift During Measurements | 0.89 dB* |
|-----------------------------------|----------|

\*Drifts >5% have been considered in the scaling factor

### 1.2.4 Measurement Uncertainty

|                                 |       |
|---------------------------------|-------|
| Expanded Uncertainty (k=2) 95 % | 23.4% |
|---------------------------------|-------|

## 2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

Device under testing is an smart remote controller. It can be used as hand-held device or held close to body.

|                             |              |
|-----------------------------|--------------|
| <b>Device Category</b>      | Portable     |
| <b>Exposure Environment</b> | Uncontrolled |

### 2.1 Supported Frequency Bands and Operational Modes

| TX Frequency bands | Modes of Operation                | Transmitter Frequency Range (MHz) |
|--------------------|-----------------------------------|-----------------------------------|
|                    | 2.4 GHz WLAN                      | 2412-2472                         |
|                    | BT/BLE                            | 2402-2480                         |
|                    | IEEE802.15.4-2011 UWB positioning | 3494, 6489                        |

All transmitter can operate simultaneously.

### 2.2 SAR test Exclusions

Due to the size and form factor of the DUT it can be body-worn or hand-held similarly to a mobile phone. Thus, based on footnote 26 in KDB447798, extremity SAR was not fully tested. Worst case verifications were made at 0 mm separation to verify extremity compliance.

#### 2.2.1 IEEE802.15.4 UWB positioning

**Standalone SAR test exclusion** consideration for UWB transmitter at 3494 MHz frequency has been made to according to RSS-102, table 1 and KDB 447498 D01 General RF Exposure Guidance v06, section 4.3.1, for test separation distances  $\leq 50\text{mm}$ .

The maximum power of the transmitter is 0.1259 mW which is  $< 2\text{mW}$  i.e. below RSS-102 power exemption limit.

FCC SAR test exclusion was defined according to equation

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0, \text{ for separation distances } \leq 50\text{mm}$$

| Frequency [GHz] | Max power (including tune-up tolerance) | Max Power [mW] | Antenna to edge distance [mm] | Result (4.3.1 a) | SAR test required ( $\leq 3.0$ ) |
|-----------------|-----------------------------------------|----------------|-------------------------------|------------------|----------------------------------|
| 3.494           | -9                                      | 0.1259         | 5                             | 0.05             | <b>NO</b>                        |

**Standalone SAR estimation** for the UWB transmitter at 3494 MHz is needed for simultaneous transmission evaluation of the DUT according to KDB 447498 D01 General RF Exposure Guidance v06, section 4.3.2.

It was defined according to equation:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})} / x]$   
W/kg, for test separation distances  $\leq 50$  mm; where  $x = 7.5$  for 1-g SAR and  $x = 18.75$  for 10-g SAR

| Frequency [GHz] | Max power (including tune-up tolerance) | Max Power [mW] | Antenna to edge distance [mm] | Estimated SAR Result (4.3.2 b)) |
|-----------------|-----------------------------------------|----------------|-------------------------------|---------------------------------|
| 3.494           | -9                                      | 0.1259         | 5                             | 0.006                           |

According to 47CFR §2.1093 Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

**Power Density** is calculated by equation:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot R^2}$$

Where,

S = Power Density

P = Power Input to Antenna

G = Gain of Antenna

R = Distance from transmitting Antenna

| Modes of Operation | Frequency [MHz] | Distance, R [cm] | Maximum power input to Antenna, P [dBm] | Power Input to Antenna, P [mW] | Power Gain of Antenna, G [dBi] | Power Density, S [mW/cm <sup>2</sup> ] |
|--------------------|-----------------|------------------|-----------------------------------------|--------------------------------|--------------------------------|----------------------------------------|
| IEEE802.15.4       | 6489            | 5                | -9                                      | 0.126                          | 0.44                           | 0.00044                                |

### 3. OUTPUT POWER

#### 3.1 Maximum Output Power

From a Customer;

WLAN: Maximum defined output power, including tolerance of  $\pm 1.5$  dBm.

| Standard | Transmission mode | Modulation | Data rate [MBPS] | Output power [dBm] |             |             |
|----------|-------------------|------------|------------------|--------------------|-------------|-------------|
|          |                   |            |                  | CH 1               | CH 6        | CH 11       |
| 802.11b  | DSSS              | BPSK       | 1                | 10.5               | 10.5        | 10.5        |
| 802.11b  | DSSS              | BPSK       | 2                | 12.5               | 12.5        | 12.5        |
| 802.11b  | DSSS              | BPSK       | 5.5              | <b>15.5</b>        | <b>15.5</b> | <b>15.5</b> |
| 802.11b  | DSSS              | BPSK       | 11               | 15.5               | 15.5        | 15.5        |

Maximum tuning power defined for 802.11g/n mode is 14 dBm  $\pm 1.5$  dBm thus 802.11b is selected for SAR testing.

Bluetooth: Maximum defined output power.

| Standard  | Output power [dBm] |          |          |
|-----------|--------------------|----------|----------|
|           | 2402 MHz           | 2441 MHz | 2480 MHz |
| Bluetooth | 8.0                | 8.0      | 8.0      |

UWB, Maximum defined output power

| Transmission mode | Output power [dBm] |
|-------------------|--------------------|
| IEEE802.15.4      | -9                 |

#### 3.2 Tested conducted power

Conducted output power;

WLAN:

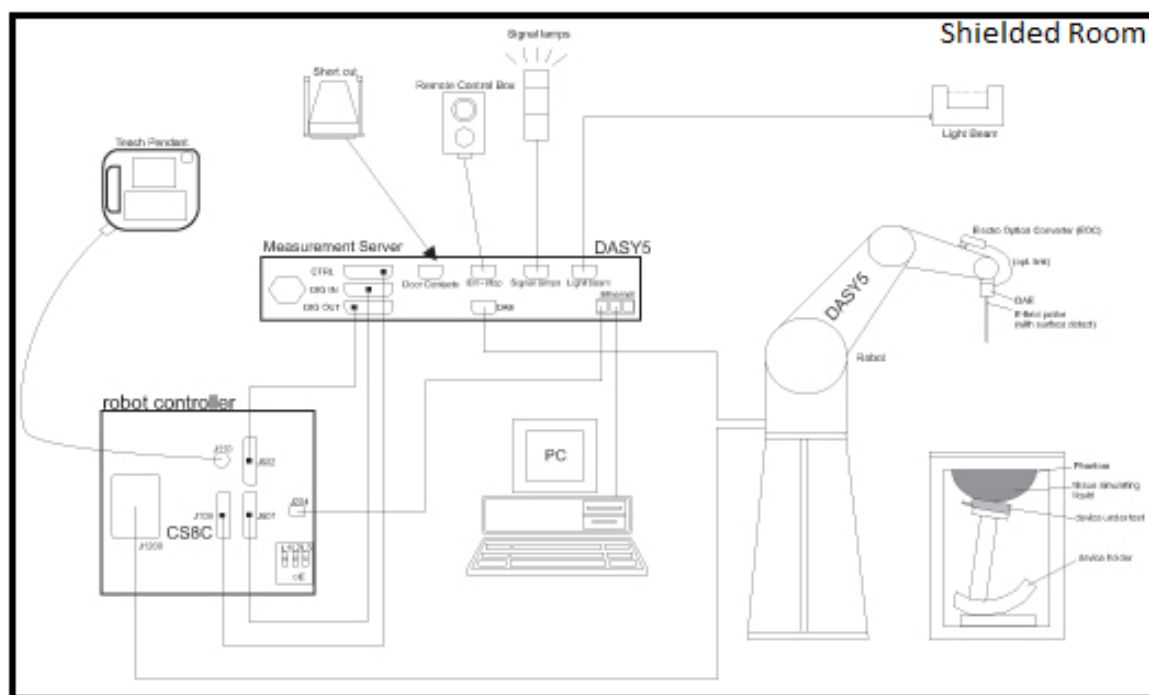
| Standard | Transmission mode | Modulation | Data rate [MBPS] | Output power [dBm] |       |       |
|----------|-------------------|------------|------------------|--------------------|-------|-------|
|          |                   |            |                  | CH 1               | CH 6  | CH 11 |
| 802.11b  | DSSS              | BPSK       | 5.5              | <b>13.25</b>       | 12.66 | 11.95 |

Bluetooth:

| Standard  | Output power [dBm] |          |            |
|-----------|--------------------|----------|------------|
|           | 2402 MHz           | 2441 MHz | 2480 MHz   |
| Bluetooth | 4.92               | 6.93     | <b>8.0</b> |

## 4. TEST EQUIPMENT

Dasy52 near field scanning systems, manufactured by SPEAG were used for SAR testing. The test system consists of high precision robotics system (Staubli), robot controller, computer, near-field probe, probe alignment sensor, and a phantom containing the tissue equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location of maximum electromagnetic field.



**Figure 1 Schematic Laboratory Picture**

### 4.1 Test Equipment List

Main used test system components are listed below. For full equipment list and calibration intervals, please contact the testing laboratory.

| Test Equipment   | Model       | Serial Number | Calibration Date |
|------------------|-------------|---------------|------------------|
| DAE              | DAE4        | 756           | 03.2018          |
| Probe            | EX3DV4      | 7447          | 03.2018          |
| Dipole           | D2450V2     | 729           | 07.2017          |
| DASY5 Software   | 52.8.8.1258 | -             | NA               |
| Signal Generator | SMIQ06B     | 835136042     | NA               |
| Amplifier        | AR          | 320421        | NA               |
| Power meter      | NRP-Z81     | 100218        | 12.2017          |

#### 4.1.1 Isotropic E-field Probe Type EX3DV4

|                     |                                                                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Construction</b> | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| <b>Calibration</b>  | Calibration certificate in Appendix D                                                                                                                       |

|                      |                                                                                                                                                  |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Frequency</b>     | 10 MHz to >6 GHz (dosimetry); Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)                                                                          |
| <b>Directivity</b>   | $\pm 0.3$ dB in HSL (rotation around probe axis)<br>$\pm 0.5$ dB in tissue material (rotation normal to probe axis)                              |
| <b>Dynamic Range</b> | 10 $\mu$ W/g to > 100 mW/g, Linearity: $\pm 0.2$ dB                                                                                              |
| <b>Dimensions</b>    | Overall length: 330 mm<br>Tip length: 10 mm<br>Body diameter: 12 mm<br>Tip diameter: 2.5 mm<br>Distance from probe tip to dipole centers: 1.0 mm |
| <b>Application</b>   | General dosimetry up to 6 GHz<br>Compliance tests of mobile phones<br>Fast automatic scanning in arbitrary phantoms                              |

## 4.2 Phantoms

### Modular Flat Phantom (MFP)

The Triple Modular Phantom consists of three identical modules that can be installed and removed separately without emptying the liquid. It is used for compliance testing of small wireless devices in body-worn configurations.

## 4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEEE 1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within  $\pm 10\%$  of the recommended values in all frequencies used. A liquid compensation algorithm was used in DASY5 with which measured peak average SAR values were corrected for the deviation of used liquid. Depth of the tissue simulant was at least 15.0 cm from the inner surface of the flat phantom.

| <b>Body 600-6000 MHz tissue simulant liquid Ingredients</b> |
|-------------------------------------------------------------|
| Deionized Water, tween, salt                                |

#### 4.4 System Validation Status

| Frequency [MHz] | Test System | Dipole Type / SN | Probe Type / SN   | Calibrated Signal Type | DAE Unit / SN | Dielectric Constant $\epsilon$ Body tissue simulant | Conductivity $\sigma$ [S/m] Body tissue simulant | Validation Done      |
|-----------------|-------------|------------------|-------------------|------------------------|---------------|-----------------------------------------------------|--------------------------------------------------|----------------------|
|                 |             |                  |                   |                        |               |                                                     |                                                  | Body tissue simulant |
| 2450            | SAR 2       | D2450V2- SN:729  | EX3DV4 - SN: 7447 | CW                     | DAE 4 / 756   | 52.9                                                | 1.89                                             | 04.2018              |

#### 4.5 System Check

| Date     | Tissue Type | Tissue Temp. [°C] | Frequency [MHz] | Input Power | Measured SAR <sub>1g</sub> [W/kg] | 1 W Target SAR <sub>1g</sub> [W/kg] | 1 W Normalized SAR <sub>1g</sub> [W/kg] | Deviation 1g (%) | Plot # |
|----------|-------------|-------------------|-----------------|-------------|-----------------------------------|-------------------------------------|-----------------------------------------|------------------|--------|
| 6.6.2018 | M600-6000   | 22±2              | 2450            | 250mW       | 12.2                              | 53.7                                | 48.8                                    | -9.1             | 1      |

##### 4.5.1 Tissue Simulant Verification

| Date     | Tissue Type | Tissue Temp. [°C] | Frequency [MHz] | Target                       |                                | Measured                    |                                | Deviation $\sigma$ (%) | Deviation $\epsilon$ (%) |
|----------|-------------|-------------------|-----------------|------------------------------|--------------------------------|-----------------------------|--------------------------------|------------------------|--------------------------|
|          |             |                   |                 | Conductivity, $\sigma$ [S/m] | Dielectric Constant $\epsilon$ | Conductivity $\sigma$ [S/m] | Dielectric Constant $\epsilon$ |                        |                          |
| 6.6.2018 | M600-6000   | 22                | 2450            | 1.95                         | 52.7                           | 1.98                        | 50.4                           | 1.7                    | -4.4                     |
|          |             |                   | 2412            | 1.91                         | 52.8                           | 1.95                        | 50.4                           | 2.0                    | -4.4                     |
|          |             |                   | 2480            | 1.99                         | 52.7                           | 2.0                         | 50.4                           | 0.6                    | -4.4                     |

## 5. TEST PROCEDURE

The DUT was set to transmit continuously at a maximum power level using a manufacturer specified software.

### 5.1.1 *Body-worn Configuration*, 5 mm separation distance

The DUT was placed below the flat phantom using a SPEAG device holder. The DUT was lifted towards the phantom until 5mm separation distance was reached.

Photos of the test positions are presented in appendix A.

## 5.2 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan with 7x7x7 points covering a volume of 30x30x30mm was performed around the highest E-field value to determine the averaged SAR value. Power drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

## 5.3 SAR Averaging Methods

The maximum SAR value is averaged over a cube of tissue using interpolation and extrapolation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy47 are all based on the modified Quadratic Shepard's method (Robert J. Renka, "Multivariate Interpolation of Large Sets of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

## 6. MEASUREMENT UNCERTAINTY

| <b>Uncertainty Budget</b><br><b>IEEE 1528-2013</b> |               |             |      |                      |                       |                |                 |                                       |
|----------------------------------------------------|---------------|-------------|------|----------------------|-----------------------|----------------|-----------------|---------------------------------------|
| Error Description                                  | Uncert. value | Prob. Dist. | Div. | (c <sub>i</sub> ) 1g | (c <sub>i</sub> ) 10g | Std. Unc. (1g) | Std. Unc. (10g) | (v <sub>i</sub> )<br>v <sub>eff</sub> |
| <b>Measurement System</b>                          |               |             |      |                      |                       |                |                 |                                       |
| Probe Calibration                                  | ±6.0 %        | N           | 1    | 1                    | 1                     | ±6.0 %         | ±6.0 %          | ∞                                     |
| Axial Isotropy                                     | ±4.7 %        | R           |      | 0.7                  | 0.7                   | ±1.9 %         | ±1.9 %          | ∞                                     |
| Hemispherical Isotropy                             | ±9.6 %        | R           | 1.73 | 0.7                  | 0.7                   | ±3.9 %         | ±3.9 %          | ∞                                     |
| Boundary Effects                                   | ±1.0 %        | R           | 1.73 | 1                    | 1                     | ±0.6 %         | ±0.6 %          | ∞                                     |
| Linearity                                          | ±4.7 %        | R           | 1.73 | 1                    | 1                     | ±2.7 %         | ±2.7 %          | ∞                                     |
| System Detection Limits                            | ±1.0 %        | R           | 1.73 | 1                    | 1                     | ±0.6 %         | ±0.6 %          | ∞                                     |
| Modulation Response <sup>m</sup>                   | ±2.4 %        | R           | 1.73 | 1                    | 1                     | ±1.4 %         | ±1.4 %          | ∞                                     |
| Readout Electronics                                | ±0.3 %        | N           | 1    | 1                    | 1                     | ±0.3 %         | ±0.3 %          | ∞                                     |
| Response Time                                      | ±0.8 %        | R           | 1.73 | 1                    | 1                     | ±0.5 %         | ±0.5 %          | ∞                                     |
| Integration Time                                   | ±2.6 %        | R           | 1.73 | 1                    | 1                     | ±1.5 %         | ±1.5 %          | ∞                                     |
| RF Ambient Noise                                   | ±3.0 %        | R           | 1.73 | 1                    | 1                     | ±1.7 %         | ±1.7 %          | ∞                                     |
| RF Ambient Reflections                             | ±3.0 %        | R           | 1.73 | 1                    | 1                     | ±1.7 %         | ±1.7 %          | ∞                                     |
| Probe Positioner                                   | ±0.4 %        | R           | 1.73 | 1                    | 1                     | ±0.2 %         | ±0.2 %          | ∞                                     |
| Probe Positioning                                  | ±2.9 %        | R           | 1.73 | 1                    | 1                     | ±1.7 %         | ±1.7 %          | ∞                                     |
| Max. SAR Eval.                                     | ±2.0 %        | R           | 1.73 | 1                    | 1                     | ±1.2 %         | ±1.2 %          | ∞                                     |
| <b>Test Sample Related</b>                         |               |             |      |                      |                       |                |                 |                                       |
| Device Positioning                                 | ±2.9 %        | N           | 1    | 1                    | 1                     | ±2.9 %         | ±2.9 %          | 145                                   |
| Device Holder                                      | ±3.6 %        | N           | 1    | 1                    | 1                     | ±3.6 %         | ±3.6 %          | 5                                     |
| Power Drift                                        | ±5.0 %        | R           | 1.73 | 1                    | 1                     | ±2.9 %         | ±2.9 %          | ∞                                     |
| Power Scaling                                      | ±6 %          | R           | 1.73 | 1                    | 1                     | ±3.5 %         | ± 3.5%          | ∞                                     |
| <b>Phantom and Setup</b>                           |               |             |      |                      |                       |                |                 |                                       |
| Phantom Uncertainty                                | ±6.1 %        | R           | 1.73 | 1                    | 1                     | ±3.5 %         | ±3.5 %          | ∞                                     |
| SAR correction                                     | ±1.9 %        | R           | 1.73 | 1                    | 0.84                  | ±1.1 %         | ±0.9 %          | ∞                                     |
| Liquid Conductivity (mea.)                         | ±2.5 %        | R           | 1.73 | 0.78                 | 0.71                  | ±1.1 %         | ±1.0 %          | ∞                                     |
| Liquid Permittivity (mea.)                         | ±2.5 %        | R           | 1.73 | 0.26                 | 0.26                  | ±0.3 %         | ±0.4 %          | ∞                                     |
| Temp. unc. - Conductivity                          | ±3.4 %        | R           | 1.73 | 0.78                 | 0.71                  | ±1.5 %         | ±1.4 %          | ∞                                     |
| Temp. unc. - Permittivity                          | ±0.4 %        | R           | 1.73 | 0.23                 | 0.26                  | ±0.1 %         | ±0.1 %          | ∞                                     |
| Combined Std. Uncertainty                          |               |             |      |                      |                       | ±11.7 %        | ±11.6 %         | 361                                   |
| <b>Expanded STD Uncertainty</b>                    |               |             |      |                      |                       | <b>±23.4 %</b> | <b>±23.3 %</b>  |                                       |

## 7. TEST RESULTS

### 7.1 Body-Worn Configuration 2.4GHz WLAN, 5 mm separation distance

| Band    | Channel | Test Position** | Maximum Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Duty Cycle | Measured SAR <sub>1g</sub> [mW/g] | Scaling Factor | Reported SAR <sub>1g</sub> [mW/g] | Plot # |
|---------|---------|-----------------|---------------------|-----------------------|------------------|------------|-----------------------------------|----------------|-----------------------------------|--------|
| 802.11b | 1       | Left side       | 15.5                | 13.25                 | -0.22*           | 1          | 0.26                              | 1.77           | <b>0.46</b>                       | 2      |
| 802.11b | 1       | Right side      | 15.5                | 13.25                 | -0.11            | 1          | 0.0723                            | 1.68           | 0.12                              |        |
| 802.11b | 1       | Top side        | 15.5                | 13.25                 | 0.2              | 1          | 0.0309                            | 1.68           | 0.05                              |        |
| 802.11b | 1       | Bottom side     | 15.5                | 13.25                 | -0.2             | 1          | 0.0124                            | 1.68           | 0.02                              |        |
| 802.11b | 1       | Front           | 15.5                | 13.25                 | -0.03            | 1          | 0.132                             | 1.68           | 0.22                              |        |
| 802.11b | 1       | Back            | 15.5                | 13.25                 | 0.08             | 1          | 0.179                             | 1.68           | 0.30                              |        |

\*Drift considered in the scaling factor

\*\*Picture of the test position is presented in appendix A.

### 7.2 Body-Worn Configuration Bluetooth, 5 mm separation distance

| Band | Channel | Test Position** | Maximum Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Duty Cycle | Measured SAR <sub>1g</sub> [mW/g] | Scaling Factor | Reported SAR <sub>1g</sub> [mW/g] | Plot # |
|------|---------|-----------------|---------------------|-----------------------|------------------|------------|-----------------------------------|----------------|-----------------------------------|--------|
| 2.45 | 78      | Left side       | 8                   | 8.0                   | -0.54*           | 1          | 0.0009                            | 1.13           | 0.001                             |        |
| 2.45 | 78      | Right side      | 8                   | 8.0                   | 0.17             | 1          | 0.06                              | 1.00           | 0.060                             |        |
| 2.45 | 78      | Top side        | 8                   | 8.0                   | NA***            | 1          | 0.0019                            | 1.00           | 0.002                             |        |
| 2.45 | 78      | Bottom side     | 8                   | 8.0                   | NA***            | 1          | 0.00034                           | 1.00           | 0.0003                            |        |
| 2.45 | 78      | Front           | 8                   | 8.0                   | 0.32*            | 1          | 0.035                             | 1.08           | 0.038                             |        |
| 2.45 | 78      | Back            | 8                   | 8.0                   | 0.89*            | 1          | 0.058                             | 1.23           | <b>0.072</b>                      | 3      |

\*Drift considered in the scaling factor

\*\*The picture of the test position is presented in appendix A.

\*\*\* Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

### 7.3 Limb Configuration checks, 0 mm separation distance

| Band     | Channel | Test Position** | Maximum Power [dBm] | Conducted Power [dBm] | Power Drift [dB] | Duty Cycle | Measured SAR <sub>10g</sub> [mW/g] | Scaling Factor | Reported SAR <sub>10g</sub> [mW/g] | Plot # |
|----------|---------|-----------------|---------------------|-----------------------|------------------|------------|------------------------------------|----------------|------------------------------------|--------|
| WLAN 2.4 | 1       | Left side       | 15.5                | 13.25                 | -0.11            | 1          | 0.328                              | 1.68           | 0.55                               |        |
| BT 2.45  | 78      | Back side       | 8                   | 8.0                   | 0.49             | 1          | 0.0768                             | 1.12           | 0.086                              |        |

### 7.4 Simultaneous transmission evaluation

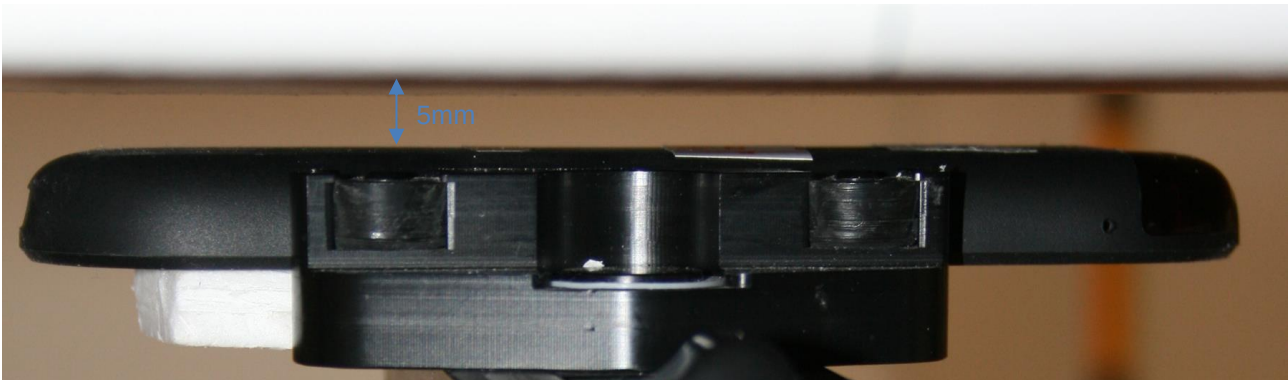
| Exposure Condition      | Body SAR <sub>1g</sub> [mW/g] |       |       |        |       |       |
|-------------------------|-------------------------------|-------|-------|--------|-------|-------|
| Test Position           | Left                          | Right | Top   | Bottom | Front | Back  |
| WLAN 2.4 GHZ            | 0.46                          | 0.12  | 0.05  | 0.02   | 0.22  | 0.3   |
| Bluetooth 2.45 GHZ      | 0.001                         | 0.060 | 0.002 | 0.0003 | 0.038 | 0.072 |
| UWB positioning 3.5 GHz | 0.006                         | 0.006 | 0.006 | 0.006  | 0.006 | 0.006 |
| SAR Summation           | 0.47                          | 0.19  | 0.06  | 0.03   | 0.26  | 0.38  |

| Exposure Condition               | Body SAR <sub>1g</sub> [mW/g] or Power density / requirement |        |        |        |        |        |
|----------------------------------|--------------------------------------------------------------|--------|--------|--------|--------|--------|
| Test Position                    | Left                                                         | Right  | Top    | Bottom | Front  | Back   |
| WLAN 2.4GHZ                      | 0.2875                                                       | 0.0750 | 0.0313 | 0.0125 | 0.1375 | 0.1875 |
| Bluetooth 2.45GHZ                | 0.001                                                        | 0.060  | 0.002  | 0.0003 | 0.038  | 0.072  |
| UWB positioning 6.4G             | 0.0004                                                       | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 |
| Summation                        | 0.29                                                         | 0.14   | 0.03   | 0.01   | 0.18   | 0.26   |
| Simultaneous exposure evaluation | SUM<1                                                        | SUM<1  | SUM<1  | SUM<1  | SUM<1  | SUM<1  |

## APPENDIX A: PHOTOS OF THE DUT

Size of the DUT is: 135 x 40 x 10 mm





Back of the DUT toward the phantom.



Front of the DUT toward the phantom.



Right side of the DUT toward the phantom.



Left side of the DUT toward the phantom.



Bottom side of the DUT toward the phantom.



Top side of the DUT toward the phantom.

## APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 6.6.2018 9:29:26

Test Laboratory: Verkotan Oy

**DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:729**

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.983$  S/m;  $\epsilon_r = 50.391$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.68, 7.68, 7.68); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 31.0$
- Electronics: DAE4 Sn756; Calibrated: 8.3.2018
- Phantom: SAR2\_Phantom 1\_triple flat; Type: QD 000 P51 Cx; Serial: 03\_May\_2017
- DASYS2 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Pin=250 mW/Zoom Scan (7x9x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 88.44 V/m; Power Drift = -0.01 dB

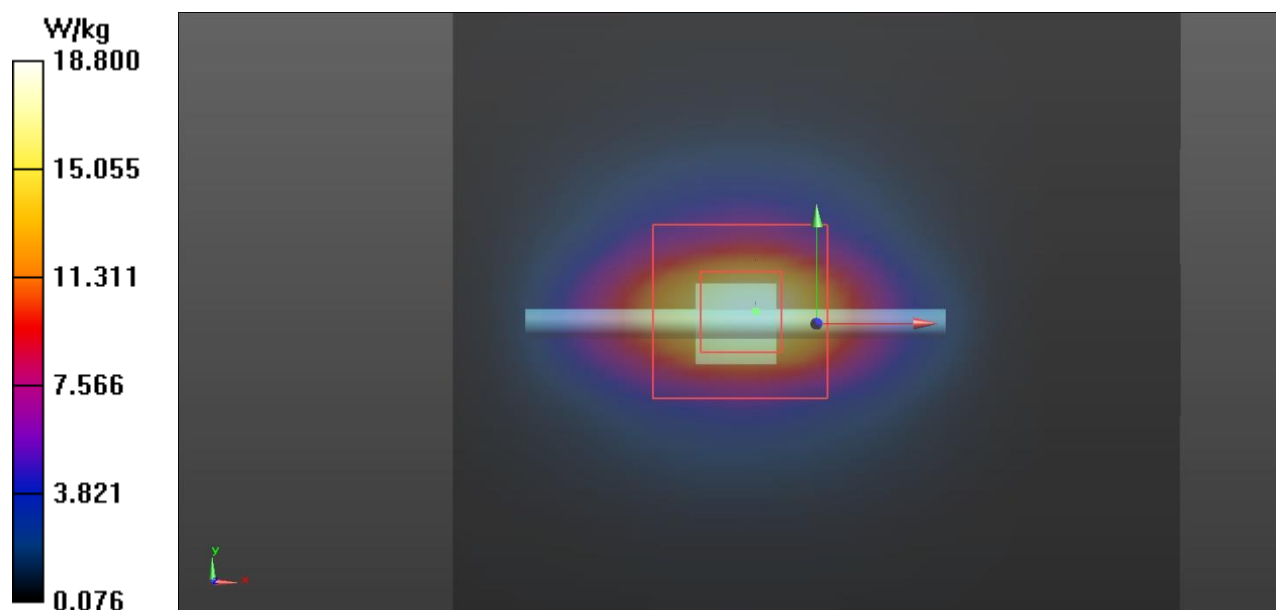
Peak SAR (extrapolated) = 24.8 W/kg

**SAR(1 g) = 12.2 W/kg; SAR(10 g) = 5.72 W/kg** (SAR corrected for target medium)

Maximum value of SAR (measured) = 18.8 W/kg

**Pin=250 mW/Area Scan (61x61x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 20.1 W/kg



## APPENDIX C: MEASUREMENT SCAN

Plot 2

Date/Time: 6.6.2018 11:22:27

Test Laboratory: Verkotan Oy

### DUT: 7Hugs

Communication System: UID 0, WLAN 2.4 (0); Communication System Band: WLAN2.4GHz; Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.951$  S/m;  $\epsilon_r = 50.445$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.68, 7.68, 7.68); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = -4.0, 31.0$
- Electronics: DAE4 Sn756; Calibrated: 8.3.2018
- Phantom: SAR2\_Phantom 1\_triple flat; Type: QD 000 P51 Cx; Serial: 03\_May\_2017
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Configuration/DUT 3 Left side/Area Scan (131x41x1):** Interpolated grid:  $dx=1.200$  mm,  $dy=1.200$  mm

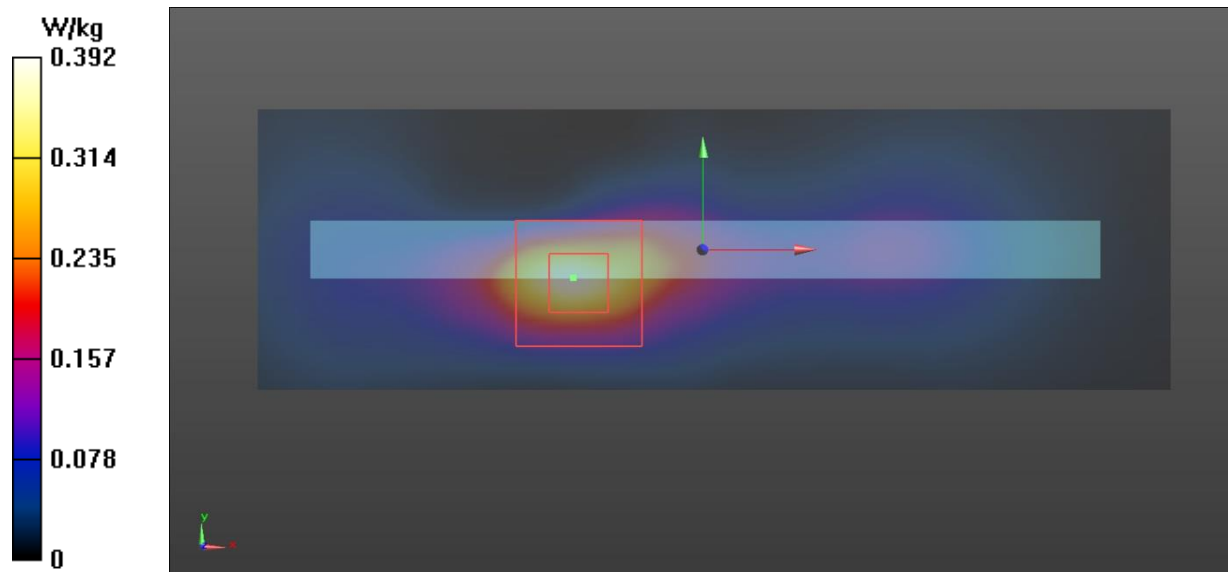
Maximum value of SAR (interpolated) = 0.392 W/kg

**Configuration/DUT 3 Left side/Zoom Scan 2 (5x5x7)/Cube 0:** Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

Reference Value = 9.672 V/m; Power Drift = -0.22 dB Peak SAR (extrapolated) = 0.591 W/kg

**SAR(1 g) = 0.260 W/kg; SAR(10 g) = 0.106 W/kg** (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.450 W/kg



Plot 3

Test Laboratory: Verkotan Oy

## DUT: 7Hugs

Communication System: UID 0, Bluetooth (0); Communication System Band: Bluetooth; Frequency: 2480 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used:  $f = 2480$  MHz;  $\sigma = 2.005$  S/m;  $\epsilon_r = 50.358$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.68, 7.68, 7.68); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = -4.0, 31.0$
- Electronics: DAE4 Sn756; Calibrated: 8.3.2018
- Phantom: SAR2\_Phantom 1\_triple flat; Type: QD 000 P51 Cx; Serial: 03\_May\_2017
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

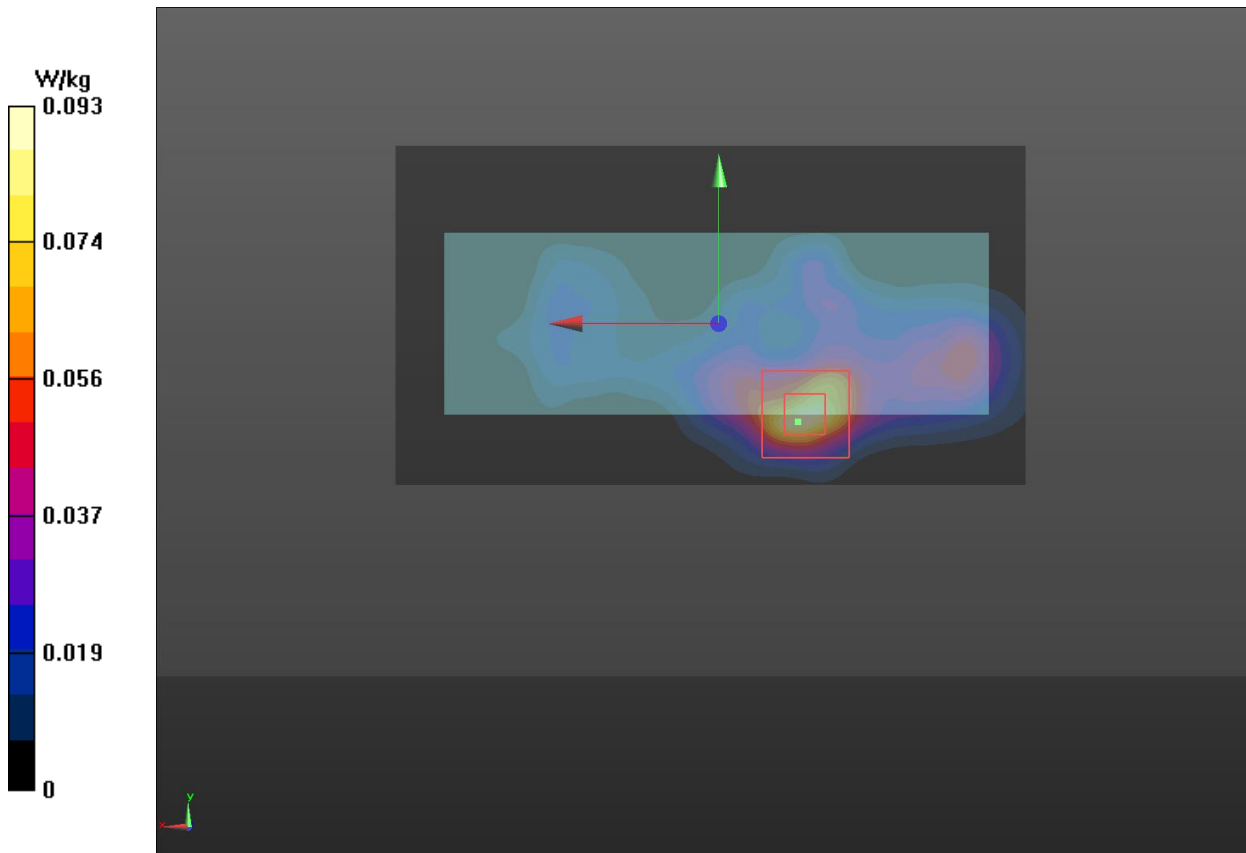
**Configuration 2/DUT 2 Back side 2 2/Zoom Scan 2 (6x6x7)/Cube 0:** Measurement grid:  $dx=7.5$ mm,  $dy=7.5$ mm,  $dz=5$ mm

Reference Value = 1.835 V/m; Power Drift = 0.89 dB

Peak SAR (extrapolated) = 0.129 W/kg

**SAR(1 g) = 0.058 W/kg; SAR(10 g) = 0.025 W/kg** (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.0931 W/kg



## APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION REPORTS

Calibration Laboratory of  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst  
S Service suisse d'étalonnage  
S Servizio svizzero di taratura  
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **Verkotan**

Certificate No: EX3-7447\_Mar18

### CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7447**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **March 20, 2018**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|------------------|-----------------------------------|------------------------|
| Power meter NRP            | SN: 104778       | 04-Apr-17 (No. 217-02521/02522)   | Apr-18                 |
| Power sensor NRP-Z91       | SN: 103244       | 04-Apr-17 (No. 217-02521)         | Apr-18                 |
| Power sensor NRP-Z91       | SN: 103245       | 04-Apr-17 (No. 217-02525)         | Apr-18                 |
| Reference 20 dB Attenuator | SN: S5277 (20x)  | 07-Apr-17 (No. 217-02528)         | Apr-18                 |
| Reference Probe ES3DV2     | SN: 3013         | 30-Dec-17 (No. ES3-3013_Dec17)    | Dec-18                 |
| DAE4                       | SN: 660          | 21-Dec-17 (No. DAE4-660_Dec17)    | Dec-18                 |
| Secondary Standards        | ID               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B         | SN: GB41293874   | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A        | SN: MY41498087   | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A        | SN: 000110210    | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| RF generator HP 8648C      | SN: US3642U01700 | 04-Aug-99 (in house check Jun-16) | In house check: Jun-18 |
| Network Analyzer HP 8753E  | SN: US37390585   | 18-Oct-01 (in house check Oct-17) | In house check: Oct-18 |

|                        | Name          | Function              | Signature |
|------------------------|---------------|-----------------------|-----------|
| Calibrated by:         | Jeton Kasrati | Laboratory Technician |           |
| Approved by:           | Katja Pokovic | Technical Manager     |           |
| Issued: March 22, 2018 |               |                       |           |

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

EX3DV4- SN:7447

March 20, 2018

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7447

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-----------|
| 750                  | 41.9                               | 0.89                            | 10.35   | 10.35   | 10.35   | 0.50               | 0.80                    | ± 12.0 %  |
| 900                  | 41.5                               | 0.97                            | 9.63    | 9.63    | 9.63    | 0.43               | 0.89                    | ± 12.0 %  |
| 1750                 | 40.1                               | 1.37                            | 8.68    | 8.68    | 8.68    | 0.35               | 0.85                    | ± 12.0 %  |
| 1950                 | 40.0                               | 1.40                            | 8.76    | 8.76    | 8.76    | 0.32               | 0.85                    | ± 12.0 %  |
| 2150                 | 39.7                               | 1.53                            | 8.65    | 8.65    | 8.65    | 0.29               | 0.85                    | ± 12.0 %  |
| 2300                 | 39.5                               | 1.67                            | 8.21    | 8.21    | 8.21    | 0.31               | 0.88                    | ± 12.0 %  |
| 2450                 | 39.2                               | 1.80                            | 7.77    | 7.77    | 7.77    | 0.34               | 0.85                    | ± 12.0 %  |
| 2600                 | 39.0                               | 1.96                            | 7.46    | 7.46    | 7.46    | 0.39               | 0.85                    | ± 12.0 %  |
| 5250                 | 35.9                               | 4.71                            | 5.17    | 5.17    | 5.17    | 0.35               | 1.80                    | ± 13.1 %  |
| 5600                 | 35.5                               | 5.07                            | 4.46    | 4.46    | 4.46    | 0.40               | 1.80                    | ± 13.1 %  |
| 5750                 | 35.4                               | 5.22                            | 4.68    | 4.68    | 4.68    | 0.40               | 1.80                    | ± 13.1 %  |

<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4- SN:7447

March 20, 2018

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7447

### Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth (mm) | Unc (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|------------|-----------|
| 750                  | 55.5                               | 0.96                            | 10.20   | 10.20   | 10.20   | 0.56               | 0.80       | ± 12.0 %  |
| 900                  | 55.0                               | 1.05                            | 9.89    | 9.89    | 9.89    | 0.41               | 0.96       | ± 12.0 %  |
| 1750                 | 53.4                               | 1.49                            | 8.25    | 8.25    | 8.25    | 0.36               | 0.87       | ± 12.0 %  |
| 1950                 | 53.3                               | 1.52                            | 8.12    | 8.12    | 8.12    | 0.35               | 0.85       | ± 12.0 %  |
| 2450                 | 52.7                               | 1.95                            | 7.68    | 7.68    | 7.68    | 0.39               | 0.90       | ± 12.0 %  |
| 2600                 | 52.5                               | 2.16                            | 7.48    | 7.48    | 7.48    | 0.25               | 1.05       | ± 12.0 %  |
| 5250                 | 48.9                               | 5.36                            | 4.36    | 4.36    | 4.36    | 0.50               | 1.90       | ± 13.1 %  |
| 5600                 | 48.5                               | 5.77                            | 3.74    | 3.74    | 3.74    | 0.50               | 1.90       | ± 13.1 %  |
| 5750                 | 48.3                               | 5.94                            | 4.05    | 4.05    | 4.05    | 0.50               | 1.90       | ± 13.1 %  |

<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

## APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS



### SAR Reference Dipole Calibration Report

Ref : ACR.165.32.17.SATU.A

**VERKOTAN LTD.**  
ELEKTRONIIKKATIE 17  
90590, OULU, FINLAND  
**SAR REFERENCE DIPOLE**  
FREQUENCY: 2450 MHZ  
SERIAL NO.: D2450V2-729

Calibrated at MVG US  
2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 06/14/17

#### Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.165.32.17.SATU.A

|                      | <i>Name</i>   | <i>Function</i> | <i>Date</i> | <i>Signature</i>     |
|----------------------|---------------|-----------------|-------------|----------------------|
| <i>Prepared by :</i> | Jérôme LUC    | Product Manager | 6/14/2017   | <i>JS</i>            |
| <i>Checked by :</i>  | Jérôme LUC    | Product Manager | 6/14/2017   | <i>JS</i>            |
| <i>Approved by :</i> | Kim RUTKOWSKI | Quality Manager | 6/14/2017   | <i>Kim Rutkowski</i> |

|                       | <i>Customer Name</i> |
|-----------------------|----------------------|
| <i>Distribution :</i> | Verkotan Ltd.        |

| <i>Issue</i> | <i>Date</i> | <i>Modifications</i> |
|--------------|-------------|----------------------|
| A            | 6/14/2017   | Initial release      |
|              |             |                      |
|              |             |                      |
|              |             |                      |

Page: 2/11

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.165.32.17.SATU.A

|      |            |      |            |      |
|------|------------|------|------------|------|
| 1950 | 40.0 ± 5 % |      | 1.40 ± 5 % |      |
| 2000 | 40.0 ± 5 % |      | 1.40 ± 5 % |      |
| 2100 | 39.8 ± 5 % |      | 1.49 ± 5 % |      |
| 2300 | 39.5 ± 5 % |      | 1.67 ± 5 % |      |
| 2450 | 39.2 ± 5 % | PASS | 1.80 ± 5 % | PASS |
| 2600 | 39.0 ± 5 % |      | 1.96 ± 5 % |      |
| 3000 | 38.5 ± 5 % |      | 2.40 ± 5 % |      |
| 3500 | 37.9 ± 5 % |      | 2.91 ± 5 % |      |

### 7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

|                                           |                                                           |
|-------------------------------------------|-----------------------------------------------------------|
| Software                                  | OPENSAR V4                                                |
| Phantom                                   | SN 20/09 SAM71                                            |
| Probe                                     | SN 18/11 EPG122                                           |
| Liquid                                    | Head Liquid Values: $\epsilon_{ps}^*$ : 37.5 sigma : 1.80 |
| Distance between dipole center and liquid | 10.0 mm                                                   |
| Area scan resolution                      | dx=8mm/dy=8mm                                             |
| Zoon Scan Resolution                      | dx=5mm/dy=5mm/dz=5mm                                      |
| Frequency                                 | 2450 MHz                                                  |
| Input power                               | 20 dBm                                                    |
| Liquid Temperature                        | 21 °C                                                     |
| Lab Temperature                           | 21 °C                                                     |
| Lab Humidity                              | 45 %                                                      |

| Frequency<br>MHz | 1 g SAR (W/kg/W) |          | 10 g SAR (W/kg/W) |          |
|------------------|------------------|----------|-------------------|----------|
|                  | required         | measured | required          | measured |
| 300              | 2.85             |          | 1.94              |          |
| 450              | 4.58             |          | 3.06              |          |
| 750              | 8.49             |          | 5.55              |          |
| 835              | 9.56             |          | 6.22              |          |
| 900              | 10.9             |          | 6.99              |          |
| 1450             | 29               |          | 16                |          |
| 1500             | 30.5             |          | 16.8              |          |
| 1640             | 34.2             |          | 18.4              |          |
| 1750             | 36.4             |          | 19.3              |          |
| 1800             | 38.4             |          | 20.1              |          |
| 1900             | 39.7             |          | 20.5              |          |
| 1950             | 40.5             |          | 20.9              |          |

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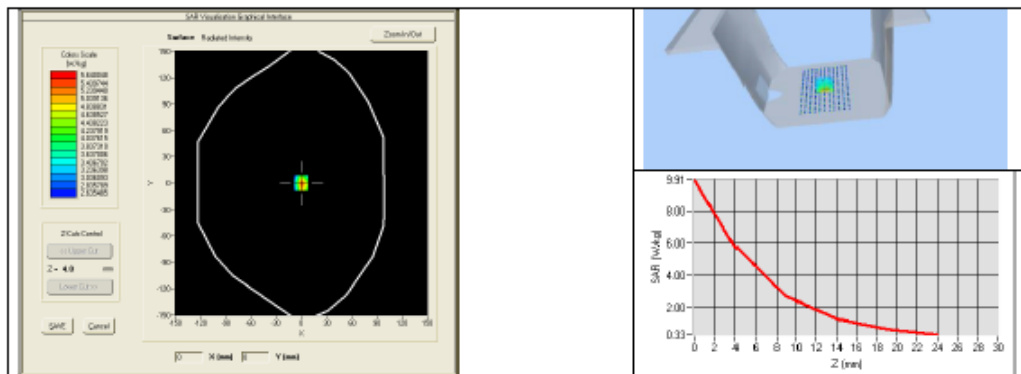
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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.165.32.17.SATUA

|      |      |              |      |              |
|------|------|--------------|------|--------------|
| 2000 | 41.1 |              | 21.1 |              |
| 2100 | 43.6 |              | 21.9 |              |
| 2300 | 48.7 |              | 23.3 |              |
| 2450 | 52.4 | 53.43 (5.34) | 24   | 24.05 (2.41) |
| 2600 | 55.3 |              | 24.6 |              |
| 3000 | 63.8 |              | 25.7 |              |
| 3500 | 67.1 |              | 25   |              |



### 7.3 BODY LIQUID MEASUREMENT

| Frequency<br>MHz | Relative permittivity ( $\epsilon_r'$ ) |          | Conductivity ( $\sigma$ ) S/m |          |
|------------------|-----------------------------------------|----------|-------------------------------|----------|
|                  | required                                | measured | required                      | measured |
| 150              | 61.9 $\pm$ 5 %                          |          | 0.80 $\pm$ 5 %                |          |
| 300              | 58.2 $\pm$ 5 %                          |          | 0.92 $\pm$ 5 %                |          |
| 450              | 56.7 $\pm$ 5 %                          |          | 0.94 $\pm$ 5 %                |          |
| 750              | 55.5 $\pm$ 5 %                          |          | 0.96 $\pm$ 5 %                |          |
| 835              | 55.2 $\pm$ 5 %                          |          | 0.97 $\pm$ 5 %                |          |
| 900              | 55.0 $\pm$ 5 %                          |          | 1.05 $\pm$ 5 %                |          |
| 915              | 55.0 $\pm$ 5 %                          |          | 1.06 $\pm$ 5 %                |          |
| 1450             | 54.0 $\pm$ 5 %                          |          | 1.30 $\pm$ 5 %                |          |
| 1610             | 53.8 $\pm$ 5 %                          |          | 1.40 $\pm$ 5 %                |          |
| 1800             | 53.3 $\pm$ 5 %                          |          | 1.52 $\pm$ 5 %                |          |
| 1900             | 53.3 $\pm$ 5 %                          |          | 1.52 $\pm$ 5 %                |          |
| 2000             | 53.3 $\pm$ 5 %                          |          | 1.52 $\pm$ 5 %                |          |
| 2100             | 53.2 $\pm$ 5 %                          |          | 1.62 $\pm$ 5 %                |          |
| 2450             | 52.7 $\pm$ 5 %                          | PASS     | 1.95 $\pm$ 5 %                | PASS     |
| 2600             | 52.5 $\pm$ 5 %                          |          | 2.16 $\pm$ 5 %                |          |
| 3000             | 52.0 $\pm$ 5 %                          |          | 2.73 $\pm$ 5 %                |          |

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

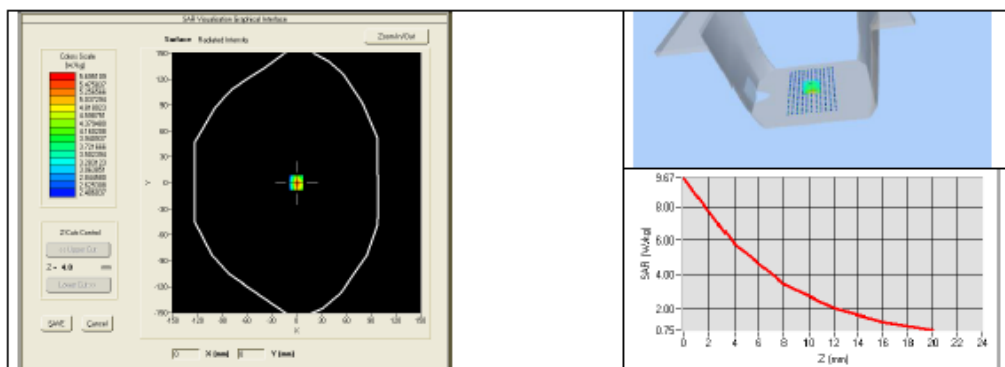
Ref: ACR.165.32.17.SATUA

|      |            |  |            |  |
|------|------------|--|------------|--|
| 3500 | 51.3 ±5 %  |  | 3.31 ±5 %  |  |
| 5200 | 49.0 ±10 % |  | 5.30 ±10 % |  |
| 5300 | 48.9 ±10 % |  | 5.42 ±10 % |  |
| 5400 | 48.7 ±10 % |  | 5.53 ±10 % |  |
| 5500 | 48.6 ±10 % |  | 5.65 ±10 % |  |
| 5600 | 48.5 ±10 % |  | 5.77 ±10 % |  |
| 5800 | 48.2 ±10 % |  | 6.00 ±10 % |  |

### 7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

|                                           |                                                            |
|-------------------------------------------|------------------------------------------------------------|
| Software                                  | OPENSAR V4                                                 |
| Phantom                                   | SN 20/09 SAM71                                             |
| Probe                                     | SN 18/11 EPG122                                            |
| Liquid                                    | Body Liquid Values: $\epsilon_{ps}$ : 53.2 $\sigma$ : 1.89 |
| Distance between dipole center and liquid | 10.0 mm                                                    |
| Area scan resolution                      | $dx=8mm/dy=8mm$                                            |
| Zoon Scan Resolution                      | $dx=5mm/dy=5mm/dz=5mm$                                     |
| Frequency                                 | 2450 MHz                                                   |
| Input power                               | 20 dBm                                                     |
| Liquid Temperature                        | 21 °C                                                      |
| Lab Temperature                           | 21 °C                                                      |
| Lab Humidity                              | 45 %                                                       |

| Frequency MHz | 1 g SAR (W/kg/W) | 10 g SAR (W/kg/W) |
|---------------|------------------|-------------------|
|               | measured         | measured          |
| 2450          | 53.69 (5.37)     | 24.72 (2.47)      |



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