

## SAR Compliance Test Report

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |                                                                                                                                        |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Date of Report</b>                                   | 14/08/2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Client's Contact person:</b>   | Panasonic Corporation of North America<br>Two Riverfront Plaza, 9 <sup>th</sup> Floor<br>Newark, 07102-5490, NJ<br>USA                 |
| <b>Number of pages:</b>                                 | 31                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Responsible Test engineer:</b> | Ilari Kinnunen                                                                                                                         |
| <b>Testing laboratory:</b>                              | <b>Verkotan Oy</b><br>Elektroniikkatie 17<br>90590 Oulu<br>Finland                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Client:</b>                    | <b>Panasonic Entertainment &amp; Communication Co., Ltd.</b><br>1-10-12 Yagumo-higashi-machi, Moriguchi<br>City, Osaka 570-0021, Japan |
| <b>Tested device</b>                                    | <b>KX-TGEA60</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   |                                                                                                                                        |
| <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>447498 D04 Interim General RF Exposure Guidance v01</b><br/><b>648474 D04, Handset SAR v01r03</b><br/><b>865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04</b></p> <p><b>IEC/IEEE 62209-1528, 2020</b><br/>Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices</p> <p><b>RSS-102, Issue 5, 2015</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>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   |                                                                                                                                        |

**Date and signatures:**

14.08.2024

**Laboratory Manager**

*Miia Nurkkala*

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## 1. SUMMARY OF SAR TEST REPORT

### 1.1 Test Details

#### Equipment under Test (DUT):

|                                      |                   |
|--------------------------------------|-------------------|
| <b>Product:</b>                      | Cordless Phone    |
| <b>Manufacturer:</b>                 | Panasonic         |
| <b>Model:</b>                        | KX-TGEA60         |
| <b>Serial Number:</b>                | PRJ00561900002    |
| <b>FCC ID Number:</b>                | ACJ96NKX-TGEA60B  |
| <b>DUT Number:</b>                   | 20639             |
| <b>Battery Type used in testing:</b> | Ni-MH Battery     |
| <b>State of the Sample:</b>          | Production sample |

#### Testing information:

|                                          |                                                                                                                    |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Testing performed:</b>                | 6.5.2024                                                                                                           |
| <b>Notes:</b>                            | -                                                                                                                  |
| <b>Document history and changes:</b>     | This report replaces FCC_SAR report_KX-TGEA60_ID6640_12082024.docx<br>Photos of the DUT removed to separate annex. |
| <b>Document ID:</b>                      | FCC_SAR report_KX-TGEA60_ID6640_14082024.docx                                                                      |
| <b>Temperature °C</b>                    | 22±2 / Controlled                                                                                                  |
| <b>Humidity RH%</b>                      | 30±20 / Controlled                                                                                                 |
| <b>Measurement performed by:</b>         | Ilari Kinnunen                                                                                                     |
| <b>FCC Test Firm Designation Number:</b> | F10005                                                                                                             |
| <b>ISED Company Number:</b>              | 22218                                                                                                              |

## 1.2 Maximum Results

The maximum reported\* SAR values for Head/Body-worn 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 Health Canada's RF exposure guideline, Safety Code 6 for Head/Body SAR<sub>1g</sub> is 1.6 W/kg.

### 1.2.1 Standalone SAR

| System | Highest Reported* SAR <sub>1g</sub> (W/kg) in Head Exposure Condition | Highest Reported* SAR <sub>1g</sub> (W/kg) in Body-Worn Exposure Condition, 0mm separation distance | Result |
|--------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------|
| DECT   | 0.04**                                                                | 0.05**                                                                                              | PASS   |

\* Reported SAR Values are scaled to upper limit of power tuning tolerance.

\*\*Maximum output power for ISED is lower, thus reported SAR values for ISED are overestimated.

### 1.2.2 Maximum Drift

|                                   |         |
|-----------------------------------|---------|
| Maximum Drift During Measurements | 1.23dB* |
|-----------------------------------|---------|

\*Larger than 5% drifts included to scaling factors

### 1.2.3 Measurement Uncertainty

SAR 1g: 0.3 – 3 GHz:

|                                 |         |
|---------------------------------|---------|
| Expanded Uncertainty (k=2) 95 % | ±22.1 % |
|---------------------------------|---------|

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

The DUT is a cordless phone supporting DECT technology. Photos of the DUT are shown in annex A.

|                             |                                 |
|-----------------------------|---------------------------------|
| <b>Device Category</b>      | Portable                        |
| <b>Exposure Environment</b> | General population uncontrolled |

### 2.1 Supported Frequency Bands and Operational Modes

| TX Frequency bands | Modes of Operation | Transmitter Frequency Range [MHz] |
|--------------------|--------------------|-----------------------------------|
|                    | DECT               | 1920 – 1930                       |

### 3. OUTPUT POWER

#### 3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

| Technology | Max Output Power [dBm] |
|------------|------------------------|
| DECT       | 20.67*                 |

\*Maximum output power for ISED is lower, thus reported SAR values for ISED are overestimated.

#### 3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector;

| Channel No. | Frequency (MHz) | Maximum Conducted Output Power (dBm) |
|-------------|-----------------|--------------------------------------|
| 4           | 1921.536        | 19.2                                 |
| 2           | 1924.992        | 19.4                                 |
| 0           | 1928.448        | 19.2                                 |

## 4. TEST EQUIPMENT

Dasy52 near field scanning system, manufactured by SPEAG was 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. The system is verified by measuring a known source i.e. a verification dipole. The dipole is fed with cw signal using a setup shown in figure 2.

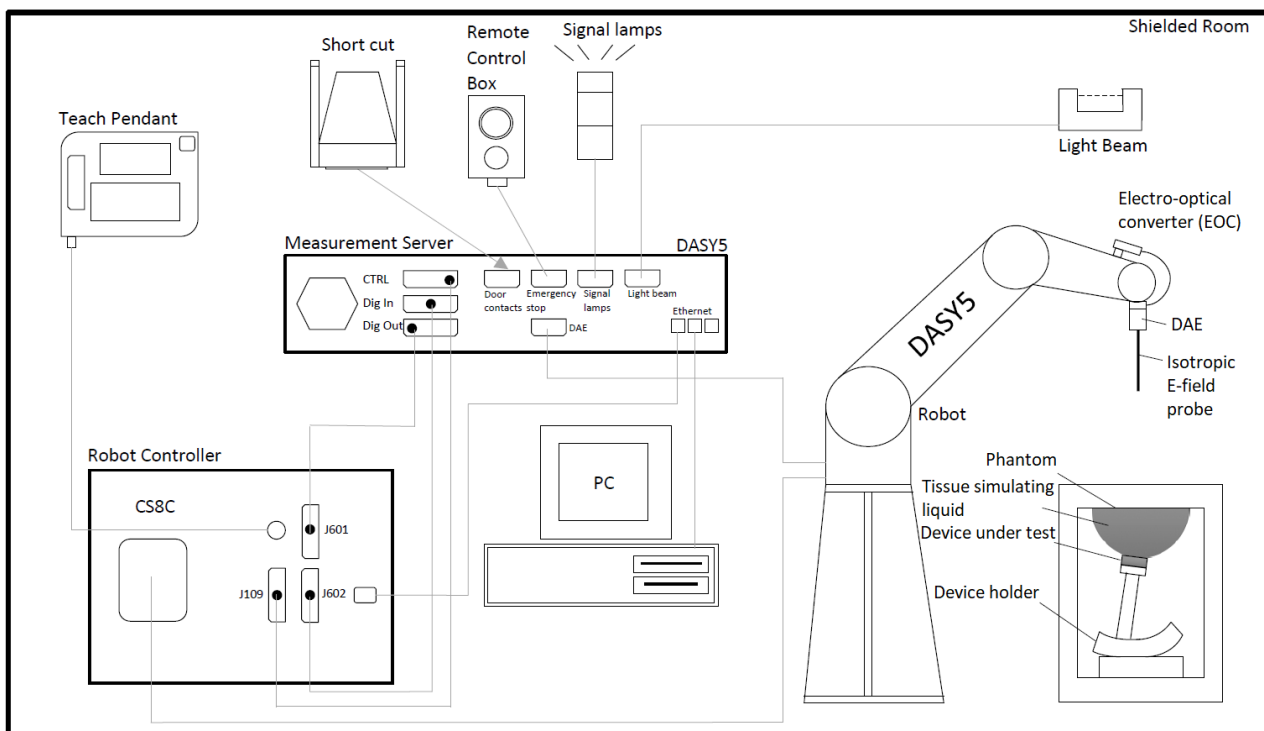


Figure 1 Schematic Laboratory Picture

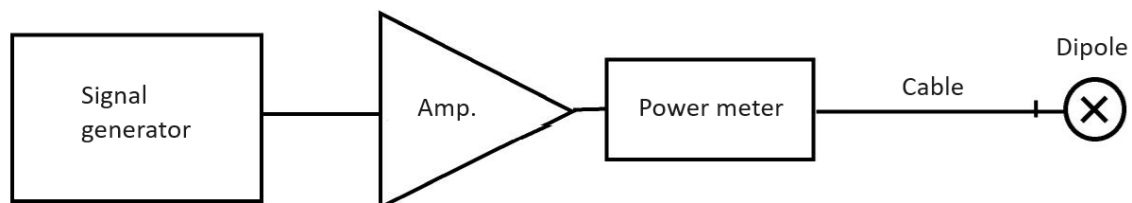


Figure 2 Signal source setup for system checks.



Figure 3 system setup. In system check the DUT is replaced by a verification dipole.

## 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 | Interval [years] |
|--------------------------------|-------------|---------------|------------------|------------------|
| Amplifier, 800MHz-4200MHz, 10W | 10S1G4A     | 320421        | NA               | NA               |
| DAE4, converter                | DAE4        | 710           | 10/2023          | 1                |
| Directional Power sensor       | NRT-Z44     | 107780        | 02/2024          | 1                |
| Isotropic DOS probe            | EX3DV4      | 3852          | 10/2023          | 1                |
| Network Analyzer               | E5071C      | MY46102812    | 05/2023          | 1                |
| Power reflection meter         | NRT         | 835065/049    | 02/2024          | 3                |
| System validation dipole       | D1900V2     | 511           | 03/2023          | 3                |
| Vector Signal Generator        | MG3710E     | 6262028676    | 11/2023          | 1                |
| DASY5 Software                 | 52.8.8.1258 | -             | NA               | NA               |

#### 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                                                                                         |
| <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

SAM Phantom:

The phantom used in SAR tests were the right and left head sections and flat phantom section of the twin-headed "SAM Phantom" manufactured by SPEAG. The phantom conforms to the requirements of IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures.

#### 4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within  $\pm 10\%$  of the recommended values at frequencies under 3GHz and  $\pm 5\%$  at frequencies above 3GHz. 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.

| Tissue simulant liquid Ingredients |
|------------------------------------|
| Deionized Water, tween, salt       |



Figure 4 Tissue simulant depth.

## 4.4 System Validation Status

| Frequency [MHz] | Dipole Type / SN | Probe Type / SN   | Calibrated Signal Type | DAE Unit / SN | Dielectric Constant [ $\epsilon'$ ] | Conductivity $\sigma$ [S/m] | Date    |
|-----------------|------------------|-------------------|------------------------|---------------|-------------------------------------|-----------------------------|---------|
| 1900            | D1900V2-SN:511   | EX3DV4 - SN: 3852 | CW                     | DAE 4 / 710   | 38.24                               | 1.38                        | 11/2023 |

## 4.5 System Check

System checks were performed according to 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04.

| Date       | Tissue Type | Tissue Temp. [°C] | Frequency [MHz] | Input Power [mW] | 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 [%] | Plot # |
|------------|-------------|-------------------|-----------------|------------------|-----------------------------------|-------------------------------------|-----------------------------------------|---------------|--------|
| 06.05.2024 | WB Head     | 22                | 1900            | 250              | 9.53                              | 38.02                               | 38.12                                   | 0.3           | 1      |

### 4.5.1 Tissue Simulant Verification

| Date       | Tissue Type | Tissue Temp [°C] | Frequency [MHz] | Measured                                     |                                       | Target                             |                             | Deviation      |              |
|------------|-------------|------------------|-----------------|----------------------------------------------|---------------------------------------|------------------------------------|-----------------------------|----------------|--------------|
|            |             |                  |                 | Dielectric Constant [ $\epsilon$ ]<br>Target | Conductivity $\sigma$ [S/m]<br>Target | Dielectric Constant [ $\epsilon$ ] | Conductivity $\sigma$ [S/m] | $\epsilon$ [%] | $\sigma$ [%] |
| 06.05.2024 | WB Head     | 22               | 1900            | 40.0                                         | 1.40                                  | 39.2                               | 1.42                        | -2.0           | 1.7          |

|            |         |    |         |      |      |      |      |      |     |
|------------|---------|----|---------|------|------|------|------|------|-----|
| 06.05.2024 | WB Head | 22 | 1921.54 | 40.0 | 1.40 | 39.2 | 1.43 | -2.1 | 2.5 |
| 06.05.2024 | WB Head | 22 | 1924.99 | 40.0 | 1.40 | 39.1 | 1.44 | -2.1 | 2.7 |
| 06.05.2024 | WB Head | 22 | 1928.45 | 40.0 | 1.40 | 39.1 | 1.44 | -2.2 | 2.8 |

## 5. TEST PROCEDURE

Testing was carried out in accordance with FCC KDB Publications 447498 D04 Interim General RF Exposure Guidance v01 and RSS-102, Issue 5.

Low, mid and high frequency channels for the configuration with the highest SAR value were tested as per ISED notice 2016-DRS001.

The DUT was set to transmit at maximum power and duty cycle (4.1%) using test software.

### 5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.



Device holder supplied by SPEAG

### 5.2 Test Positions

#### 5.2.1 Against Phantom Head

Measurements were made in "cheek" and "tilt" positions on both the left hand and right-hand sides of the phantom.

The positions used in the measurements were according to IEC/IEEE 62209-1528, 2020 "Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices".

Photos of the test positions are presented in appendix A.

#### 5.2.2 Body-worn Configuration, 0mm separation distance

Body SAR was tested from all sides of the device (front, back, left, right, top and bottom). The device was placed in the SPEAG holder/on the top of a Rohacell and lifted towards the phantom until the distance between the phantom and the device was 0mm.

Photos of the test positions are presented in appendix A

### 5.3 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

### 5.4 SAR Averaging Methods

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

The interpolation, extrapolation and maximum search routines within Dasy52 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).

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighboring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

## 6. MEASUREMENT UNCERTAINTY

| <b>DASY5 Uncertainty Budget</b><br>According to IEC/IEEE 62209-1528<br>(Frequency band: 300MHz - 3GHz range) |                                     |                  |                |      |           |            |                   |                    |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------|----------------|------|-----------|------------|-------------------|--------------------|
| Symbol                                                                                                       | Error Description                   | Uncert.<br>value | Prob.<br>Dist. | Div. | (c)<br>1g | (c)<br>10g | Std. Unc.<br>(1g) | Std. Unc.<br>(10g) |
| <b>Measurement System Errors</b>                                                                             |                                     |                  |                |      |           |            |                   |                    |
| CF                                                                                                           | Probe Calibration                   | ±12.0%           | N              | √2   | 1         | 1          | ±6.0%             | ±6.0%              |
| CF <sub>drift</sub>                                                                                          | Probe Calibration Drift             | ±1.7%            | R              | √3   | 1         | 1          | ±1.0%             | ±1.0%              |
| LIN                                                                                                          | Probe Linearity                     | ±4.7%            | R              | √3   | 1         | 1          | ±2.7%             | ±2.7%              |
| BBS                                                                                                          | Broadband Signal                    | ±3.0%            | R              | √3   | 1         | 1          | ±1.7%             | ±1.7%              |
| ISO                                                                                                          | Probe Isotropy                      | ±7.6%            | R              | 3    | 1         | 1          | ±4.4%             | ±4.4%              |
| DAE                                                                                                          | Data Acquisition                    | ±0.3%            | N              | 1    | 1         | 1          | ±0.3%             | ±0.3%              |
| AMB                                                                                                          | RF Ambient                          | ±1.8%            | N              | 1    | 1         | 1          | ±1.8%             | ±1.8%              |
| Δ <sub>sys</sub>                                                                                             | Probe Positioning                   | ±3.9%            | N              | 1    | 0.14      | 0.14       | ±0.5%             | ±0.5%              |
| DAT                                                                                                          | Data Processing                     | ±1.2%            | N              | 1    | 1         | 1          | ±1.2%             | ±1.2%              |
| <b>Phantom and Device Errors</b>                                                                             |                                     |                  |                |      |           |            |                   |                    |
| LIQ(σ)                                                                                                       | Conductivity (meas.) <sup>DAK</sup> | ±2.5%            | N              | √1   | 0.78      | 0.71       | ±2.0%             | ±1.8%              |
| LIQ(T <sub>a</sub> )                                                                                         | Conductivity (temp.) <sup>BB</sup>  | ±3.3%            | R              | √3   | 0.78      | 0.71       | ±1.5%             | ±1.4%              |
| EPS                                                                                                          | Phantom Permittivity                | ±14.0%           | R              | 3    | 0         | 0          | ±0%               | ±0%                |
| DIS                                                                                                          | Distance DUT - TSL                  | ±2.0%            | N              | 1    | 2         | 2          | ±4.0%             | ±4.0%              |
| D <sub>xyz</sub>                                                                                             | Device Positioning (±0.5mm)         | ±1.0%            | N              | 1    | 1         | 1          | ±1.0%             | ±1.0%              |
| H                                                                                                            | Device Holder                       | ±3.6%            | N              | √1   | 1         | 1          | ±3.6%             | ±3.6%              |
| MOD                                                                                                          | DUT Modulation <sup>m</sup>         | ±2.4%            | R              | √3   | 1         | 1          | ±1.4%             | ±1.4%              |
| TAS                                                                                                          | Time-average SAR                    | ±2.6%            | R              | 3    | 1         | 1          | ±1.5%             | ±1.5%              |
| RF <sub>drift</sub>                                                                                          | DUT drift                           | ±2.5%            | N              | 1    | 1         | 1          | ±2.5%             | ±2.5%              |
| VAL                                                                                                          | Val Antenna Unc. <sup>val</sup>     | ±0.0%            | N              | 1    | 1         | 1          | ±0%               | ±0%                |
| RF <sub>in</sub>                                                                                             | Unc. Input Power <sup>val</sup>     | ±0.0%            | N              | 1    | 1         | 1          | ±0%               | ±0%                |
| <b>Correction to the SAR results</b>                                                                         |                                     |                  |                |      |           |            |                   |                    |
| C(ε, σ)                                                                                                      | Deviation to Target                 | ±1.9%            | N              | √1   | 1         | 0.84       | ±1.9%             | ±1.6%              |
| C(R)                                                                                                         | SAR scaling <sup>p</sup>            | ±0%              | R              | 3    | 1         | 1          | ±0%               | ±0%                |
| u(ΔSAR)                                                                                                      | Combined Uncertainty                |                  |                |      |           |            | ±11.0%            | ±10.9%             |
| U                                                                                                            | <b>Expanded Uncertainty</b>         |                  |                |      |           |            | ±22.1%            | ±21.9%             |

## 7. TEST RESULTS

### 7.1 SAR Results for Head Exposure Condition

| Technology | Channel | Frequency [MHz] | Maximum Power [dBm] | Conducted Power [dBm] | Test position | Measured SAR <sub>1g</sub> [W/kg] | Power Drift*** [dB] | Duty Cycle | Scaling Factor***** | Reported SAR <sub>1g</sub> [W/kg] | Plot # |
|------------|---------|-----------------|---------------------|-----------------------|---------------|-----------------------------------|---------------------|------------|---------------------|-----------------------------------|--------|
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Right Cheek   | 0.00977                           | 0**                 | 4.1%       | 1.97                | 0.02                              |        |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Right Tilt    | 0.0000145                         | 0**                 | 4.1%       | 1.82                | 0.00003                           |        |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Left Cheek    | 0.0239                            | -0.43               | 4.1%       | 1.48                | 0.04                              | 2      |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Left Tilt     | 0.00509                           | 0.3                 | 4.1%       | 1.44                | 0.01                              |        |
| DECT       | 4       | 1921.536        | 20.67****           | 19.2                  | Left Cheek    | 0.0226                            | -0.36               | 4.1%       | 1.52                | 0.03                              |        |
| DECT       | 0       | 1928.448        | 20.67****           | 19.2                  | Left Cheek    | 0.0183                            | -0.36               | 4.1%       | 1.52                | 0.03                              |        |

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

\*\*\*Larger than 5% drifts included to scaling factors

\*\*\*\*Maximum output power for ISSED is lower, thus reported SAR values for ISSED are overestimated.

\*\*\*\*\*The scaling factor is calculated using formula  $10^{\frac{(\text{Maximum power} - (\text{Conducted power} - \text{Power Drift}))}{10}}$

### 7.2 SAR Results for Body Exposure Condition with 0mm separation

| Technology | Channel | Frequency [MHz] | Maximum Power [dBm] | Conducted Power [dBm] | Test position | Measured SAR <sub>1g</sub> [W/kg] | Power Drift*** [dB] | Duty Cycle | Scaling Factor***** | Reported SAR <sub>1g</sub> [W/kg] | Plot # |
|------------|---------|-----------------|---------------------|-----------------------|---------------|-----------------------------------|---------------------|------------|---------------------|-----------------------------------|--------|
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Front         | 0.0192                            | 0**                 | 4.1%       | 1.34                | 0.03                              |        |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Back          | 0.0291                            | 0.74                | 4.1%       | 1.59                | 0.05                              | 3      |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Left          | 0*                                | 0**                 | 4.1%       | 1.34                | 0                                 |        |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Right         | 0.0243                            | 1.23                | 4.1%       | 1.78                | 0.04                              |        |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Top           | 0.00000471                        | 0**                 | 4.1%       | 1.34                | 0                                 |        |
| DECT       | 2       | 1924.992        | 20.67****           | 19.4                  | Bottom        | 0*                                | 0**                 | 4.1%       | 1.34                | 0                                 |        |
| DECT       | 4       | 1921.536        | 20.67****           | 19.2                  | Back          | 0.0323                            | 0**                 | 4.1%       | 1.40                | 0.05                              |        |
| DECT       | 0       | 1928.448        | 20.67****           | 19.2                  | Back          | 0.0329                            | 0.32                | 4.1%       | 1.51                | 0.05                              |        |

\*Due to low e-field generated by DUT, the measurements are not applicable

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

\*\*\*Larger than 5% drifts included to scaling factors

\*\*\*\*Maximum output power for ISSED is lower, thus reported SAR values for ISSED are overestimated.

\*\*\*\*\*The scaling factor is calculated using formula  $10^{\frac{(\text{Maximum power} - (\text{Conducted power} - \text{Power Drift}))}{10}}$

### 7.3 IEC 62209-2 AMD1:2019

According to IEC 62209-2 AMD1:2019, the zoom scan complies if the peak spatial-average SAR is below 0.1 W/kg, or if the following criteria is met:

1. The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak is larger than the horizontal grid step.
2. Ratio of SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum is at least 30%.

Zoom scan compliance according to IEC 62209-2 AMD1:2019 is automatically verified by DASY5 software and all zoom scans in this test report do pass the criteria. The smallest horizontal distance and Ratio between measurement points M2 and M1 of the highest SAR results is available in Appendix C.

## APPENDIX A: PHOTOS OF THE DUT

Annex A is provided as a separate document.

## APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 06/05/2024 08:33:17

Test Laboratory: Verkotan Oy

**DUT: D1900V2 - SN511; Type: D1900V2; Serial: SN511**

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;

Communication System PAR: 0 dB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.424$  S/m;  $\epsilon_r = 39.208$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.75, 7.66, 7.73) @ 1900 MHz; Calibrated: 23/10/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$
  - Electronics: DAE4 Sn710; Calibrated: 24/10/2023
  - Phantom: SAR2 frontTwin-SAM V4.0 (30deg probe tilt); Type: QD 000 P40 CC;
  - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/1900 MHz System Check/Area Scan (61x61x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 15.7 W/kg

**Configuration/1900 MHz System Check/Zoom Scan (7x8x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 108.4 V/m; Power Drift = -0.25 dB

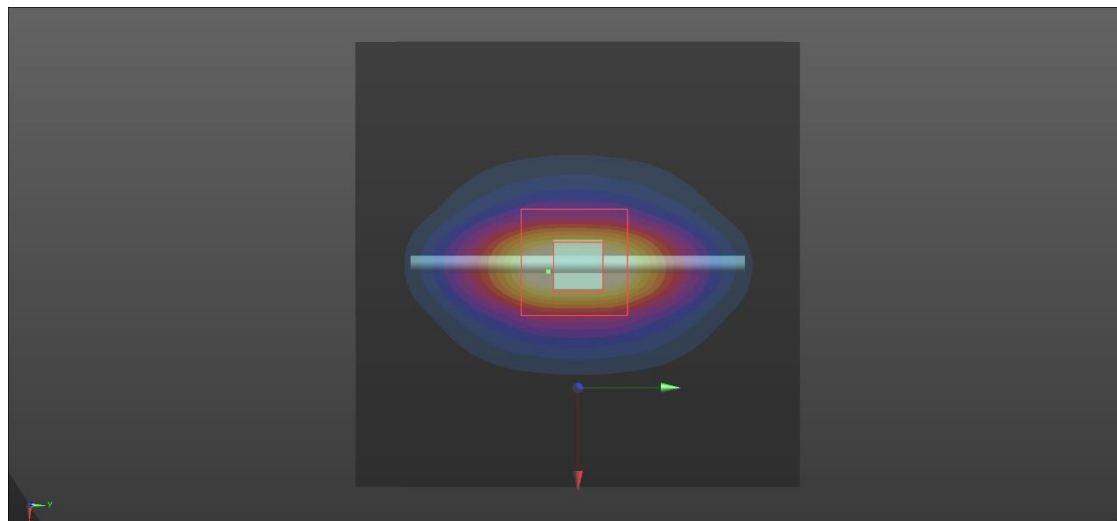
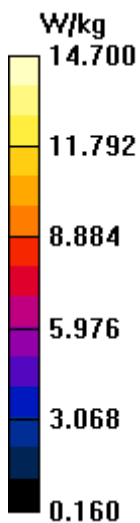
Peak SAR (extrapolated) = 17.3 W/kg

**SAR(1 g) = 9.53 W/kg; SAR(10 g) = 4.98 W/kg** (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 9.9 mm

Ratio of SAR at M2 to SAR at M1 = 55.3%

Maximum value of SAR (measured) = 14.7 W/kg



## APPENDIX C: MEASUREMENT SCANS

Plot 2

Date/Time: 06/05/2024 09:10:07

Test Laboratory: Verkotan Oy

### DUT: Panasonic

Communication System: UID 0, DECT (0); Communication System Band: FCC; Frequency: 1924.99 MHz;  
Communication System PAR: 13.86 dB;  
Medium parameters used:  $f = 1925$  MHz;  $\sigma = 1.438$  S/m;  $\epsilon_r = 39.142$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Left Section  
Measurement Standard: DASYS (IEEE/IEC)

### DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.75, 7.66, 7.73) @ 1924.99 MHz; Calibrated: 23/10/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = -4.0, 31.0$
  - Electronics: DAE4 Sn710; Calibrated: 24/10/2023
  - Phantom: SAR2 frontTwin-SAM V4.0 (30deg probe tilt); Type: QD 000 P40 CC;
  - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Head SAR Left/DECT 1924.992MHz, Left Cheek/Zoom Scan (9x10x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 3.540 V/m; Power Drift = -0.43 dB

Peak SAR (extrapolated) = 0.0570 W/kg

**SAR(1 g) = 0.024 W/kg; SAR(10 g) = 0.00873 W/kg** (SAR corrected for target medium)

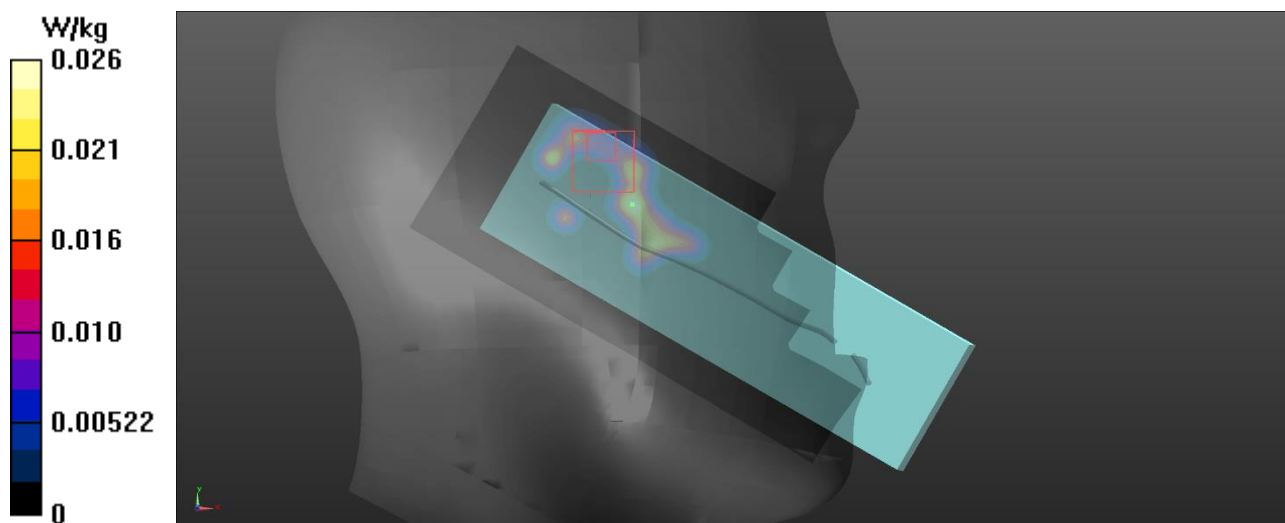
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid

Ratio of SAR at M2 to SAR at M1 = 55.3%

Maximum value of SAR (measured) = 0.0301 W/kg

**Head SAR Left/DECT 1924.992MHz, Left Cheek/Area Scan (51x121x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 0.0261 W/kg



Plot 3

Date/Time: 06/05/2024 14:09:20

Test Laboratory: Verkotan Oy

## DUT: Panasonic

Communication System: UID 0, DECT (0); Communication System Band: FCC; Frequency: 1924.99 MHz;

Communication System PAR: 13.86 dB;

Medium parameters used:  $f = 1925$  MHz;  $\sigma = 1.438$  S/m;  $\epsilon_r = 39.142$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

## DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.75, 7.66, 7.73) @ 1924.99 MHz; Calibrated: 23/10/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection),  $z = 31.0, -4.0$
  - Electronics: DAE4 Sn710; Calibrated: 24/10/2023
  - Phantom: SAR2 frontTwin-SAM V4.0 (30deg probe tilt); Type: QD 000 P40 CC;
  - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Body SAR/DECT 1924.992MHz, Back, 0mm/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 4.364 V/m; Power Drift = 0.74 dB

Peak SAR (extrapolated) = 0.0550 W/kg

**SAR(1 g) = 0.029 W/kg; SAR(10 g) = 0.014 W/kg** (SAR corrected for target medium)

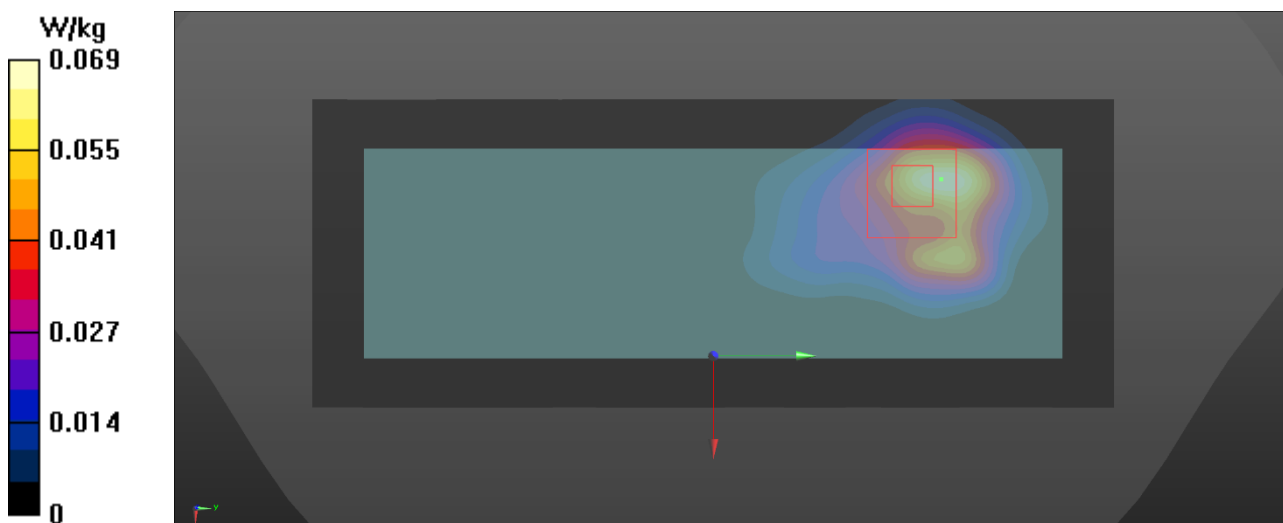
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid

Ratio of SAR at M2 to SAR at M1 = 51.1%

Maximum value of SAR (measured) = 0.0460 W/kg

**Body SAR/DECT 1924.992MHz, Back, 0mm/Area Scan (51x131x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 0.0686 W/kg



## APPENDIX D: RELEVANT PAGES FROM PROBE AND DAE4 CALIBRATION REPORTS

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




S Schweizerischer Kalibrierdienst  
C 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**  
Oulu, Finland

Certificate No.

**EX-3852\_Oct23**

**CALIBRATION CERTIFICATE**

Object **EX3DV4 - SN:3852**

Calibration procedure(s) **QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6,  
QA CAL-25.v8  
Calibration procedure for dosimetric E-field probes**

Calibration date **October 23, 2023**

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 ± 3) °C and humidity < 70%.  
Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID               | Cal Date (Certificate No.)        | Scheduled Calibration |
|----------------------------|------------------|-----------------------------------|-----------------------|
| Power meter NRP2           | SN: 104778       | 30-Mar-23 (No. 217-03804/03805)   | Mar-24                |
| Power sensor NRP-291       | SN: 103244       | 30-Mar-23 (No. 217-03804)         | Mar-24                |
| OCF DAK-3.5 (weighted)     | SN: 1249         | 05-Oct-23 (OCF-DAK3.5-1249_Oct23) | Oct-24                |
| OCF DAK-12                 | SN: 1016         | 05-Oct-23 (OCF-DAK12-1016_Oct23)  | Oct-24                |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 30-Mar-23 (No. 217-03809)         | Mar-24                |
| DAE4                       | SN: 660          | 16-Mar-23 (No. DAE4-660_Mar23)    | Mar-24                |
| Reference Probe ES3DV2     | SN: 3013         | 06-Jan-23 (No. ES3-3013_Jan23)    | Jan-24                |

| Secondary Standards     | ID               | Check Date (in house)             | Scheduled Check        |
|-------------------------|------------------|-----------------------------------|------------------------|
| Power meter E4419B      | SN: GB41293874   | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A     | SN: MY41498067   | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A     | SN: 000110210    | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| RF generator HP 8649C   | SN: US3642U01700 | 04-Aug-99 (in house check Jun-22) | In house check: Jun-24 |
| Network Analyzer E8358A | SN: US41080477   | 31-Mar-14 (in house check Oct-22) | In house check: Oct-24 |

|               | Name            | Function              | Signature                                                                            |
|---------------|-----------------|-----------------------|--------------------------------------------------------------------------------------|
| Calibrated by | Johanna Lieshaj | Laboratory Technician |  |
| Approved by   | Sven Kühn       | Technical Manager     |  |

Issued: October 23, 2023

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

EX3DV4 - SN:3852

October 23, 2023

## Parameters of Probe: EX3DV4 - SN:3852

### Basic Calibration Parameters

|                                                           | Sensor X | Sensor Y | Sensor Z | Unc (k = 2)  |
|-----------------------------------------------------------|----------|----------|----------|--------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.42     | 0.40     | 0.47     | $\pm 10.1\%$ |
| DCP (mV) <sup>B</sup>                                     | 102.6    | 101.5    | 101.2    | $\pm 4.7\%$  |

### Calibration Results for Modulation Response

| UID   | Communication System Name   |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | C     | D<br>dB | VR<br>mV | Max<br>dev. | Max<br>Unc <sup>E</sup><br>k = 2 |
|-------|-----------------------------|---|---------|------------------------------|-------|---------|----------|-------------|----------------------------------|
| D     | CW                          | X | 0.00    | 0.00                         | 1.00  | 0.00    | 148.1    | $\pm 1.2\%$ | $\pm 4.7\%$                      |
|       |                             | Y | 0.00    | 0.00                         | 1.00  |         | 135.0    |             |                                  |
|       |                             | Z | 0.00    | 0.00                         | 1.00  |         | 125.7    |             |                                  |
| 10352 | Pulse Waveform (200Hz, 10%) | X | 20.00   | 88.23                        | 18.81 | 10.00   | 60.0     | $\pm 2.9\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 15.83   | 85.04                        | 18.58 |         | 60.0     |             |                                  |
|       |                             | Z | 20.00   | 89.60                        | 19.58 |         | 60.0     |             |                                  |
| 10353 | Pulse Waveform (200Hz, 20%) | X | 20.00   | 89.81                        | 18.49 | 6.99    | 80.0     | $\pm 1.6\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 20.00   | 89.05                        | 18.11 |         | 80.0     |             |                                  |
|       |                             | Z | 20.00   | 91.94                        | 19.69 |         | 80.0     |             |                                  |
| 10354 | Pulse Waveform (200Hz, 40%) | X | 20.00   | 94.09                        | 19.25 | 3.98    | 95.0     | $\pm 1.2\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 20.00   | 88.35                        | 16.15 |         | 95.0     |             |                                  |
|       |                             | Z | 20.00   | 93.97                        | 19.35 |         | 95.0     |             |                                  |
| 10355 | Pulse Waveform (200Hz, 60%) | X | 20.00   | 100.39                       | 20.91 | 2.22    | 120.0    | $\pm 1.2\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 2.38    | 71.76                        | 9.70  |         | 120.0    |             |                                  |
|       |                             | Z | 20.00   | 97.37                        | 19.68 |         | 120.0    |             |                                  |
| 10387 | QPSK Waveform, 1 MHz        | X | 1.64    | 66.74                        | 15.13 | 1.00    | 150.0    | $\pm 2.8\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 1.57    | 65.66                        | 14.38 |         | 150.0    |             |                                  |
|       |                             | Z | 1.68    | 66.38                        | 15.01 |         | 150.0    |             |                                  |
| 10388 | QPSK Waveform, 10 MHz       | X | 2.18    | 68.09                        | 15.84 | 0.00    | 150.0    | $\pm 0.9\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 2.13    | 67.56                        | 15.26 |         | 150.0    |             |                                  |
|       |                             | Z | 2.26    | 68.28                        | 15.80 |         | 150.0    |             |                                  |
| 10396 | 64-QAM Waveform, 100 kHz    | X | 2.80    | 70.45                        | 18.83 | 3.01    | 150.0    | $\pm 0.7\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 2.67    | 68.53                        | 17.69 |         | 150.0    |             |                                  |
|       |                             | Z | 2.75    | 69.32                        | 18.17 |         | 150.0    |             |                                  |
| 10399 | 64-QAM Waveform, 40 MHz     | X | 3.46    | 67.10                        | 15.80 | 0.00    | 150.0    | $\pm 2.2\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 3.46    | 66.99                        | 15.61 |         | 150.0    |             |                                  |
|       |                             | Z | 3.55    | 67.36                        | 15.87 |         | 150.0    |             |                                  |
| 10414 | WLAN CCDF, 64-QAM, 40 MHz   | X | 4.78    | 65.85                        | 15.56 | 0.00    | 150.0    | $\pm 4.1\%$ | $\pm 9.6\%$                      |
|       |                             | Y | 4.86    | 65.73                        | 15.56 |         | 150.0    |             |                                  |
|       |                             | Z | 4.73    | 65.20                        | 15.31 |         | 150.0    |             |                                  |

Note: For details on UID parameters see Appendix

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the  $E^2$ -field uncertainty inside TSL (see Page 5).

<sup>B</sup> Uncertainty parameter uncertainty for maximum specified field strength.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EX3DV4 - SN:3852

October 23, 2023

## Parameters of Probe: EX3DV4 - SN:3852

### Sensor Model Parameters

|   | C1<br>fF | C2<br>fF | $\alpha$<br>$V^{-1}$ | T1<br>$ms V^{-2}$ | T2<br>$ms V^{-1}$ | T3<br>ms | T4<br>$V^{-2}$ | T5<br>$V^{-1}$ | T6   |
|---|----------|----------|----------------------|-------------------|-------------------|----------|----------------|----------------|------|
| x | 40.1     | 298.39   | 35.39                | 12.42             | 0.00              | 5.06     | 1.30           | 0.18           | 1.01 |
| y | 45.2     | 342.83   | 36.51                | 8.80              | 0.45              | 5.06     | 0.00           | 0.49           | 1.01 |
| z | 44.9     | 336.32   | 35.73                | 13.60             | 0.00              | 5.08     | 0.53           | 0.35           | 1.01 |

### Other Probe Parameters

|                                               |            |
|-----------------------------------------------|------------|
| Sensor Arrangement                            | Triangular |
| Connector Angle                               | -56.9°     |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disabled   |
| Probe Overall Length                          | 337 mm     |
| Probe Body Diameter                           | 10 mm      |
| Tip Length                                    | 9 mm       |
| Tip Diameter                                  | 2.5 mm     |
| Probe Tip to Sensor X Calibration Point       | 1 mm       |
| Probe Tip to Sensor Y Calibration Point       | 1 mm       |
| Probe Tip to Sensor Z Calibration Point       | 1 mm       |
| Recommended Measurement Distance from Surface | 1.4 mm     |

Note: Measurement distance from surface can be increased to 3-4 mm for an Area Scan job.

EX3DV4 - SN:3852

October 23, 2023

## Parameters of Probe: EX3DV4 - SN:3852

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity <sup>F</sup> (S/m) | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Unc (k = 2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 6                    | 55.0                               | 0.75                            | 14.87   | 14.87   | 14.87   | 0.00               | 1.25                    | ±13.3%      |
| 13                   | 55.0                               | 0.75                            | 13.94   | 13.94   | 13.94   | 0.00               | 1.25                    | ±13.3%      |
| 30                   | 55.0                               | 0.75                            | 12.97   | 12.97   | 12.97   | 0.00               | 1.25                    | ±13.3%      |
| 64                   | 54.2                               | 0.75                            | 11.54   | 11.54   | 11.54   | 0.00               | 1.25                    | ±13.3%      |
| 128                  | 52.8                               | 0.76                            | 11.14   | 11.14   | 11.14   | 0.00               | 1.25                    | ±13.3%      |
| 220                  | 49.0                               | 0.81                            | 10.56   | 10.56   | 10.56   | 0.00               | 1.25                    | ±13.3%      |
| 450                  | 43.5                               | 0.87                            | 9.99    | 9.99    | 9.99    | 0.16               | 1.30                    | ±13.3%      |
| 1300                 | 40.8                               | 1.14                            | 8.19    | 7.92    | 8.28    | 0.48               | 1.27                    | ±12.0%      |
| 1450                 | 40.5                               | 1.20                            | 8.04    | 7.77    | 8.01    | 0.46               | 1.27                    | ±12.0%      |
| 1640                 | 40.2                               | 1.31                            | 8.04    | 7.69    | 8.00    | 0.43               | 1.27                    | ±12.0%      |
| 1810                 | 40.0                               | 1.40                            | 7.69    | 7.64    | 7.66    | 0.28               | 1.27                    | ±12.0%      |
| 1900                 | 40.0                               | 1.40                            | 7.75    | 7.66    | 7.73    | 0.28               | 1.27                    | ±12.0%      |
| 2450                 | 39.2                               | 1.80                            | 7.07    | 7.09    | 7.16    | 0.31               | 1.27                    | ±12.0%      |
| 3300                 | 38.2                               | 2.71                            | 6.76    | 6.56    | 6.80    | 0.32               | 1.27                    | ±14.0%      |
| 3500                 | 37.9                               | 2.91                            | 6.75    | 6.56    | 6.76    | 0.33               | 1.27                    | ±14.0%      |
| 3700                 | 37.7                               | 3.12                            | 6.56    | 6.40    | 6.58    | 0.34               | 1.27                    | ±14.0%      |
| 3900                 | 37.5                               | 3.32                            | 6.52    | 6.37    | 6.54    | 0.34               | 1.27                    | ±14.0%      |
| 4100                 | 37.2                               | 3.53                            | 6.23    | 6.14    | 6.27    | 0.35               | 1.27                    | ±14.0%      |
| 5250                 | 35.9                               | 4.71                            | 4.99    | 4.95    | 5.05    | 0.37               | 1.53                    | ±14.0%      |
| 5600                 | 35.5                               | 5.07                            | 4.54    | 4.50    | 4.60    | 0.37               | 1.75                    | ±14.0%      |
| 5750                 | 35.4                               | 5.22                            | 4.62    | 4.57    | 4.67    | 0.38               | 1.84                    | ±14.0%      |

<sup>C</sup> Frequency validity above 300 MHz of ±100 MHz only applies for DAS7 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. Validity of ConvF assessed at 6 MHz is 4–8 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

<sup>F</sup> The probes are calibrated using tissue simulating liquids (TSL) that deviate for  $\epsilon$  and  $\sigma$  by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10%. If TSL with deviations from the target of less than ±5% are used, the calibration uncertainties are 11.1% for 0.7–3 GHz and 13.1% for 3–6 GHz.

<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.

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



**S** Schweizerischer Kalibrierdienst  
**C** 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**  
Oulu, Finland

Certificate No: **DAE4-710\_Oct23**

## CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 710**

Calibration procedure(s) **QA CAL-06.v30**  
**Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **October 24, 2023**

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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards             | ID #               | Cal Date (Certificate No.) | Scheduled Calibration  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278        | 29-Aug-23 (No:37421)       | Aug-24                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Auto DAE Calibration Unit     | SE UWS 053 AA 1001 | 27-Jan-23 (in house check) | In house check: Jan-24 |
| Calibrator Box V2.1           | SE UMS 006 AA 1002 | 27-Jan-23 (in house check) | In house check: Jan-24 |

|                |                               |                                   |               |
|----------------|-------------------------------|-----------------------------------|---------------|
| Calibrated by: | Name<br><b>Adrian Gehring</b> | Function<br>Laboratory Technician | Signature<br> |
| Approved by:   | Sven Kühn                     | Technical Manager                 |               |

Issued: October 24, 2023

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

## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1  $\mu$ V , full range = -100...+300 mV

Low Range: 1LSB = 61 nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X                         | Y                         | Z                         |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range          | 403.489 $\pm$ 0.02% (k=2) | 403.630 $\pm$ 0.02% (k=2) | 403.790 $\pm$ 0.02% (k=2) |
| Low Range           | 3.95386 $\pm$ 1.50% (k=2) | 3.95941 $\pm$ 1.50% (k=2) | 3.98294 $\pm$ 1.50% (k=2) |

## Connector Angle

|                                           |                   |
|-------------------------------------------|-------------------|
| Connector Angle to be used in DASY system | 348.0 ° $\pm$ 1 ° |
|-------------------------------------------|-------------------|

## Appendix (Additional assessments outside the scope of SCS0108)

### 1. DC Voltage Linearity

| High Range        | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 200036.47                 | -2.57                        | -0.00     |
| Channel X + Input | 20003.58                  | -3.79                        | -0.02     |
| Channel X - Input | -20005.57                 | -0.23                        | 0.00      |
| Channel Y + Input | 200037.33                 | -1.59                        | -0.00     |
| Channel Y + Input | 20006.19                  | -0.94                        | -0.00     |
| Channel Y - Input | -20000.51                 | 4.99                         | -0.02     |
| Channel Z + Input | 200035.92                 | -2.91                        | -0.00     |
| Channel Z + Input | 20004.26                  | -2.95                        | -0.01     |
| Channel Z - Input | -20003.74                 | 1.84                         | -0.01     |

| Low Range         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2002.29                   | -0.15                        | -0.01     |
| Channel X + Input | 202.60                    | 0.39                         | 0.20      |
| Channel X - Input | -199.14                   | -1.53                        | 0.77      |
| Channel Y + Input | 2003.02                   | 0.81                         | 0.04      |
| Channel Y + Input | 202.06                    | -0.02                        | -0.01     |
| Channel Y - Input | -198.45                   | -0.73                        | 0.37      |
| Channel Z + Input | 2002.44                   | 0.22                         | 0.01      |
| Channel Z + Input | 202.31                    | 0.25                         | 0.12      |
| Channel Z - Input | -197.76                   | -0.05                        | 0.03      |

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | Common mode Input Voltage (mV) | High Range Average Reading ( $\mu\text{V}$ ) | Low Range Average Reading ( $\mu\text{V}$ ) |
|-----------|--------------------------------|----------------------------------------------|---------------------------------------------|
| Channel X | 200                            | 21.54                                        | 19.50                                       |
|           | - 200                          | -18.41                                       | -20.09                                      |
| Channel Y | 200                            | 3.59                                         | 3.00                                        |
|           | - 200                          | -3.69                                        | -4.30                                       |
| Channel Z | 200                            | 6.85                                         | 6.63                                        |
|           | - 200                          | -6.66                                        | -7.04                                       |

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | Input Voltage (mV) | Channel X ( $\mu\text{V}$ ) | Channel Y ( $\mu\text{V}$ ) | Channel Z ( $\mu\text{V}$ ) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200                | -                           | -2.56                       | -1.31                       |
| Channel Y | 200                | 7.12                        | -                           | 0.08                        |
| Channel Z | 200                | 4.90                        | 4.94                        | -                           |

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16568            | 13901           |
| Channel Y | 15697            | 16612           |
| Channel Z | 16047            | 13868           |

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec  
Input 10M $\Omega$

|           | Average ( $\mu$ V) | min. Offset ( $\mu$ V) | max. Offset ( $\mu$ V) | Std. Deviation ( $\mu$ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | -1.93              | -4.03                  | -0.29                  | 0.67                      |
| Channel Y | -0.73              | -2.35                  | 1.14                   | 0.66                      |
| Channel Z | 0.35               | -1.17                  | 2.13                   | 0.64                      |

#### 6. Input Offset Current

Nominal input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

|           | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200            | 200              |
| Channel Y | 200            | 200              |
| Channel Z | 200            | 200              |

#### 8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9              |
| Supply (- Vcc) | -7.6              |

#### 9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01             | +6            | +14               |
| Supply (- Vcc) | -0.01             | -8            | -9                |

## APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS



### SAR Reference Dipole Calibration Report

Ref : ACR.68.5.23.BES.A

**VERKOTAN OY**  
**ELEKTRONIIKKATIE 17**  
**90590, OULU, FINLAND**  
**SAR REFERENCE DIPOLE**  
**FREQUENCY: 1900 MHZ**  
**SERIAL NO.: 511**

**Calibrated at MVG**  
**Z.I. de la pointe du diable**  
**Technopôle Brest Iroise – 295 avenue Alexis de Rochon**  
**29280 PLOUZANE - FRANCE**

**Calibration date: 03/09/2023**




Accreditations #2-6789 and #2-6814  
Scope available on [www.cofrac.fr](http://www.cofrac.fr)

The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.

*Summary:*

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

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACTL68.5.23.BES.A

|                        | Name          | Function                | Date     | Signature |
|------------------------|---------------|-------------------------|----------|-----------|
| Prepared by :          | Cyrille ONNEE | Measurement Responsible | 3/9/2023 |           |
| Checked & approved by: | Jérôme Luc    | Technical Manager       | 3/9/2023 |           |
| Authorized by:         | Yann Toutain  | Laboratory Director     | 3/9/2023 |           |

Yann  
Toutain ID

Signature  
numérique de  
Yann Toutain ID  
Date : 2023.03.09  
15:01:12 +01'00'

|                | Customer Name |
|----------------|---------------|
| Distribution : | Verkotan Oy   |

| Issue | Name          | Date     | Modifications   |
|-------|---------------|----------|-----------------|
| A     | Cyrille ONNEE | 3/9/2023 | Initial release |
|       |               |          |                 |
|       |               |          |                 |

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Template: ACR.DDD.N.YY.MTVG.B.ISSUE\_SAR Reference Dipole v1.

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.5.23.BES.A

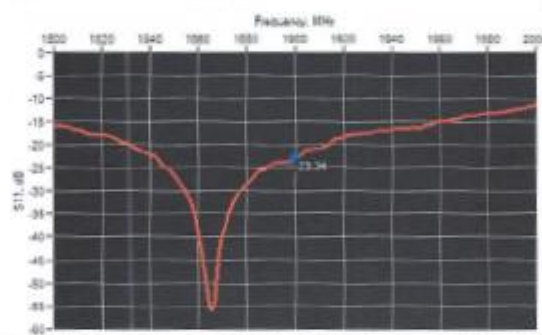
### 6 CALIBRATION RESULTS

#### 6.1 MECHANICAL DIMENSIONS

| L mm     |              | h mm     |              | d mm     |             |
|----------|--------------|----------|--------------|----------|-------------|
| Measured | Required     | Measured | Required     | Measured | Required    |
| -        | 68.00 +/- 2% | -        | 39.50 +/- 2% | -        | 3.60 +/- 2% |

#### 6.2 S11 PARAMETER

##### 6.2.1 S11 parameter in Head Liquid



| Frequency (MHz) | S11 parameter (dB) | Requirement (dB) | Impedance     |
|-----------------|--------------------|------------------|---------------|
| 1900            | -23.34             | -20              | 48.5Ω - 6.6jΩ |

#### 6.3 SAR

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

##### 6.3.1 SAR with Head Liquid

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 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.

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Template: ACR.DDD.N.YY.MFGR.ISSUE\_SAR Reference Dipole.v1.

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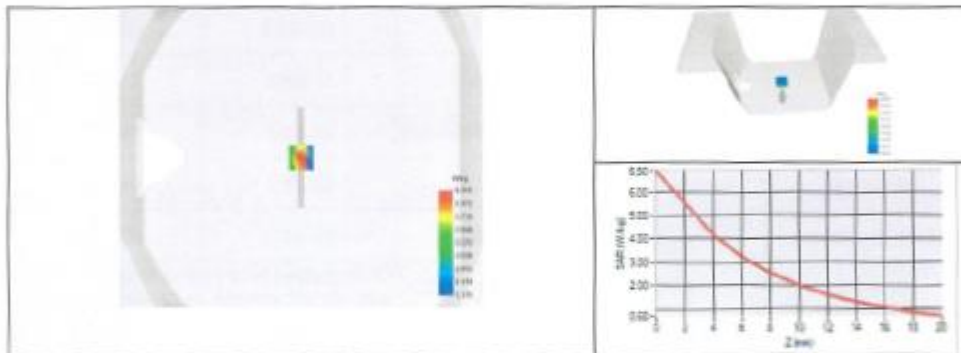


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.5.23.BFS.A

|                                           |                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|
| Software                                  | OPENSAR V5                                                          |
| Phantom                                   | SN 13/09 SAM68                                                      |
| Probe                                     | SN 41/18 EPG0333                                                    |
| Liquid                                    | Head Liquid Values: $\epsilon_{\text{rel}}' : 40.4$ $\sigma : 1.40$ |
| Distance between dipole center and liquid | 10.0 mm                                                             |
| Area scan resolution                      | $dx=8\text{mm}/dy=8\text{mm}$                                       |
| Zoon Scan Resolution                      | $dx=8\text{mm}/dy=8\text{mm}/dz=5\text{mm}$                         |
| Frequency                                 | 1900 MHz                                                            |
| Input power                               | 20 dBm                                                              |
| Liquid Temperature                        | 20 +/- 1 °C                                                         |
| Lab Temperature                           | 20 +/- 1 °C                                                         |
| Lab Humidity                              | 30-70 %                                                             |

| Frequency | 1g SAR (W/kg) |                           |                         | 10g SAR (W/kg) |                           |                         |
|-----------|---------------|---------------------------|-------------------------|----------------|---------------------------|-------------------------|
|           | Measured      | Measured normalized to 1W | Target normalized to 1W | Measured       | Measured normalized to 1W | Target normalized to 1W |
| 1900 MHz  | 3.80          | 38.02                     | 39.70                   | 1.94           | 19.41                     | 20.50                   |



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Template: ACR.DDD.N.YY.MYGB.ISSUE\_SAR Reference Dipole v1.

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