# SAR TEST REPORT

## Test Report No.: 14420105H-E-R2

| | |
|---|---|
| **Customer** | **Sony Group Corporation** |
| **Description of EUT** | **Digital Wireless Transmitter** |
| **Model Number of EUT** | **DWT-P30** |
| **FCC ID** | **AK8DWTP30** |
| **Test Regulation** | **FCC47CFR 2.1093** |
| **Test Result** | **Complied (Refer to SECTION 4)** |
| **Issue Date** | **November 18, 2022** |
| **Remarks** | **The highest reported SAR (1 g)**<br>Standalone Tx (Body-worn) : 0.69 W/kg<br>Simultaneous Tx (Body-worn) : 1.09 W/kg |

| **Representative Test Engineer** | **Approved By** |
|---|---|
| Hisayoshi Sato<br>Engineer | Takayuki Shimada<br>Leader |

CERTIFICATE 5107.02

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☒ There is no testing item of "Non-accreditation".

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- The information provided from the customer for this report is identified in Section 1.
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# REVISION HISTORY

## Original Test Report No.: 14420105H-E

This report is a revised version of 14420105H-E-R1. 14420105H-E-R1 is replaced with this report.

【1/2】

| Revision | Test report No. | Date | Page Revised Contents |
|---|---|---|---|
| -<br>(Original) | 14420105H-E | October 3, 2022 | - |
| 1 | 14420105H-E-R1 | November 14, 2022 | Cover page, Section 4.2: Stand-alone SAR result, Section 4.3: Simultaneous transmission SAR result<br><br>Correction of SAR Value.<br>-Cover page :<br>Standalone Tx (Body-worn) 0.74 W/kg→ 0.69 W/kg<br>Simultaneous Tx (Body-worn) 1.14 W/kg→1.09 W/kg<br>-Section 4.2: Standalone Tx<br>0.738 W/kg→0.694 W/kg<br>-Section 4.3: Simultaneous Tx<br>1.138 W/kg→1.094 W/kg |
| 1 | 14420105H-E-R1 | November 14, 2022 | Section 5: Tune-up tolerance information and software information<br><br>Correction of Maximum tune-up tolerance limit for 470.125 to 607.875 MHz.<br>14.39 dBm→14.12 dBm<br>27.50 mW→25.85 mW |
| 1 | 14420105H-E-R1 | November 14, 2022 | Section 6.2: SAR test exclusion considerations according to KDB 447498 D01<br><br>Correction of Output Power for 607.875 MHz in table.<br>14.39 dBm→14.12 dBm<br>27 mW→26 mW |

【2/2】

| Revision | Test report No. | Date | Page Revised Contents |
|---|---|---|---|
| 1 | 14420105H-E-R1 | November 14, 2022 | Section 8.1: Output Power and SAR test required<br>Correction of Tune-up upper Power.<br><br>Section 12.1: Measured and Reported (Scaled) SAR Results<br>Correction of Tune-up upper Power and Reported SAR Value.<br><br>Tune-up upper Power:<br>470.125 MHz: 14.39 dBm→14.12 dBm<br>539.000 MHz :14.39 dBm→14.12 dBm<br>607.875 MHz :14.39 dBm→14.12 dBm<br><br>Reported SAR Value:<br>Listed in order from the top row of the table to the bottom row.<br>0.042→0.039<br>0.065→0.061<br>0.076→0.072<br>0.069→0.065<br>0.738→0.694<br>0.306→0.287<br>0.241→0.226<br>0.015→0.014<br>0.135→0.127<br>0.134→0.126<br>0.046→0.043 |
| 1 | 14420105H-E-R1 | November 14, 2022 | Section 13: Simultaneous Transmission SAR Analysis<br>Correction of SAR Value for Radio microphone.<br><br>SAR Value for Radio microphone:<br>Listed in order from the top row of the table to the bottom row.<br>0.042→0.039<br>0.065→0.061<br>0.076→0.072<br>0.069→0.065<br>0.738→0.694<br>0.015→0.014<br>0.135→0.127<br>0.134→0.126<br>0.046→0.043 |
| 2 | 14420105H-E-R2 | November 18, 2022 | APPENDIX 4: Photographs of test setup<br>Addition of below explanatory note.<br><br>*The model printing of the EUT is different from the application model since this EUT is an engineering prototype.<br>This difference has no effect on the Radio specification. |

## Reference: Abbreviations (Including words undescribed in this report)

| | | | |
|---|---|---|---|
| AAN | Asymmetric Artificial Network | GPS | Global Positioning System |
| AC | Alternating Current | Hori. | Horizontal |
| AM | Amplitude Modulation | ICES | Interference-Causing Equipment Standard |
| AMN | Artificial Mains Network | I/O | Input/Output |
| Amp, AMP | Amplifier | IEC | International Electrotechnical Commission |
| ANSI | American National Standards Institute | IEEE | Institute of Electrical and Electronics Engineers |
| Ant, ANT | Antenna | IF | Intermediate Frequency |
| AP | Access Point | ILAC | International Laboratory Accreditation Conference |
| ASK | Amplitude Shift Keying | ISED | Innovation, Science and Economic Development Canada |
| Atten., ATT | Attenuator | ISN | Impedance Stabilization Network |
| AV | Average | ISO | International Organization for Standardization |
| BPSK | Binary Phase-Shift Keying | JAB | Japan Accreditation Board |
| BR | Bluetooth Basic Rate | LAN | Local Area Network |
| BT | Bluetooth | LCL | Longitudinal Conversion Loss |
| BT LE | Bluetooth Low Energy | LIMS | Laboratory Information Management System |
| BW | BandWidth | LISN | Line Impedance Stabilization Network |
| C.F | Correction Factor | MRA | Mutual Recognition Arrangement |
| Cal Int | Calibration Interval | N/A | Not Applicable |
| CAV | CISPR AV | NIST | National Institute of Standards and Technology |
| CCK | Complementary Code Keying | NS | No signal detect. |
| CDN | Coupling Decoupling Network | NSA | Normalized Site Attenuation |
| Ch., CH | Channel | OBW | Occupied BandWidth |
| CISPR | Comite International Special des Perturbations Radioelectriques | OFDM | Orthogonal Frequency Division Multiplexing |
| Corr. | Correction | PER | Packet Error Rate |
| CPE | Customer premise equipment | PK | Peak |
| CW | Continuous Wave | $P_{LT}$ | long-term flicker severity |
| DBPSK | Differential BPSK | POHC(A) | Partial Odd Harmonic Current |
| DC | Direct Current | Pol., Pola. | Polarization |
| DET | Detector | PR-ASK | Phase Reversal ASK |
| D-factor | Distance factor | $P_{ST}$ | short-term flicker severity |
| Dmax | maximum absolute voltage change during an observation period | QAM | Quadrature Amplitude Modulation |
| DQPSK | Differential QPSK | QP | Quasi-Peak |
| DSSS | Direct Sequence Spread Spectrum | QPSK | Quadrature Phase Shift Keying |
| DUT | Device Under Test | r.m.s., RMS | Root Mean Square |
| EDR | Enhanced Data Rate | RBW | Resolution BandWidth |
| e.i.r.p., EIRP | Equivalent Isotropically Radiated Power | RE | Radio Equipment |
| EM clamp | Electromagnetic clamp | REV | Reverse |
| EMC | ElectroMagnetic Compatibility | RF | Radio Frequency |
| EMI | ElectroMagnetic Interference | RFID | Radio Frequency Identifier |
| EMS | ElectroMagnetic Susceptibility | RNSS | Radio Navigation Satellite Service |
| EN | European Norm | RSS | Radio Standards Specifications |
| e.r.p., ERP | Effective Radiated Power | Rx | Receiving |
| ETSI | European Telecommunications Standards Institute | SINAD | Ratio of (Signal + Noise + Distortion) to (Noise + Distortion) |
| EU | European Union | S/N | Signal to Noise ratio |
| EUT | Equipment Under Test | SA, S/A | Spectrum Analyzer |
| Fac. | Factor | SG | Signal Generator |
| FCC | Federal Communications Commission | SVSWR | Site-Voltage Standing Wave Ratio |
| FHSS | Frequency Hopping Spread Spectrum | THC(A) | Total Harmonic Current |
| FM | Frequency Modulation | THD(%) | Total Harmonic Distortion |
| Freq. | Frequency | TR, T/R | Test Receiver |
| FSK | Frequency Shift Keying | Tx | Transmitting |
| Fund | Fundamental | VBW | Video BandWidth |
| FWD | Forward | Vert. | Vertical |
| GFSK | Gaussian Frequency-Shift Keying | WLAN | Wireless LAN |
| GNSS | Global Navigation Satellite System | xDSL | Generic term for all types of DSL technology |
| | | | (DSL: Digital Subscriber Line) |

## CONTENTS PAGE

## SECTION 1: Customer information

| | |
|---|---|
| Company Name | Sony Group Corporation |
| Address | 8-4, Shiomi Kisarazu-shi, Chiba, 292-0834 Japan. |
| Telephone Number | +81-438-37-4704 |
| Contact Person | Youhei Hisano |

*Remarks
Sony Global Manufacturing & Operations Corporation (Subsidiary Company Name) is on behalf of the applicant: Sony Group Corporation.

The information provided from the customer is as follows;
- Customer, Description of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer Information
- SECTION 2: Equipment Under Test (EUT) other than the Receipt Date and Test Date
- SECTION 5: Tune-up tolerance information and software information

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 5.

## SECTION 2: Equipment under test (EUT)

### 2.1 Identification of EUT

| | |
|---|---|
| Description | Digital Wireless Transmitter |
| Model Number | DWT-P30 |
| Serial Number | 910010 |
| Condition | Engineering prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification | No Modification by the test lab |
| Receipt Date | July 24, 2022 |
| Test Date | August 3 and 4, 2022 |

## 2.2 Product Description

### General Specification

| | |
|---|---|
| Rating | DC 3.0 V (Battery (2 x AA Batteries)), DC 5.0 V (USB) |
| Option battery | N/A |
| Body-worn accessory | N/A |

### Radio Specification

**<Radio microphone part>**

| | |
|---|---|
| Radio type | Transmitter |
| Modulation type | π/4 shift QPSK |
| Emission designator | 192KG1D, 192KG1E |
| Necessary bandwidth | 192 kHz, Manufacturer defined |
| Channel spacing | 25 kHz |
| Frequency of operation | 470.125 MHz to 607.875 MHz, 614.125 MHz to 615.875 MHz |
| RF power | 470.125 MHz to 607.875 MHz: 25 mW, 10 mW, 2 mW<br>614.125 MHz to 615.875 MHz: 10 mW, 2 mW |
| Antenna gain | 2.8 dBi max |
| AF Specification | 20 Hz - 22000 Hz, Maximum input: -22 dBu (MIC level, ATT 0 dB) |
| Operating temperature | 0 deg. C to 50 deg. C |

**<RF remote part>**

| | |
|---|---|
| Radio Type | Transceiver |
| Modulation type | DSSS |
| Frequency of Operation | 2405 MHz to 2475 MHz |
| Channel spacing | 5 MHz |
| Method of frequency generation | Synthesizer |
| Antenna Gain | -3.0 dBi max |
| Operating temperature | 0 deg. C to 50 deg. C |

## SECTION 3: Test standard information

### 3.1 Test Specification

Title : **FCC47CFR 2.1093**
Radiofrequency radiation exposure evaluation: portable devices.

**Published RF exposure KDB procedures**

| | |
|---|---|
| ☑ **KDB 447498 D01(v06)** | RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices |
| ☐ **KDB 447498 D02(v02r01)** | SAR Measurement Procedures for USB Dongle Transmitters |
| ☐ **KDB 648474 D04(v01r03)** | SAR Evaluation Considerations for Wireless Handsets |
| ☐ **KDB 941225 D01(v03r01)** | 3G SAR Measurement Procedures |
| ☐ **KDB 941225 D05(v02r05)** | SAR Evaluation Considerations for LTE Devices |
| ☐ **KDB 941225 D06(v02r01)** | SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities (Hot Spot SAR) |
| ☐ **KDB 941225 D07(v01r02)** | SAR Evaluation Procedures for UMPC Mini-Tablet Devices |
| ☐ **KDB 616217 D04(v01r02)** | SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers |
| ☑ **KDB 865664 D01(v01r04)** | SAR Measurement Requirements for 100 MHz to 6 GHz |
| ☐ **KDB 248227 D01(v02r02)** | SAR Guidance for 802.11(Wi-Fi) Transmitters |

**Reference**
[1] SPEAG uncertainty document
[2] IEEE Std 1528-2013
[3] IEC 62209-2:2010 + AMD1:2019 CS

### 3.2 Procedure

| **Transmitter** | **Radio microphone and RF remote** |
|---|---|
| **Test Procedure** | Published RF exposure KDB procedures |
| **Category** | SAR |
| Note: UL Japan, Inc.’s SAR Work Procedures: Work Instructions-ULID-003598 and Work Instructions-ULID-003599 | |

### 3.3 Additions or deviations to standard

Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Exposure limit

(A) Limits for Occupational/Controlled Exposure (W/kg)

| Spatial Average (averaged over the whole body) | Spatial Peak (averaged over any 1 g of tissue) | Spatial Peak (hands/wrists/feet/ankles averaged over 10 g) |
|---|---|---|
| 0.4 | 8.0 | 20.0 |

(B) Limits for General population/Uncontrolled Exposure (W/kg)

| Spatial Average (averaged over the whole body | Spatial Peak (averaged over any 1 g of tissue) | Spatial Peak (hands/wrists/feet/ankles averaged over 10 g) |
|---|---|---|
| 0.08 | 1.6 | 4.0 |

**Occupational/Controlled Environments:** are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

**General Population/Uncontrolled Environments:** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**NOTE:GENERAL POPULATION/UNCONTROLLED EXPOSURE**
**SPATIAL PEAK(averaged over any 1 g of tissue) LIMIT**
**1.6 W/kg**

### 3.5 SAR

Specific Absorption Rate (SAR): The time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ), as shown in the following equation:

$$\mathrm{SAR} = \frac{\mathrm{d}}{\mathrm{dt}}\left(\frac{\mathrm{dW}}{\mathrm{dm}}\right) = \frac{\mathrm{d}}{\mathrm{dt}}\left(\frac{\mathrm{dW}}{\rho \mathrm{dV}}\right)$$

SAR is expressed in units of watts per kilogram (W/kg) or equivalently milliwatts per gram (mW/g).

SAR is related to the E-field at a point by the following equation:

$$\mathrm{SAR} = \frac{\sigma|\mathrm{E}|^2}{\rho}$$

where
σ = conductivity of the tissue (S/m)
ρ = mass density of the tissue (kg/m3)
E = rms E-field strength (V/m)

### 3.6 Test Location

UL Japan, Inc. Ise EMC Lab.
Shielded room for SAR testing
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919
ISED Lab Company Number: 2973C / CAB identifier: JP0002
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999

## SECTION 4: Test result

### 4.1 Result

Complied
Highest values at each band are listed next section.

### 4.2 Stand-alone SAR result

| RF Exposure Conditions | | Equipment Class - Highest Reported SAR (W/kg) |
|---|---|---|
| | | Radio microphone |
| Standalone Tx (1-g SAR) | Body-worn | 0.694 |

*Details are shown at section 12.

### 4.3 Simultaneous transmission SAR result

The combinations of modes that can be transmitted simultaneously are as follows.
Radio microphone + RF remote

| RF Exposure Conditions | | Equipment Class - Highest Reported SAR (W/kg) |
|---|---|---|
| | | Radio microphone + RF remote |
| Simultaneous Tx (1-g SAR) | Body-worn | 1.094 |

## SECTION 5: Tune-up tolerance information and software information

Maximum tune-up tolerance limit

| Mode | Frequency band [MHz] | Maximum tune-up tolerance limit [dBm] | Maximum tune-up tolerance limit [mW] |
|---|---|---|---|
| Radio microphone | 470.125 to 607.875 | 14.12 | 25.85 |
| Radio microphone | 614.125 to 615.875 | 9.44 | 8.80 |
| RF remote | 2440 | 0.40 | 1.10 |
| RF remote | 2405 and 2475 | -2.00 | 0.63 |

| Software setting |
|---|
| *The power value of the EUT was set for testing as follows (setting value might be different from product specification value);<br>[Radio microphone]<br>Power settings: 25 m W<br>Software: Version: 0.01(220621A)<br>*This setting of software is the worst case.<br>The test was performed with condition that obtained the maximum average power in pre-check.<br>Any conditions under the normal use do not exceed the condition of setting.<br>In addition, end users cannot change the settings of the output power of the product. |

## SECTION 6: RF Exposure Conditions (Test Configurations)

### 6.1 Summary of the distance between antenna and surface of EUT

**Radio microphone**

| Test position | Distance |
|---|---|
| Front | 0 mm |
| Rear | 0 mm |
| Right | 0 mm |
| Left | 0 mm |
| Top | 0 mm |
| Bottom | 0 mm |
| Right tilt | 0 mm |

**RF remote**

| Test position | Distance |
|---|---|
| Front | 10.15 mm |
| Rear | 27.53 mm |
| Right | 10.48 mm |
| Left | 26.48 mm |
| Top | 109.50 mm |
| Bottom | 1.90 mm |
| Right tilt | < 50 mm |

*Details are shown in appendix 4

### 6.2 SAR test exclusion considerations according to KDB 447498 D01

The following is based on KDB 447498 D01.
1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
*[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR*

1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison
4. The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. When the separation of antenna to EUT's surfaces and edges are ≤ 50 mm, the separation distance used for the SAR exclusion calculations is 5 mm.
5. "N/A" displayed on below exclusion calculation means not applicable this formula since distance between antenna and surface is > 50 mm.

When the calculated threshold value by a numerical formula above-mentioned in the following table is 3.0 or less, SAR test is excluded.
The following table lists only the highest frequency and the highest tune up limit in each frequency band.

SAR exclusion calculations for antenna <50mm from the user

| Tx Interface | Frequency (MHz) | Output Power | | Calculated Threshold Value | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | dBm | mW | Front | Rear | Right | Left | Top | Bottom | Right tilt |
| Radio microphone | 607.875 | 14.12 | 26 | 4 -MEASURE- | 4 -MEASURE- | 4 -MEASURE- | 4 -MEASURE- | 4 -MEASURE- | 4 -MEASURE- | 4 -MEASURE- |
| Radio microphone | 615.875 | 9.44 | 9 | 1.4 -EXEMPT- | 1.4 -EXEMPT- | 1.4 -EXEMPT- | 1.4 -EXEMPT- | 1.4 -EXEMPT- | 1.4 -EXEMPT- | 1.4 -EXEMPT- |
| RF remote | 2475.000 | 0.40 | 1 | 0.3 -EXEMPT- | 0.3 -EXEMPT- | 0.3 -EXEMPT- | 0.3 -EXEMPT- | N/A | 0.3 -EXEMPT- | 0.3 -EXEMPT- |

2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following.
*a) [(3·50)/(√f(GHz))) + (test separation distance - 50 mm)·(f(MHz)/150)] mW at > 100 MHz and ≤ 1500 MHz*
*b) [(3·50)/(√f(GHz))) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz*

1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
2. Power and distance are rounded to the nearest mW and mm before calculation
3. "N/A" displayed on below exclusion calculation means not applicable this formula since distance between antenna and surface is < 50 mm.

When output power is less than the calculated threshold value by a numerical formula above-mentioned in the following table, SAR test is excluded.
The following table lists only the highest frequency and the highest tune up limit in each frequency band.

SAR exclusion calculations for antenna >50mm from the user

| Tx Interface | Frequency (MHz) | Output Power | | Calculated Threshold Value | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | dBm | mW | Front | Rear | Right | Left | Top | Bottom | Right tilt |
| Radio microphone | 607.875 | 14.12 | 26 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Radio microphone | 615.875 | 9.44 | 9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| RF remote | 2475.000 | 0.40 | 1 | N/A | N/A | N/A | N/A | 690.3 mW -EXEMPT- | N/A | N/A |

## 6.3 Estimated SAR for Simultaneous Transmission SAR Analysis

The following is based on KDB 447498 D01.
When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

*(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg*
*for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.*

*0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.*

1. The upper frequency of the frequency band was used in order to calculate estimated SAR.
2. Power and distance are rounded to the nearest mW and mm before calculation
3. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied. For antennas ≤50 mm from each side the separation distance used for the estimated SAR calculations is 5 mm as conservative.

| Tx Interface | Frequency (MHz) | Output Power | | Estimated 1-g SAR Value (W/kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | dBm | mW | Front | Rear | Right | Left | Top | Bottom | Right tilt |
| RF remote | 2475 | 0.40 | 1 | 0.042 | 0.042 | 0.042 | 0.042 | 0.400 | 0.042 | 0.042 |

Estimated SAR of Right with accessory = Estimated SAR of Right = 0.042 W/kg

The test separation distances of Top with accessory is > 50 mm.
Estimated SAR of Top with accessory = 0.400 W/kg

## SECTION 7: Description of the Body setup

### 7.1 Procedure for SAR test position determination

-The tested procedure was performed according to the KDB 447498 D01 (Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies).

### 7.2 Test position for Body setup

| No. | Position | Test distance | Radio microphone | RF remote |
|---|---|---|---|---|
| | | | Tested | Tested |
| 1 | Front | 0 mm | ☑ | ☐ |
| 2 | Rear | 0 mm | ☑ | ☐ |
| 3 | Right | 0 mm | ☑ | ☐ |
| 4 | Left | 0 mm | ☑ | ☐ |
| 5 | Top | 0 mm | ☑ | ☐ |
| 6 | Bottom | 0 mm | ☑ | ☐ |
| 7 | Right tilt*1 | 0 mm | ☑ | ☐ |

*1: From the results of pre-test of Front tilt, Rear tilt, Right tilt, and Left tilt, Right tilt was the worst of these positions. Therefore, it was tested in that position.

## SECTION 8: Description of the operating mode

### 8.1 Output Power and SAR test required

| Mode | Freq. (MHz) | Tune-up upper Power (dBm) (Burst) | Measured average Power (dBm) (Burst) | Initial test configuration | Note(s) |
|---|---|---|---|---|---|
| Radio microphone | 470.125 | 14.12 | 13.98 | | 1 |
| | 539.000 | 14.12 | 14.09 | Yes | |
| | 607.875 | 14.12 | 13.88 | | |
| | 614.125 | 9.44 | - | | |
| | 615.000 | 9.44 | - | | |
| | 615.875 | 9.44 | - | | |

**Note(s):**
1. SAR test channel was chosen. (shaded blue frame)

## SECTION 9: Test surrounding

### 9.1 Measurement uncertainty

This measurement uncertainty budget is suggested by IEEE Std 1528(2013) and IEC62209-2:2010+AMD1:2019 CSV, and determined by Schmid & Partner Engineering AG (DASY5/6 Uncertainty Budget). Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz Section 2.8.1., when the highest measured SAR(1 g) within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std.1528 (2013) is not required in SAR reports submitted for equipment approval.

<Body>

| Error Description | Uncert. value | Prob. Dist. | Div. | (ci) 1 g | (ci) 10 g | Std. Unc. (1 g) | Std.Unc. (10 g) |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe Calibration | ± 6.55 % | N | 1 | 1 | 1 | ± 6.55 % | ± 6.55 % |
| Axial Isotropy | ± 4.7 % | R | √3 | 0.7 | 0.7 | ± 1.9 % | ± 1.9 % |
| Hemispherical Isotropy | ± 9.6 % | R | √3 | 0.7 | 0.7 | ± 3.9 % | ± 3.9 % |
| Linearity | ± 4.7 % | R | √3 | 1 | 1 | ± 2.7 % | ± 2.7 % |
| Modulation Response | ± 2.4 % | R | √3 | 1 | 1 | ± 1.4 % | ± 1.4 % |
| System Detection Limits | ± 1.0 % | R | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| Boundary Effects | ± 2.0 % | R | √3 | 1 | 1 | ± 1.2 % | ± 1.2 % |
| Readout Electronics | ± 0.3 % | N | 1 | 1 | 1 | ± 0.3 % | ± 0.3 % |
| Response Time | ± 0.8 % | R | √3 | 1 | 1 | ± 0.5 % | ± 0.5 % |
| Integration Time | ± 2.6 % | R | √3 | 1 | 1 | ± 1.5 % | ± 1.5 % |
| RF Ambient Noise | ± 3.0 % | R | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| RF Ambient Reflections | ± 3.0 % | R | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| Probe Positioner | ± 0.04 % | R | √3 | 1 | 1 | ± 0.0 % | ± 0.0 % |
| Probe Positioning | ± 0.8 % | R | √3 | 1 | 1 | ± 0.5 % | ± 0.5 % |
| Post-processing | ± 4.0 % | R | √3 | 1 | 1 | ± 2.3 % | ± 2.3 % |
| **Test Sample Related** | | | | | | | |
| Device Holder | ± 3.6 % | N | 1 | 1 | 1 | ± 3.6 % | ± 3.6 % |
| Test sample Positioning | ± 2.9 % | N | 1 | 1 | 1 | ± 2.9 % | ± 2.9 % |
| Power Scaling | ± 0.0 % | R | √3 | 1 | 1 | ± 0.0 % | ± 0.0 % |
| Power Drift | ± 5.0 % | R | √3 | 1 | 1 | ± 2.9 % | ± 2.9 % |
| **Phantom and Setup** | | | | | | | |
| Phantom Uncertainty | ± 7.6 % | R | √3 | 1 | 1 | ± 4.4 % | ± 4.4 % |
| SAR correction | ± 1.9 % | N | 1 | 1 | 0.84 | ± 1.9 % | ± 1.6 % |
| Liquid Conductivity (mea.) | + 3.3 % | N | 1 | 0.78 | 0.71 | ± 2.6 % | ± 2.4 % |
| Liquid Permittivity (mea.) | - 4.6 % | N | 1 | 0.23 | 0.26 | ± 1.1 % | ± 1.2 % |
| Temp. unc. - Conductivity | ± 3.4 % | R | √3 | 0.78 | 0.71 | ± 1.5 % | ± 1.4 % |
| Temp. unc. - Permittivity | ± 0.4 % | R | √3 | 0.23 | 0.26 | ± 0.1 % | ± 0.1 % |
| Combined Std. Uncertainty | | | | | | ± 12.2 % | ± 12.1 % |
| **Expanded STD Uncertainty ( $\kappa$ =2)** | | | | | | ± 24.5 % | ± 24.3 % |

Note: This uncertainty budget for validation is worst-case.
Table of uncertainties are listed for ISO/IEC 17025.

## SECTION 10: Parameter Check

The dielectric parameters were checked prior to assessment using the DAK dielectric probe kit.
The dielectric parameters measurement is reported in each correspondent section.

According to KDB 865664 D01, +/- 5 % tolerances are required for εr and σ and then below table which is the target value of the simulated tissue liquid is quoted from KDB 865664 D01.

| Target Frequency | Head | | Body | |
|---|---|---|---|---|
| (MHz) | $\varepsilon_r$ | σ (S/m) | $\varepsilon_r$ | σ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.90 | 55.2 | 0.97 |
| 900 | 41.5 | 0.97 | 55.0 | 1.05 |
| 915 | 41.5 | 0.98 | 55.0 | 1.06 |
| 1450 | 40.5 | 1.20 | 54.0 | 1.30 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 |
| 1800 – 2000 | 40.0 | 1.40 | 53.3 | 1.52 |
| 2450 | 39.2 | 1.80 | 52.7 | 1.95 |
| 3000 | 38.5 | 2.40 | 52.0 | 2.73 |
| 5800 | 35.3 | 5.27 | 48.2 | 6.00 |

($\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m$^3$)

The dielectric parameters are linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

### 10.1 For SAR system check

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Ambient Temp. [deg.c] | Relative Humidity [%] | Liquid type | Liquid Temp. [deg.c] | Measured Frequency [MHz] | Target [σ] | Target [εr] | Measure [σ] | Measure [εr] | Deviation σ [%] | Deviation εr [%] | Limit [%] | Remark |
| 2022/8/3 | 21.0 | 40 | HBBL600-10000 | 20.5 | 450.000 | 0.87 | 43.5 | 0.86 | 41.5 | -0.7 | ***-4.6*** | +/- 5 | |
| 2022/8/4 | 21.0 | 40 | HBBL600-10000 | 20.5 | 600.000 | 0.88 | 42.7 | 0.91 | 41.1 | ***3.0*** | -3.8 | +/- 5 | |

### 10.2 For SAR measurement

| DIELECTRIC PARAMETERS MEASUREMENT RESULTS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Ambient Temp. [deg.c] | Relative Humidity [%] | Liquid type | Liquid Temp. [deg.c] | Measured Frequency [MHz] | Target [σ] | Target [εr] | Measure [σ] | Measure [εr] | Deviation σ [%] | Deviation εr [%] | Limit [%] | Remark |
| 2022/8/3 | 21.0 | 40 | HBBL600-10000 | 20.5 | 470.125 | 0.87 | 43.4 | 0.87 | 41.4 | -0.4 | ***-4.6*** | +/- 5 | |
| 2022/8/3 | 21.0 | 40 | HBBL600-10000 | 20.5 | 539.000 | 0.88 | 43.0 | 0.89 | 41.2 | 1.4 | -4.2 | +/- 5 | |
| 2022/8/4 | 21.0 | 40 | HBBL600-10000 | 20.5 | 607.875 | 0.88 | 42.7 | 0.91 | 41.1 | ***3.3*** | -3.8 | +/- 5 | |

## SECTION 11: System Check confirmation

The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm ± 0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm ± 0.5 cm for measurements > 3 GHz.
The DASY system with an E-Field Probe was used for the measurements.
The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom).
The standard measuring distance was 10 mm (above 1 GHz to 6 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
The coarse grid with a grid spacing of 12 mm (1 GHz to 3 GHz) and15 mm (below 1 GHz) was aligned with the dipole.
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
Distance between probe sensors and phantom surface was set to 3 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
The dipole input power (forward power) was 100 mW(For 5 GHz band) or 250 mW(For other band).
The results are normalized to 1 W input power.

**Target Value**

| Freq [MHz] | Model,S/N | Head | |
|---|---|---|---|
| | | (SPEAG) 1 g [W/kg] | (SPEAG) 10 g [W/kg] |
| 450 | D450V3,1051 | 4.56 | 3.06 |
| 600 | D600V3,1003 | 6.80 | 4.44 |

The target(reference) SAR values can be obtained from the calibration certificate of system validation dipoles(Refer to Appendix 3). The target SAR values are SAR measured value in the calibration certificate scaled to 1 W.

| Date Tested | Test Freq | Model,S/N | T.S. Liquid | | Measured Results | | Target (Ref. Value) | Delta ± 10 % |
|---|---|---|---|---|---|---|---|---|
| | | | | | Zoom Scan | Normalize to 1 W | | |
| 2022/8/3 | 450 | D450V3,1051 | Head | 1 g | 1.14 | 4.56 | 4.56 | 0.0 |
| | | | | 10 g | 0.76 | 3.05 | 3.06 | -0.3 |
| 2022/8/4 | 600 | D600V3,1003 | Head | 1 g | 1.66 | 6.64 | 6.80 | -2.4 |
| | | | | 10 g | 1.09 | 4.36 | 4.44 | -1.8 |

## SECTION 12: Measured and Reported (Scaled) SAR Results

**SAR Test Reduction criter**ia are as follows

**KDB 447498 D01 (General RF Exposure Guidance):**

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

✧ ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
✧ ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
✧ ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

- According to Notice 2016-DRS001 based on the IEEE1528 and IEC 62209 requirements, the low, mid and high frequency channels for the configuration with the highest SAR value must be tested regardless of the SAR value measured.
- When reported SAR value is exceed 1.2 W/kg(if any), device holder perturbation verification is required; however, since distance between device holder and antenna of EUT is enough, it was not conducted.
- Reported SAR= Measured SAR [W/kg] * Power Scaled factor * Duty Scaled factor
  Maximum tune-up tolerance limit is by the specification from a customer.
  * Power Scaled factor = Maximum tune-up tolerance limit [mW] / Measured power [mW]
  * Duty Scaled factor = 1 / Duty (%) / 100
- Maximum tune-up tolerance limit is by the specification from a customer.

Note: Measured value is rounded round off to three decimal places

## 12.1 Result of Body SAR

| Test Position | Dist. (mm) | Mode | Freq. (MHz) | Power (dBm) | | Power Scaled factor | Duty (%) | Duty Scaled factor | 1-g SAR (W/kg) | | Note | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Tune-up upper Power | Measured average Power | | | | Measured | Reported | | |
| Front | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.039 | 0.039 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |
| Rear | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.061 | 0.061 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |
| Right | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.071 | 0.072 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |
| Left | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.064 | 0.065 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |
| Top | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | 0.671 | 0.694 | 2 | 1 |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.285 | 0.287 | 1 | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | 0.214 | 0.226 | 2 | |
| Bottom | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.014 | 0.014 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |
| Right tilt | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.126 | 0.127 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |
| Right with accessory | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.125 | 0.126 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |
| Top with accessory | 0 | Radio microphone | 470.125 | 14.12 | 13.98 | 1.03 | 100.0 | 1.00 | | | | |
| | | | 539.000 | 14.12 | 14.09 | 1.01 | 100.0 | 1.00 | 0.043 | 0.043 | | |
| | | | 607.875 | 14.12 | 13.88 | 1.06 | 100.0 | 1.00 | | | | |

*1: Worst position
*2: Frequency change

## 12.2 Repeated measurement

According to KDB 865664 D1.
1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10 % from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

| Test Configuration | | | Mode | Freq. (MHz) | Meas. SAR (W/kg) | | Largest to Smallest SAR Ratio | Plot No. |
|---|---|---|---|---|---|---|---|---|
| Exposure | Position | Dist. (mm) | | | Original | Repeated | | |
| Body | Top | 0 | Radio microphone | 470.125 | 0.671 | N/A | N/A | - |

**Note(s):**
N/A: Repeated Measurement is not required since the original highest measured SAR for all band is < 0.80 W/kg.

## SECTION 13: Simultaneous Transmission SAR Analysis

The combinations of modes that can be transmitted simultaneously are as follows.
Radio microphone + RF remote

| Test Position | 1-g SAR (W/kg) | | Σ 1-g SAR (W/kg) |
|---|---|---|---|
| | Radio microphone | RF remote | |
| Front | 0.039 | 0.042 | 0.081 |
| Rear | 0.061 | 0.042 | 0.103 |
| Right | 0.072 | 0.042 | 0.114 |
| Left | 0.065 | 0.042 | 0.107 |
| Top | 0.694 | 0.400 | 1.094 |
| Bottom | 0.014 | 0.042 | 0.056 |
| Right tilt | 0.127 | 0.042 | 0.169 |
| Right with accessory | 0.126 | 0.042 | 0.168 |
| Top with accessory | 0.043 | 0.400 | 0.443 |

**Note(s):**

1. Values shaded green are estimated SAR.

**Conclusion:**

Simultaneous transmission SAR measurement(Volume Scan) is not required because sum of the 1-g SAR is < 1.6 W/kg.

## SECTION 14: Test instruments

| Local Id | LIMS ID | Description | Manufacturer | Model | Serial | Last Cal Date | Interval |
|---|---|---|---|---|---|---|---|
| MDAE-03 | 141484 | Data Acquisition Electronics | Schmid & Partner Engineering AG | DAE4 | 1372 | 2022/04/11 | 12 |
| MDA-09 | 141468 | Dipole Antenna | Schmid&Partner Engineering AG | D450V3 | 1051 | 2021/09/17 | 12 |
| MDH-01 | 142484 | Device holder | Schmid&Partner Engineering AG | Mounting device for transmitter | - | 2021/11/01 | 12 |
| MOS-33 | 88581 | Thermo-Hygrometer | CUSTOM. Inc | CTH-201 | - | 2022/07/03 | 12 |
| MRBT-02 | 142247 | SAR robot | Schmid & Partner Engineering AG | TX60 Lspeag | F10/5E3LA1/A/01 | 2022/04/25 | 12 |
| MHDC-21 | 142561 | Dual Directional Coupler | Keysight Technologies Inc | 778D | MY52180243 | - | - |
| MPF-02 | 142056 | 2mm Oval Flat Phantom | Schmid & Partner Engineering AG | QDOVA001BB | 1045 | 2022/05/23 | 12 |
| COTS-MSAR-04 | 141182 | Dielectric assessment software | Schmid&Partner Engineering AG | DAK | - | - | - |
| COTS-MPSE-02 | 173900 | Software for MA24106A | Anritsu Corporation | Anritsu PowerXpert | - | - | - |
| MDPK-03 | 141471 | Dielectric assessment kit | Schmid & Partner Engineering AG | DAKS-3.5 | 0008 | 2022/04/19 | 12 |
| MAT-78 | 142313 | Attenuator | Telegrartner | J01156A0011 | 42294119 | - | - |
| MPM-15 | 141811 | Power Meter | Keysight Technologies Inc | N1914A | MY53060017 | 2022/06/16 | 12 |
| MNA-03 | 141551 | Vector Reflectometer | COPPER MOUNTAIN TECHNOLOGIES | PLANAR R140 | 0030913 | 2022/04/18 | 12 |
| MOS-37 | 141574 | Digital thermometer | LKM electronic | DTM3000 | - | 2022/07/03 | 12 |
| MPSE-20 | 141833 | Power sensor | Keysight Technologies Inc | N8482H | MY53050001 | 2022/06/16 | 12 |
| MPSE-24 | 141843 | Power sensor | Anritsu Corporation | MA24106A | 1026164 | 2022/03/17 | 12 |
| MPSE-25 | 141844 | Power sensor | Anritsu Corporation | MA24106A | 1031504 | 2022/03/17 | 12 |
| MRFA-24 | 141875 | Pre Amplifier | R&K | R&K CGA020M602-2633R | B30550 | 2022/06/27 | 12 |
| MHBBL600-10000 | 176484 | Head Simulating Liquid | Schmid & Partner Engineering AG | HBBL600-10000V6 | SL AAH U16 BC | - | - |
| COTS-MSAR-03 | 141181 | Dasy5 | Schmid & Partner Engineering AG | DASY5 | - | - | - |
| MSG-10 | 141890 | Signal Generator | Keysight Technologies Inc | N5181A | MY47421098 | 2021/11/18 | 12 |
| MAT-81 | 141311 | Attenuator | Weinschel Associates | WA1-20-33 | 100131 | 2022/04/06 | 12 |
| MDA-21 | 141481 | Dipole Antenna | Schmid&Partner Engineering AG | D600V3 | 1003 | 2019/10/18 | 36 |
| MRENT-S22 | 221514 | Dosimetric E-Field Probe | Schmid & Partner Engineering AG | EX3DV4 | 3745 | 2022/04/19 | 12 |

***1) This test equipment was used for the tests before the expiration date of the calibration.**
**The expiration date of the calibration is the end of the expired month.**
**All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.**
**As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.**

**SAR room is checked before every testing and ambient noise is <0.012 W/kg**

## APPENDIX 1: System Check

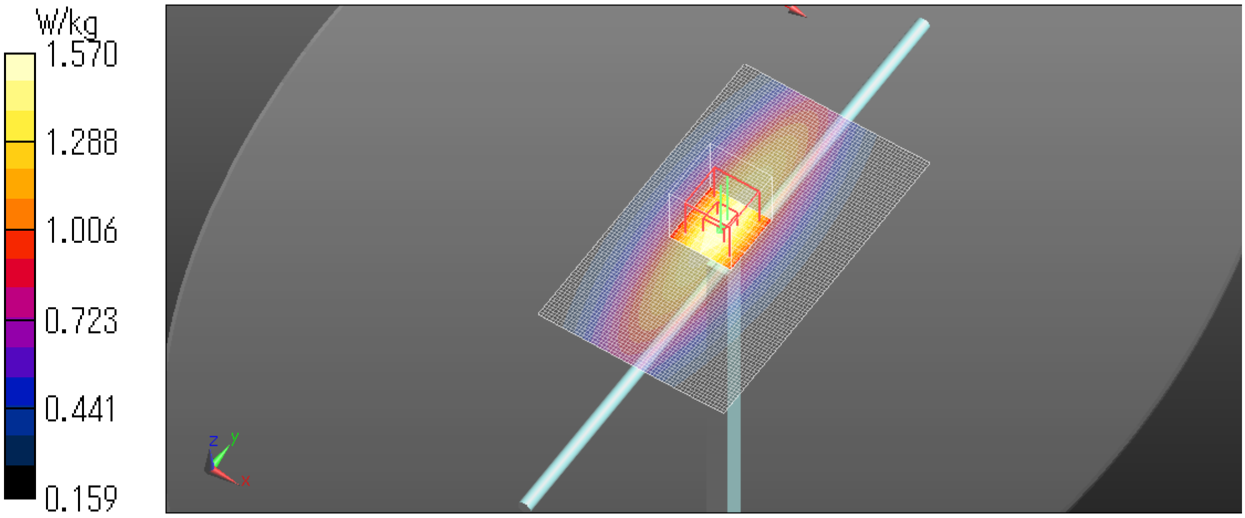
**450 MHz System check**
Communication System: UID 0, #CW (0); Communication System Band: D450 (450.0 MHz); ; Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.864 S/m; $\varepsilon_r$ = 41.49; ρ = 1000 kg/m$^3$
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3745; ConvF(9.78, 9.78, 9.78) @ 450 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372;
Phantom: ELI v4.0 (20deg probe tilt); Type: QDOVA001BB;Serial: TP:1045
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

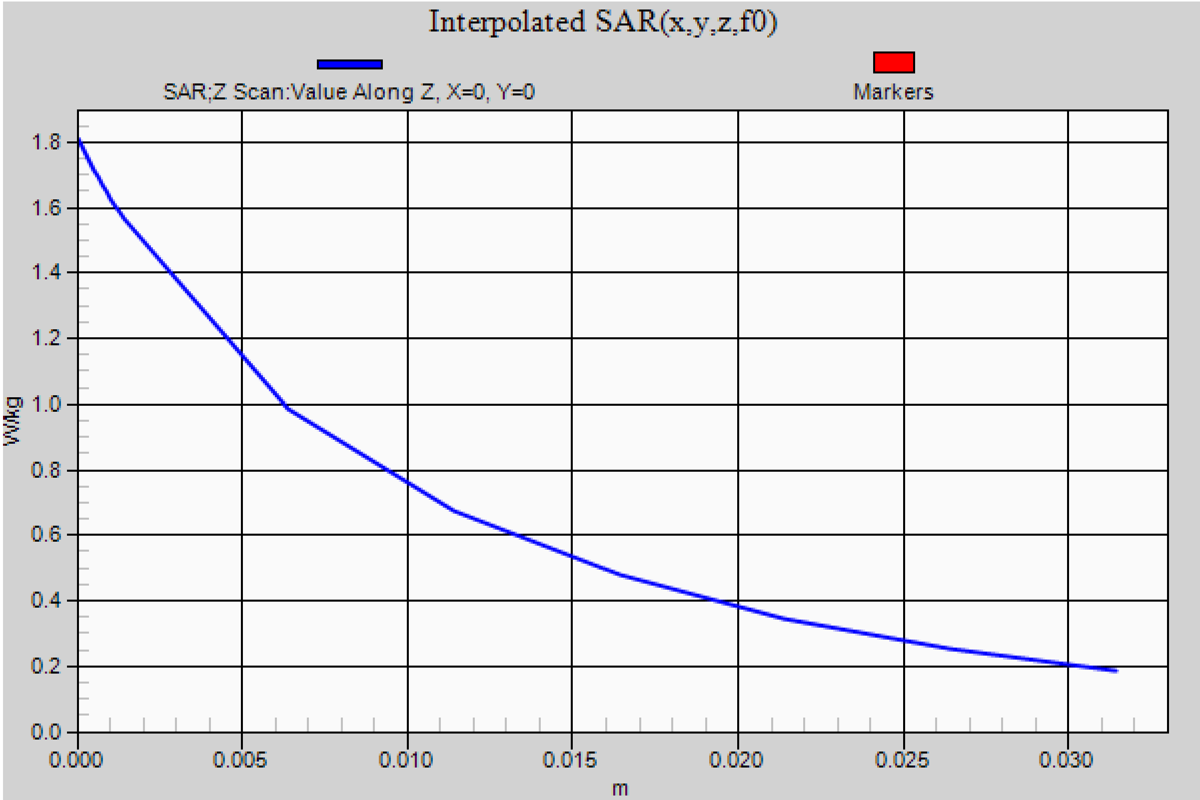
**System Performance Check at Frequencies 450 MHz/d = 15 mm, Pin = 250 mW/Area Scan (61x101x1):**
Interpolated grid: dx = 1.500 mm, dy = 1.500 mm
Maximum value of SAR (interpolated) = 1.52 W/kg

**System Performance Check at Frequencies 450 MHz/d = 15 mm, Pin = 250 mW/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx = 5 mm, dy = 5 mm, dz = 5 mm
Reference Value = 44.19 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.82 W/kg
**SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.762 W/kg**
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)
Ratio of SAR at M2 to SAR at M1 = 62.6 %
Maximum value of SAR (measured) = 1.57 W/kg

**System Performance Check at Frequencies 450 MHz/d = 15 mm, Pin = 250 mW/Z Scan (1x1x18):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 13.34 (10.80, 14.54) [mm]
Maximum value of SAR (interpolated) = 1.81 W/kg

Ambient Temp. : 21.0 degree.C.   Liquid Temp.; 20.5 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/08/03




Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

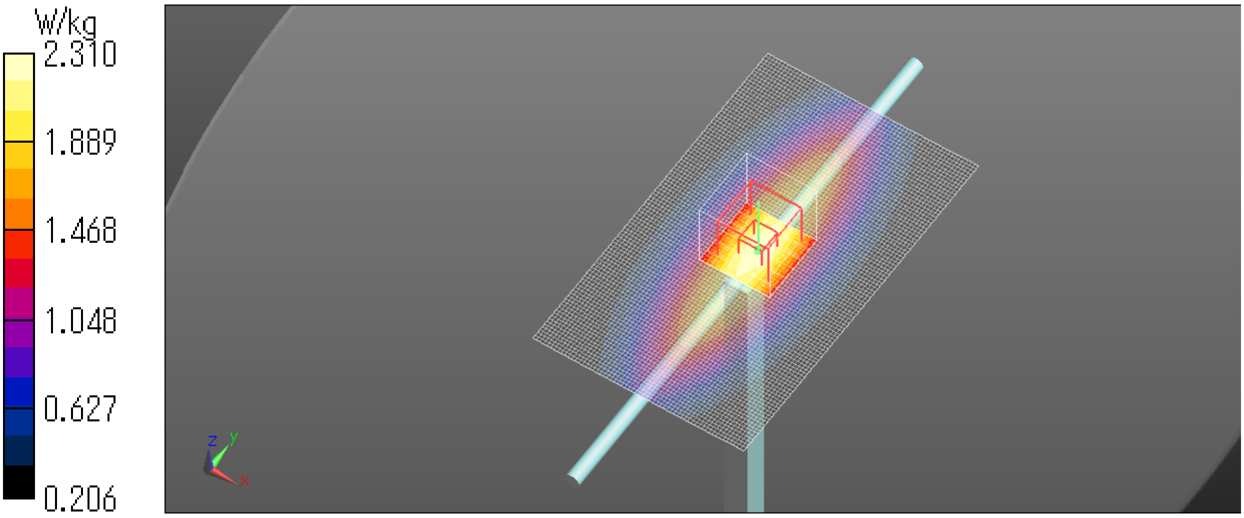
**600 MHz System check**
Communication System: UID 0, #CW (0); Communication System Band: D600 (600.0MHz); ; Duty Cycle: 1:1
Medium parameters used: f = 600 MHz; $\sigma$ = 0.908 S/m; $\varepsilon_r$ = 41.1; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3745; ConvF(9.61, 9.61, 9.61) @ 600 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372;
Phantom: ELI v4.0 (20deg probe tilt); Type: QDOVA001BB;Serial: TP:1045
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

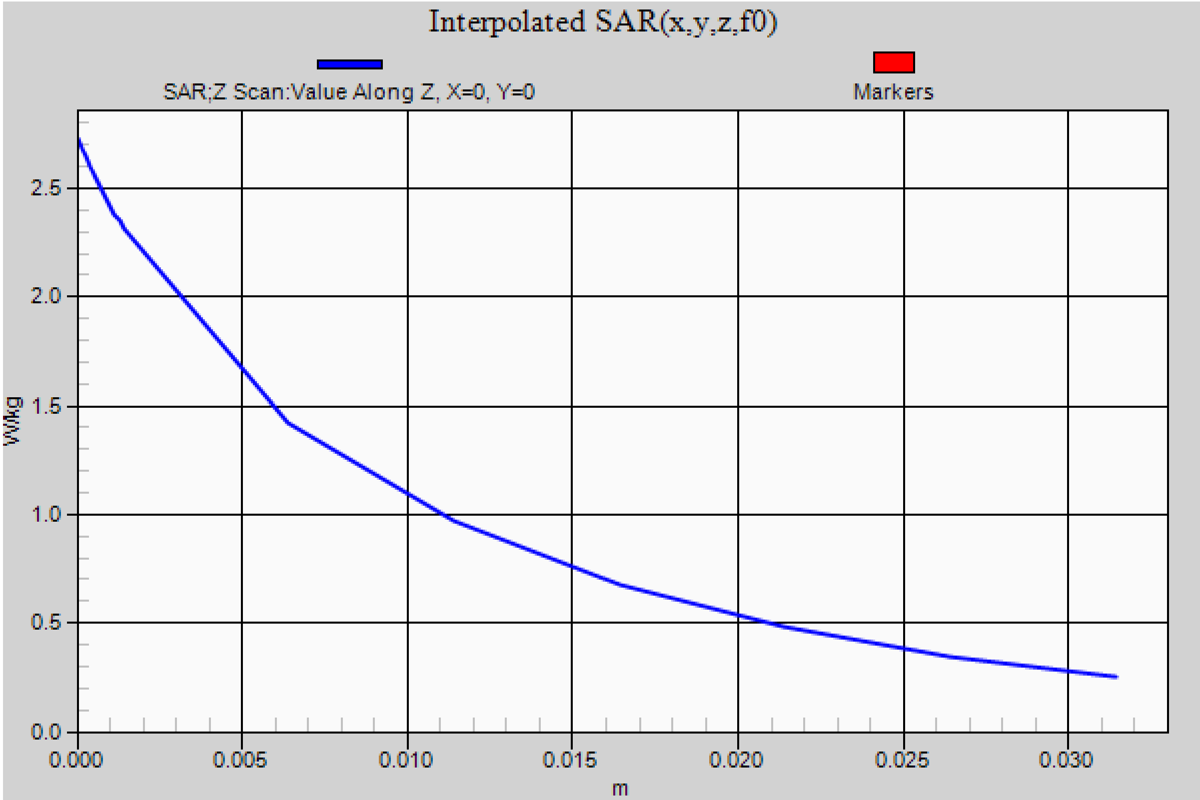
**System Performance Check at Frequencies 600 MHz/d = 15 mm, Pin = 250 mW/Area Scan (61x101x1):**
Interpolated grid: dx = 1.500 mm, dy = 1.500 mm
Maximum value of SAR (interpolated) = 2.31 W/kg

**System Performance Check at Frequencies 600 MHz/d = 15 mm, Pin = 250 mW/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx = 5 mm, dy = 5 mm, dz = 5 mm
Reference Value = 51.42 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 2.72 W/kg
**SAR(1 g) = 1.66 W/kg; SAR(10 g) = 1.09 W/kg**
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)
Ratio of SAR at M2 to SAR at M1 = 61.4 %
Maximum value of SAR (measured) = 2.31 W/kg

**System Performance Check at Frequencies 600 MHz/d = 15 mm, Pin = 250 mW/Z Scan (1x1x18):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Penetration depth = 13.11 (10.24, 13.89) [mm]
Maximum value of SAR (interpolated) = 2.73 W/kg

Ambient Temp. : 21.0 degree.C. Liquid Temp.; 20.5 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/08/04




Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
2.5
2.0
1.5
1.0
0.5
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

## APPENDIX 2: SAR Measurement data

### Evaluation procedure

### The evaluation was performed with the following procedure:

**Step 1:** Measurement of the E-field at a fixed location above the ear point or central position of flat phantom was used as a reference value for assessing the power drop.

**Step 2:** The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and the horizontal grid spacing was 15 mm x 15 mm, 12 mm x 12 mm or 10 mm x 10 mm. Based on these data, the area of the maximum absorption was determined by spline interpolation.

**Step 3:** Around this point found in the Step 2 (area scan), a volume of 30 mm x 30 mm x 30 mm or more was assessed by measuring 7 x 7 x 7 points at least for below 3 GHz and a volume of 28 mm x 28 mm x 22.5 mm or more was assessed by measuring 8 x 8 x 6(ratio step method (*1)) points at least for 5 GHz band.

And for any secondary peaks found in the Step2 which are within 2 dB of maximum peak and not with this Step3 (Zoom scan) is repeated. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

(1). The data at the surface were extrapolated, since the center of the dipoles is 1 mm(EX3DV4) away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes.
This polynomial was then used to evaluate the points between the surface and the probe tip.

(2). The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

(3). All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

***1. Ratio step method parameters used;**
**The first measurement point: 2 mm from the phantom surface, the initial grid separation: 2 mm, subsequent graded grid ratio: 1.5**
**These parameters comply with the requirement of the KDB 865664 D01.**

**Step 4**: Re-measurement of the E-field at the same location as in Step 1.
Confirmation after SAR testing
It was checked that the power drift [W] is within +/-5 %.The verification of power drift during the SAR test is that DASY5 system calculates the power drift by measuring the e-filed at the same location at beginning and the end of the scan measurement for each test position.

DASY5 system calculation Power drift value[dB] =20log(Ea)/(Eb)
Before SAR testing : Eb [V/m]
After SAR testing : Ea [V/m]

Limit of power drift[W] = +/- 5 %
X[dB] = 10log[P] = 10log(1.05/1) = 10log(1.05) -10log(1) = 0.212 dB

from E-filed relations with power.
p=E^2/η
Therefore, The correlation of power and the E-filed
X dB = 10log(P) = 10log(E)^2 = 20log(E)

Therefore,
The calculated power drift of DASY5 System must be the less than +/- 0.212 dB.

## Measurement data

**Plot No. 1**

Communication System: UID 0, Radio microphone (0); Communication System Band: UC; ; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 470.125 MHz; $\sigma$ = 0.868 S/m; $\varepsilon_r$ = 41.397; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3745; ConvF(9.78, 9.78, 9.78) @ 470.125 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372;
Phantom: ELI v4.0 (20deg probe tilt); Type: QDOVA001BB;Serial: TP:1045
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

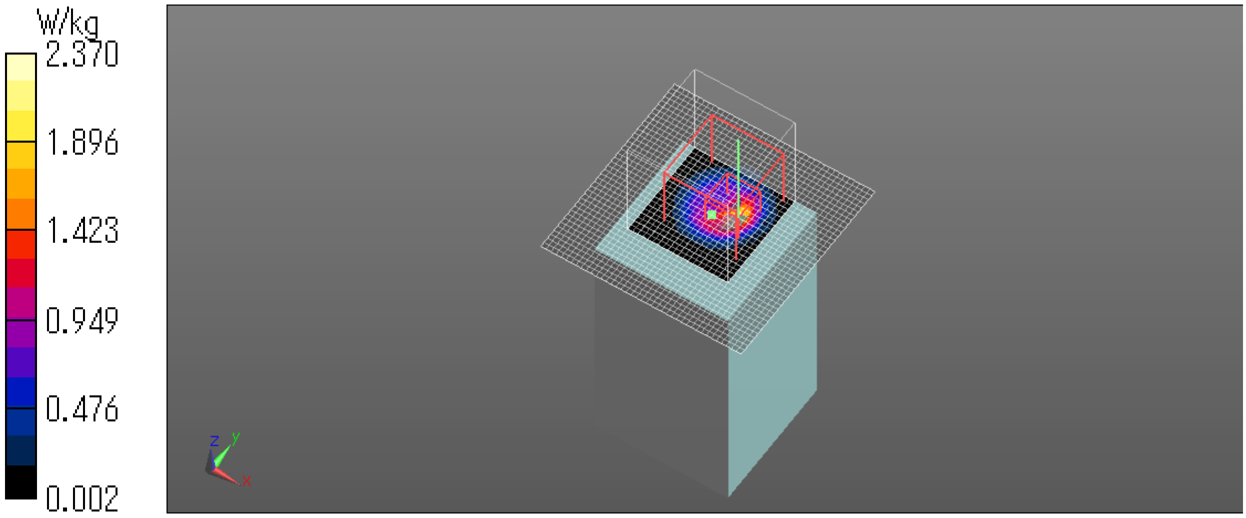
**Radio/Top Low ch/Area Scan 2 (41x41x1):** Interpolated grid: dx = 1.500 mm, dy = 1.500 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.05 W/kg

**Radio/Top Low ch/Zoom Scan finer (11x11x8)/Cube 0:** Measurement grid: dx = 3 mm, dy = 3 mm, dz = 1.4 mm
Reference Value = 23.21 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 11.0 W/kg
**SAR(1 g) = 0.671 W/kg; SAR(10 g) = 0.187 W/kg**
Smallest distance from peaks to all points 3 dB below = 3.2 mm
Ratio of SAR at M2 to SAR at M1 = 38.6 %

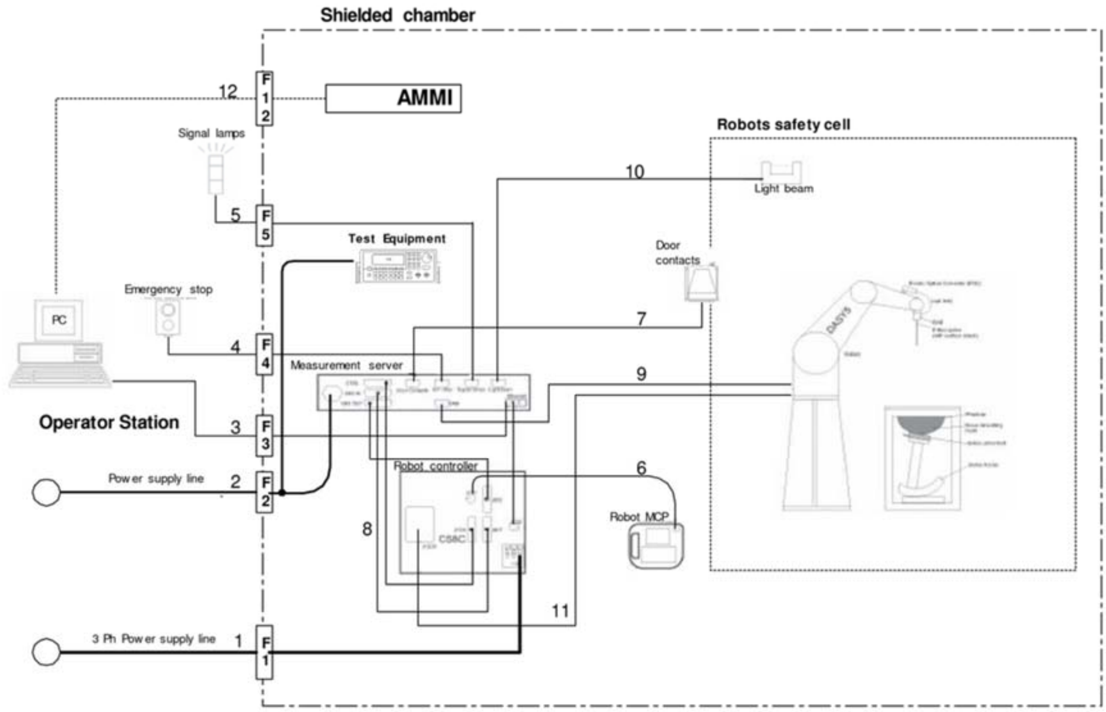
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.37 W/kg

Ambient Temp. : 21.0 degree.C.     Liquid Temp.; 20.5 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/08/03



## APPENDIX 3: System specifications

### Configuration and peripherals




The DASY5 system for performing compliance tests consist of the following items:
Our system is DASY6; however, it behaves as DASY5.

a) A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
An arm extension for accommodating the data acquisition electronics (DAE).

b) An isotropic field probe optimized and calibrated for the targeted measurement.

c) A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

d) The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection.
The EOC is connected to the measurement server.

e) The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

f) The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.

g) A computer running Windows 10 or 7 and the DASY5/6 software.

h) Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

i) The phantom, the device holder and other accessories according to the targeted measurement.

## Specifications

### a) Robot TX60L

| | | |
|---|---|---|
| **Number of Axes** | : | 6 |
| **Nominal Load** | : | 2 kg |
| **Maximum Load** | : | 5 kg |
| **Reach** | : | 920 mm |
| **Repeatability** | : | +/-0.03 mm |
| **Control Unit** | : | CS8c |
| **Programming Language** | : | VAL3 |
| **Weight** | : | 52.2 kg |
| **Manufacture** | : | Stäubli Robotics |

### b) E-Field Probe

| | | |
|---|---|---|
| **Model** | : | EX3DV4 |
| **Construction** | : | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material<br>(resistant to organic solvents, e.g., glycol ether) |
| **Frequency** | : | 10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz) |
| **Directivity** | : | +/-0.3 dB in HSL (rotation around probe axis)<br>+/-0.5 dB in tissue material (rotation normal probe axis) |
| **Dynamic Range** | : | 10uW/g to > 100 mW/g;Linearity<br>+/-0.2 dB(noise: typically < 1uW/g) |
| **Dimensions** | : | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm |
| **Application** | : | Highprecision dosimetric measurement in any exposure scenario<br>(e.g., very strong gradient fields).Only probe which enables compliance<br>testing for frequencies up to 6 GHz with precision of better 30 %. |
| **Manufacture** | : | Schmid & Partner Engineering AG |

**EX3DV4 E-field Probe**

## c) Data Acquisition Electronic (DAE4)

| | | |
|---|---|---|
| **Features** | : | Signal amplifier, multiplexer, A/D converter and control logic<br>Serial optical link for communication with DASY5 embedded system (fully remote controlled)<br>Two step probe touch detector for mechanical surface detection and emergency robot stop |
| **Measurement Range** | : | -100 to +300 mV (16 bit resolution and two range settings: 4 mV, 400 mV) |
| **Input Offset voltage** | : | < 5 μV (with auto zero) |
| **Input Resistance** | : | 200 MΩ |
| **Input Bias Current** | : | < 50 fA |
| **Battery Power** | : | > 10 h of operation (with two 9.6 V NiMH accus) |
| **Dimension** | : | 60 x 60 x 68 mm |
| **Manufacture** | : | Schmid & Partner Engineering AG |

## d) Electro-Optic Converter (EOC)

| | | |
|---|---|---|
| **Version** | : | EOC 61 |
| **Description** | : | for TX60 robot arm, including proximity sensor |
| **Manufacture** | : | Schmid & Partner Engineering AG |

## e) DASY5 Measurement server

| | | |
|---|---|---|
| **Features** | : | Intel ULV Celeron 400 MHz<br>128 MB chip disk and 128 MB RAM<br>16 Bit A/D converter for surface detection system<br>Vacuum Fluorescent Display<br>Robot Interface<br>Serial link to DAE (with watchdog supervision)<br>Door contact port (Possibility to connect a light curtain)<br>Emergency stop port (to connect the remote control)<br>Signal lamps port<br>Light beam port<br>Three Ethernet connection ports<br>Two USB 2.0 Ports<br>Two serial links<br>Expansion port for future applications |
| **Dimensions (L x W x H)** | : | 440 x 241 x 89 mm |
| **Manufacture** | : | Schmid & Partner Engineering AG |

## f) Light Beam Switches

| | | |
|---|---|---|
| **Version** | : | LB5 |
| **Dimensions (L x H)** | : | 110 x 80 mm |
| **Thickness** | : | 12 mm |
| **Beam-length** | : | 80 mm |
| **Manufacture** | : | Schmid & Partner Engineering AG |

## g) Software

| | | |
|---|---|---|
| **Item** | : | Dosimetric Assessment System DASY5 |
| **Type No.** | : | SD 000 401A, SD 000 402A |
| **Software version No.** | : | DASY52, Version 52.6 (1) |
| **Manufacture / Origin** | : | Schmid & Partner Engineering AG |

## h) Robot Control Unit

| | | |
|---|---|---|
| **Weight** | : | 70 Kg |
| **AC Input Voltage** | : | selectable |
| **Manufacturer** | : | Stäubli Robotics |

## i) Phantom and Device Holder

### Phantom

| | | |
|---|---|---|
| **Type** | : | SAM Twin Phantom V4.0 |
| **Description** | : | The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot. |
| **Material** | : | Vinylester, glass fiber reinforced (VE-GF) |
| **Shell Material** | : | Fiberglass |
| **Thickness** | : | 2.0 +/- 0.2 mm |
| **Dimensions** | : | Length: 1000 mm Width: 500 mm Height: adjustable feet |
| **Volume** | : | Approx. 25 liters |
| **Manufacture** | : | Schmid & Partner Engineering AG |

| | | |
|---|---|---|
| **Type** | : | 2 mm Flat phantom ELI4.0 or 5 |
| **Description** | : | Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles. |
| **Material** | : | Vinylester, glass fiber reinforced (VE-GF) |
| **Shell Thickness** | : | 2.0 ± 0.2 mm (sagging: < 1 %) |
| **Filling Volume** | : | Approx. 30 liters |
| **Dimensions** | : | Major ellipse axis: 600 mm Minor axis: 400 mm |
| **Manufacture** | : | Schmid & Partner Engineering AG |

### Device Holder

In combination with the Twin SAM Phantom V4.0/V4.0c or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).

**Material** : POM

### Laptio Extensions kit

Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM, ELI4 Phantoms.

**Material** : POM, Acrylic glass, Foam

### Urethane

For this measurement, the urethane foam was used as device holder.

**j) Simulated Tissues (Liquid)**
The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

**Product identifier**

| | |
|---|---|
| Trade name | Broad Band Tissue Simulation Liquid<br>HBBL600-10000V6, MBBL600-6000V6, HU16B, MU16B |
| Manufacturer/Supplier | Schmid & Partner Engineering AG |

**Declarable components:**

| | | |
|---|---|---|
| CAS: 107-21-1<br>EINECS: 203-473-3<br>Reg.nr.: 01-2119456816-28-0000 | **Ethanediol**<br>STOT RE 2, H373;<br>Acute Tox. 4, H302 | < 5.2% |
| CAS: 68608-26-4<br>EINECS: 271-781-5<br>Reg.nr.: 01-2119527859-22-0000 | **Sodium petroleum sulfonate**<br>Eye Irrit. 2, H319 | < 2.9% |
| CAS: 107-41-5<br>EINECS: 203-489-0<br>Reg.nr.: 01-2119539582-35-0000 | **Hexylene Glycol / 2-Methyl-pentane-2,4-diol**<br>Skin Irrit. 2, H315; Eye Irrit. 2, H319 | < 2.9% |
| CAS: 68920-66-1<br>NLP: 500-236-9<br>Reg.nr.: 01-2119489407-26-0000 | **Alkoxylated alcohol, > $C_{16}$**<br>Aquatic Chronic 2, H411;<br>Skin Irrit. 2, H315; Eye Irrit. 2, H319 | < 2.0% |

## System Check Dipole SAR Calibration Certificate -Dipole 450 MHz (D450V3 S/N: 1051)

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

**S** Schweizerischer Kalibrierdienst
**C** Service suisse d'étalonnage
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 **UL Japan (RCC)**

Certificate No: **D450V3-1051_Sep21**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D450V3 - SN:1051 |
| Calibration procedure(s) | QA CAL-15.v9<br>Calibration Procedure for SAR Validation Sources below 700 MHz |
| Calibration date: | September 17, 2021 |

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 NRP | SN: 104778 | 09-Apr-21 (No. 217-03291/03292) | Apr-22 |
| Power sensor NRP-Z91 | SN: 103244 | 09-Apr-21 (No. 217-03291) | Apr-22 |
| Power sensor NRP-Z91 | SN: 103245 | 09-Apr-21 (No. 217-03292) | Apr-22 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 09-Apr-21 (No. 217-03343) | Apr-22 |
| Type-N mismatch combination | SN: 310982 / 06327 | 09-Apr-21 (No. 217-03344) | Apr-22 |
| Reference Probe EX3DV4 | SN: 3877 | 30-Dec-20 (No. EX3-3877_Dec20) | Dec-21 |
| DAE4 | SN: 654 | 28-Jun-21 (No. DAE4-654_Jun21) | Jun-22 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-20) | In house check: Jun-22 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Jeffrey Katzman | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: September 17, 2021

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

Certificate No: D450V3-1051_Sep21 Page 1 of 8

**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**

**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A | not applicable or not measured |

**Calibration is Performed According to the Following Standards:**

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

c) DASY System Handbook

**Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

| | | |
|---|---|---|
| **DASY Version** | DASY52 | V52.10.4 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | ELI4 Flat Phantom | Shell thickness: 2 ± 0.2 mm |
| **Distance Dipole Center - TSL** | 15 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 450 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 43.5 | 0.87 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 42.8 ± 6 % | 0.86 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.14 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **4.59 W/kg ± 18.1 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 0.764 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **3.07 W/kg ± 17.6 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 56.7 | 0.94 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 55.9 ± 6 % | 0.95 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.18 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **4.67 W/kg ± 18.1 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 0.795 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **3.15 W/kg ± 17.6 % (k=2)** |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 56.0 Ω - 6.8 jΩ |
| Return Loss | - 21.4 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 53.0 Ω - 9.5 jΩ |
| Return Loss | - 20.3 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.350 ns |

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |

## DASY5 Validation Report for Head TSL

Date: 17.09.2021

Test Laboratory: SPEAG, Zurich, Switzerland

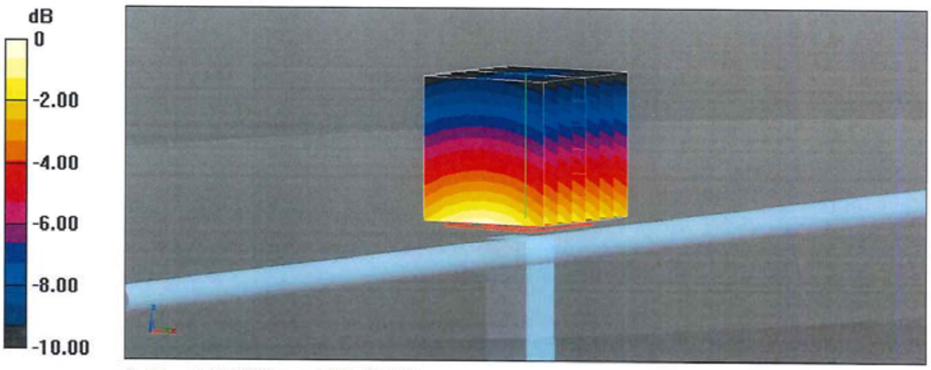
**DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1051**

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; $\sigma$ = 0.86 S/m; $\varepsilon_r$ = 42.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

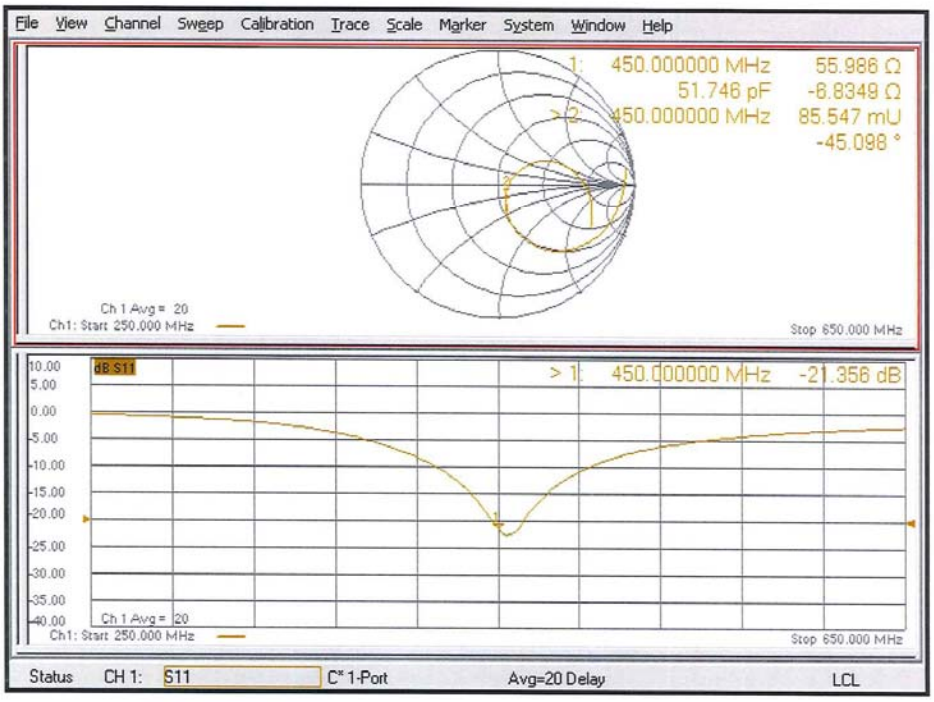
- Probe: EX3DV4 - SN3877; ConvF(10.64, 10.64, 10.64) @ 450 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 28.06.2021
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**Dipole Calibration for Head Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.24 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 1.78 W/kg
**SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.764 W/kg**
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30 mm)
Ratio of SAR at M2 to SAR at M1 = 64.2%
Maximum value of SAR (measured) = 1.55 W/kg




0 dB = 1.55 W/kg = 1.90 dBW/kg

## Impedance Measurement Plot for Head TSL




Certificate No: D450V3-1051_Sep21 Page 6 of 8

## DASY5 Validation Report for Body TSL

Date: 17.09.2021

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1051**

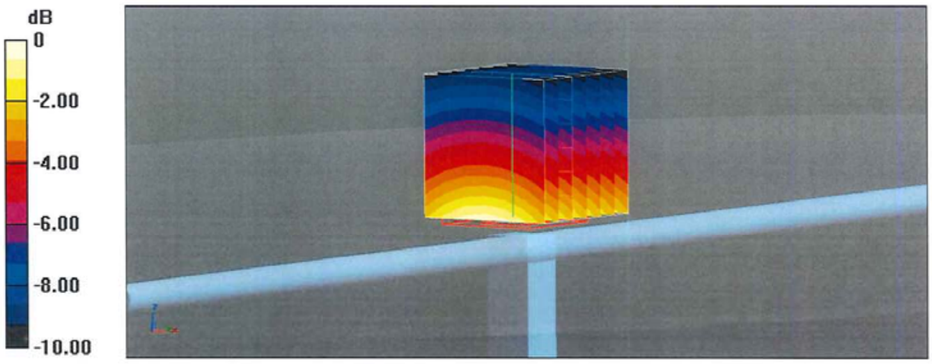
Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; $\sigma$ = 0.95 S/m; $\varepsilon_r$ = 55.9; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.64, 10.64, 10.64) @ 450 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 28.06.2021
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

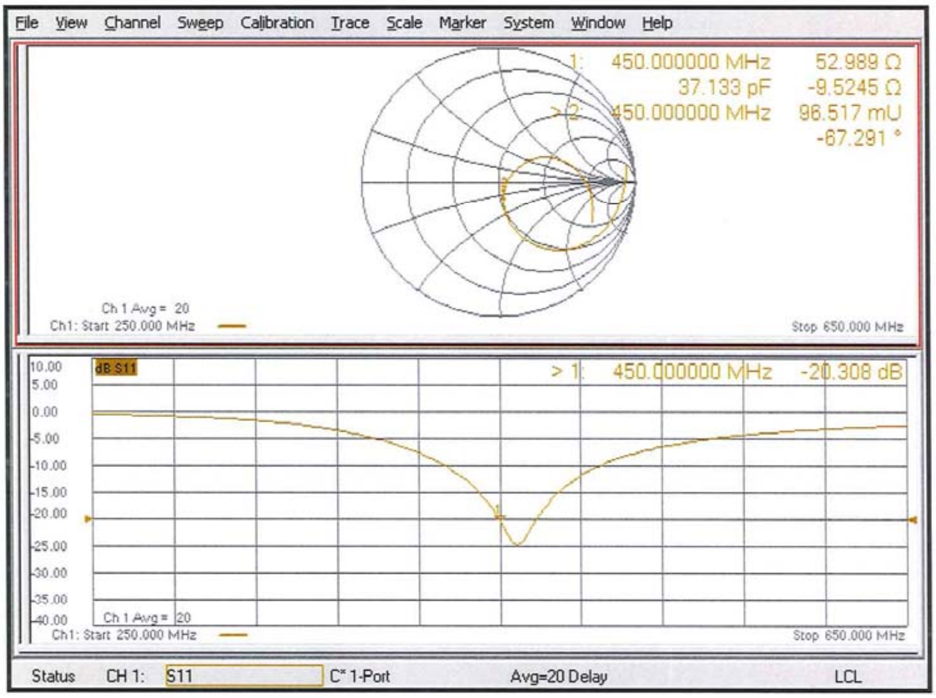
### Dipole Calibration for Body Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 42.43 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.81 W/kg
**SAR(1 g) = 1.18 W/kg; SAR(10 g) = 0.795 W/kg**
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30 mm)
Ratio of SAR at M2 to SAR at M1 = 65.4%
Maximum value of SAR (measured) = 1.58 W/kg




0 dB = 1.58 W/kg = 1.99 dBW/kg

## Impedance Measurement Plot for Body TSL



## System Check Dipole SAR Calibration Certificate -Dipole 600 MHz (D600V3 S/N: 1003)

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

**S** Schweizerischer Kalibrierdienst
**C** Service suisse d'étalonnage
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 **UL Japan (KYCOM)**

Certificate No: **D600V3-1003_Oct19**

# CALIBRATION CERTIFICATE

Object: D600V3 - SN: 1003

Calibration procedure(s): QA CAL-15.v9
Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date: October 18, 2019

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 NRP | SN: 104778 | 03-Apr-19 (No. 217-02892/02893) | Apr-20 |
| Power sensor NRP-Z91 | SN: 103244 | 03-Apr-19 (No. 217-02892) | Apr-20 |
| Power sensor NRP-Z91 | SN: 103245 | 03-Apr-19 (No. 217-02893) | Apr-20 |
| Reference 20 dB Attenuator | SN: 5277 (20x) | 04-Apr-19 (No. 217-02894) | Apr-20 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 04-Apr-19 (No. 217-02895) | Apr-20 |
| Reference Probe EX3DV4 | SN: 3877 | 31-Dec-18 (No. EX3-3877_Dec18) | Dec-19 |
| DAE4 | SN: 654 | 27-Jun-19 (No. DAE4-654_Jun19) | Jun-20 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-18) | In house check: Jun-20 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-18) | In house check: Jun-20 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-18) | In house check: Jun-20 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-18) | In house check: Jun-20 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-18) | In house check: Oct-19 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Michael Weber | Laboratory Technician | M.Weber |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: October 18, 2019

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

Certificate No: D600V3-1003_Oct19 Page 1 of 8

**Calibration Laboratory of**
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**Zeughausstrasse 43, 8004 Zurich, Switzerland**

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**S** Swiss Calibration Service

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**The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates**

Accreditation No.: **SCS 0108**

**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A | not applicable or not measured |

**Calibration is Performed According to the Following Standards:**

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.10.3 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | ELI4 Flat Phantom | Shell thickness: 2 ± 0.2 mm |
| **Distance Dipole Center - TSL** | 15 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 600 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 42.7 | 0.88 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 43.4 ± 6 % | 0.91 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.70 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **6.65 W/kg ± 18.1 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.11 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **4.36 W/kg ± 17.6 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 56.1 | 0.95 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 55.7 ± 6 % | 0.98 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.71 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **6.67 W/kg ± 18.1 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.13 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **4.43 W/kg ± 17.6 % (k=2)** |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 55.1 Ω - 3.9 jΩ |
| Return Loss | - 24.3 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 51.9 Ω - 5.8 jΩ |
| Return Loss | - 24.4 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.155 ns |

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |

## DASY5 Validation Report for Head TSL

Date: 18.10.2019

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 600 MHz; Type: D600V3; Serial: D600V3 - SN: 1003**

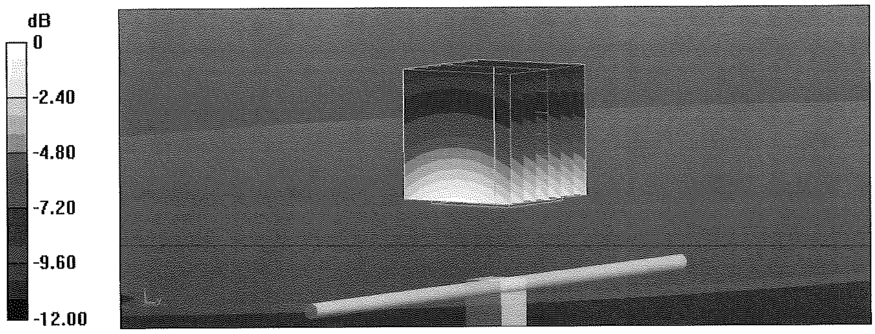
Communication System: UID 0 - CW; Frequency: 600 MHz
Medium parameters used: f = 600 MHz; $\sigma$ = 0.91 S/m; $\varepsilon_r$ = 43.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.01, 10.01, 10.01) @ 600 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 27.06.2019
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

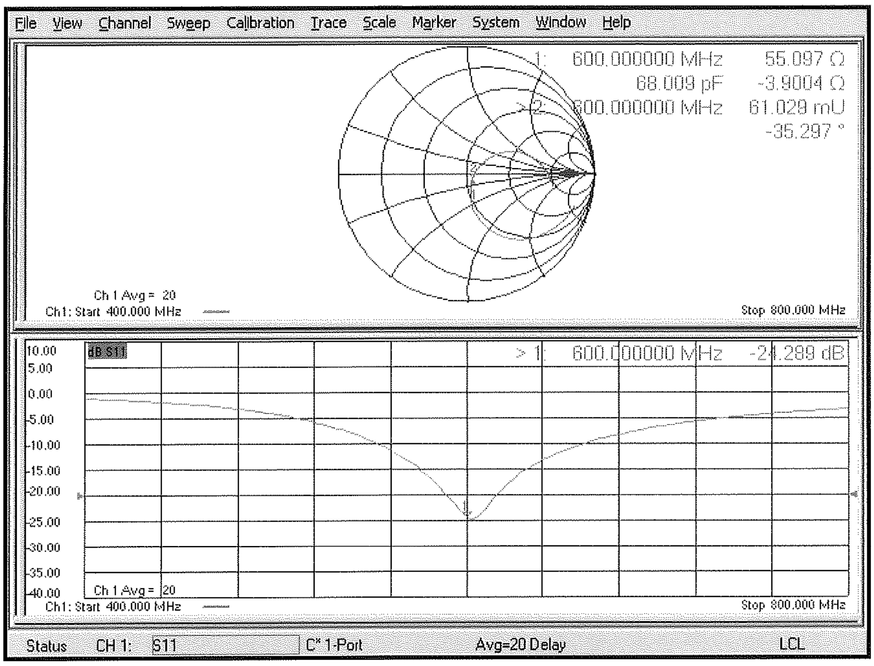
### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51.71 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.75 W/kg
**SAR(1 g) = 1.7 W/kg; SAR(10 g) = 1.11 W/kg**
Ratio of SAR at M2 to SAR at M1 = 61.8%
Maximum value of SAR (measured) = 2.35 W/kg




0 dB = 2.35 W/kg = 3.71 dBW/kg

**Impedance Measurement Plot for Head TSL**



**DASY5 Validation Report for Body TSL**

Date: 18.10.2019

Test Laboratory: SPEAG, Zurich, Switzerland

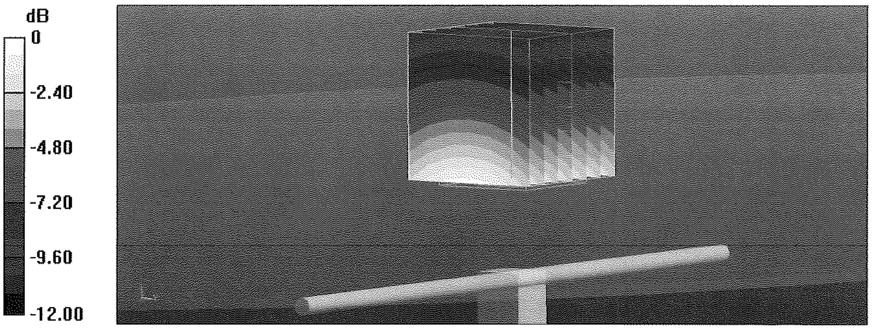
**DUT: Dipole 600 MHz; Type: D600V3; Serial: D600V3 - SN: 1003**

Communication System: UID 0 - CW; Frequency: 600 MHz
Medium parameters used: f = 600 MHz; $\sigma$ = 0.98 S/m; $\varepsilon_r$ = 55.7; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

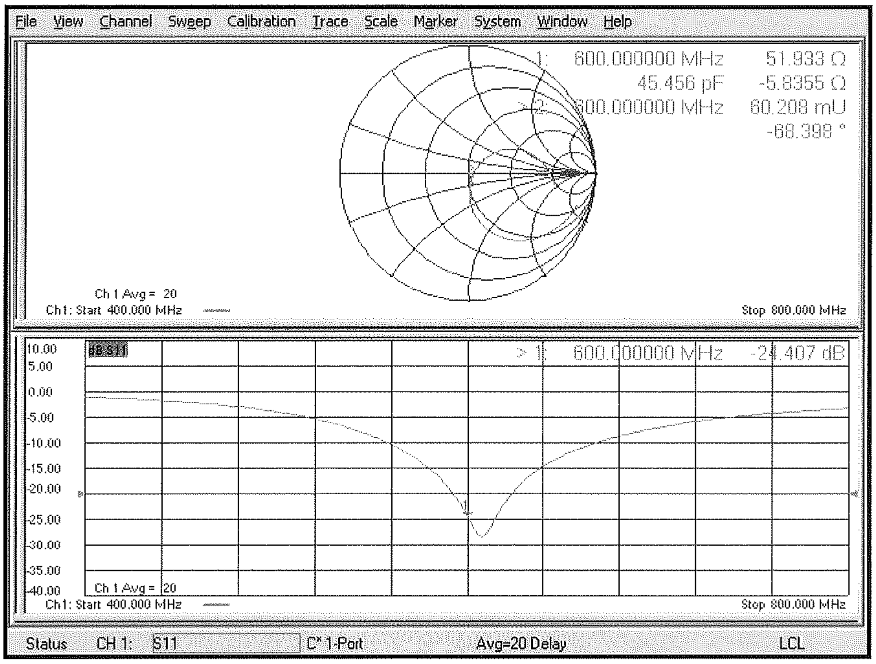
- Probe: EX3DV4 - SN3877; ConvF(10.2, 10.2, 10.2) @ 600 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 27.06.2019
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 49.80 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 2.74 W/kg
**SAR(1 g) = 1.71 W/kg; SAR(10 g) = 1.13 W/kg**
Ratio of SAR at M2 to SAR at M1 = 62.8%
Maximum value of SAR (measured) = 2.35 W/kg




0 dB = 2.35 W/kg = 3.71 dBW/kg

**Impedance Measurement Plot for Body TSL**



## D600V3 Calibration for Impedance and Return-loss

| Equipment | Dipole Antenna | Model | D600V3 |
|---|---|---|---|
| Manufacture | Schmid & Partner Engineering AG | Serial | 1003 |
| Tested by | Hisayoshi Sato | | |

### 1. Test environment

| Date | October 21, 2020 | | |
|---|---|---|---|
| Ambient Temperature | 24.5 deg.C | Relative humidity | 50 % RH |
| Date | October 1, 2021 | | |
| Ambient Temperature | 23.0 deg.C | Relative humidity | 50 % RH |

### 2. Equipment used

October 21, 2020

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| EST-30 | Network Analyzer | Keysight Technologies Inc | N5230A | MY46400314 | SAR | 2020/08/17 * 12 |
| EST-62 | Calibration Kit | Keysight Technologies Inc | 85032F | MY41495257 | SAR | 2020/09/23 * 12 |
| MPF-03 | 2 mm Oval Flat Phantom | Schmid & Partner Engineering AG | QDOVA001BB | 1203 | SAR | 2020/05/25 * 12 |
| MPSAM-03 | SAM Phantom | Schmid & Partner Engineering AG | QD000P40CD | 1764 | SAR | 2020/05/25 * 12 |
| MOS-30 | Thermo-Hygrometer | CUSTOM | CTH-201 | 3001 | SAR | 2020/07/10 * 12 |
| MHBBL600-10000 | Head Simulating Liquid | Schmid & Partner Engineering AG | HBBL600-10000V6 | SL AAH U16 BC | | - |
| MMBBL600-6000 | Body Simulating Liquid | Schmid & Partner Engineering AG | MBBL600-6000 | SL AAM U16 BC | | - |

October 1, 2021

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| EST-63 | Network Analyzer | Keysight Technologies Inc | E5071C | MY46523746 | SAR | 2021/07/02 * 12 |
| EST-57 | 2.4mm Calibration Kit | Keysight Technologies Inc | 85056A | MY44300225 | SAR | 2021/08/31 * 12 |
| MPSAM-02 | SAM Phantom | Schmid & Partner Engineering AG | QD000P40CB | 1333 | SAR | 2021/05/27 * 12 |
| MPF-02 | 2 mm Oval Flat Phantom | Schmid & Partner Engineering AG | QDOVA001BB | 1045 | SAR | 2021/05/28 * 12 |
| MOS-33 | Thermo-Hygrometer | CUSTOM | CTH-201 | - | SAR | 2021/07/08 * 12 |
| MHBBL600-10000 | Head Simulating Liquid | Schmid & Partner Engineering AG | HBBL600-10000V6 | SL AAH U16 BC | | - |
| MMBBL600-6000 | Body Simulating Liquid | Schmid & Partner Engineering AG | MBBL600-6000 | SL AAM U16 BC | | - |

## 3. Test Result

| Impeadance,Transformed to feed point | cal day | Head (real part) [Ω] | Head (img part) [jΩ] | Deviation (real part) [Ω] | Deviation (img part) [jΩ] | Tolerance | Result |
|---|---|---|---|---|---|---|---|
| Calibration (SPEAG) | 2019/10/18 | 55.10 | -3.90 | - | - | - | - |
| Calibration(ULJ) | 2020/10/21 | 56.75 | -1.78 | 1.65 | 2.12 | +/- 5 Ω +/- 5 jΩ | Complied |
| Calibration(ULJ) | 2021/10/1 | 54.57 | -3.51 | -0.53 | 0.39 | +/- 5 Ω +/- 5 jΩ | Complied |

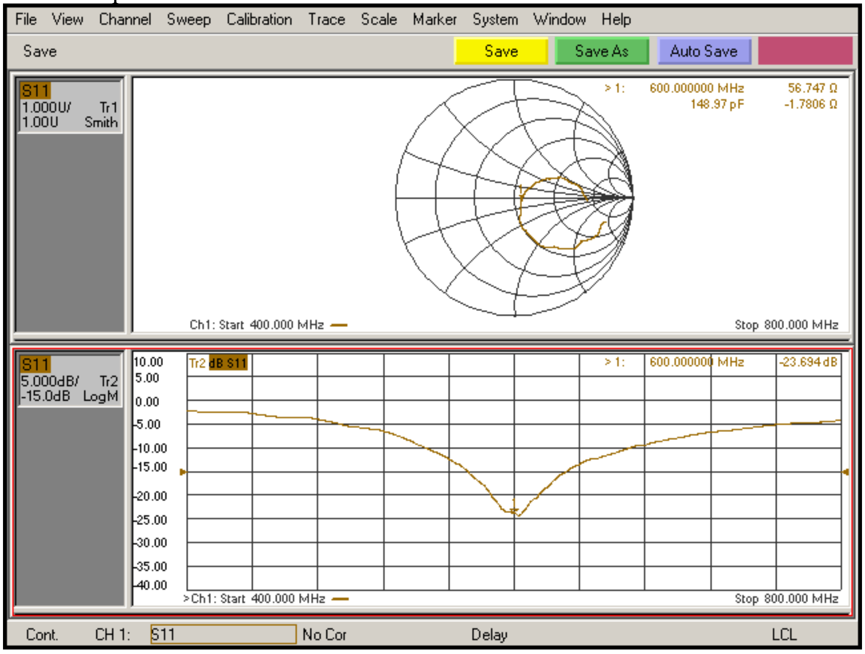
| Return loss | cal day | Head [dB] | Deviation [dB] | Tolerance [+/- dB] | Result |
|---|---|---|---|---|---|
| Calibration (SPEAG) | 2019/10/18 | -24.30 | - | - | - |
| Calibration(ULJ) | 2020/10/21 | -23.69 | 0.61 | 4.86 | Complied |
| Calibration(ULJ) | 2021/10/1 | -25.19 | -0.89 | 4.74 | Complied |

| Impeadance,Transformed to feed point | cal day | Body (real part) [Ω] | Body (img part) [jΩ] | Deviation (real part) [Ω] | Deviation (img part) [jΩ] | Tolerance | Result |
|---|---|---|---|---|---|---|---|
| Calibration (SPEAG) | 2019/10/18 | 51.90 | -5.80 | - | - | - | - |
| Calibration(ULJ) | 2020/10/21 | 51.13 | -5.62 | -0.77 | 0.18 | +/- 5 Ω +/- 5 jΩ | Complied |
| Calibration(ULJ) | 2021/10/1 | 51.71 | -5.56 | -0.19 | 0.24 | +/- 5 Ω +/- 5 jΩ | Complied |

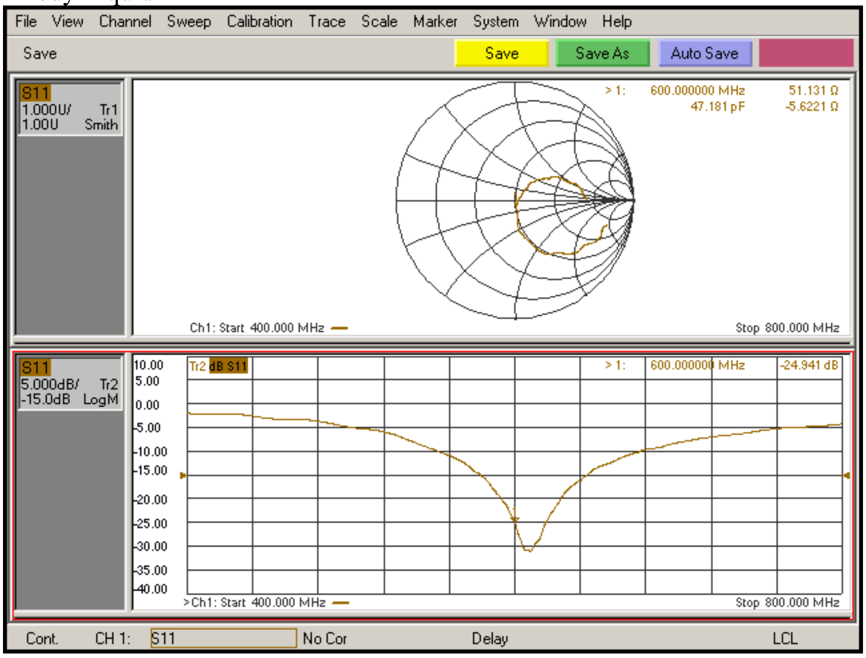
| Return loss | cal day | Body [dB] | Deviation [dB] | Tolerance [+/- dB] | Result |
|---|---|---|---|---|---|
| Calibration (SPEAG) | 2019/10/18 | -24.40 | - | - | - |
| Calibration(ULJ) | 2020/10/21 | -24.94 | -0.54 | 4.88 | Complied |
| Calibration(ULJ) | 2021/10/1 | -24.88 | -0.48 | 4.99 | Complied |

Tolerance: According to the KDB 865664 D1

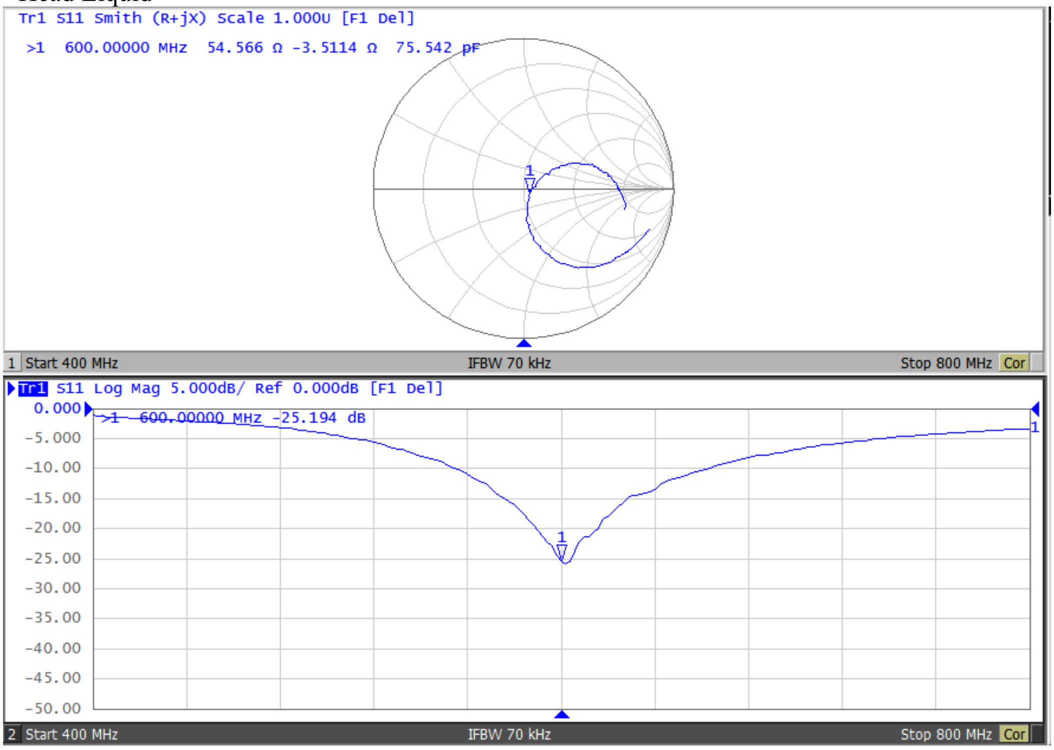
Measurement Plots
October 21, 2020
<Head Liquid>



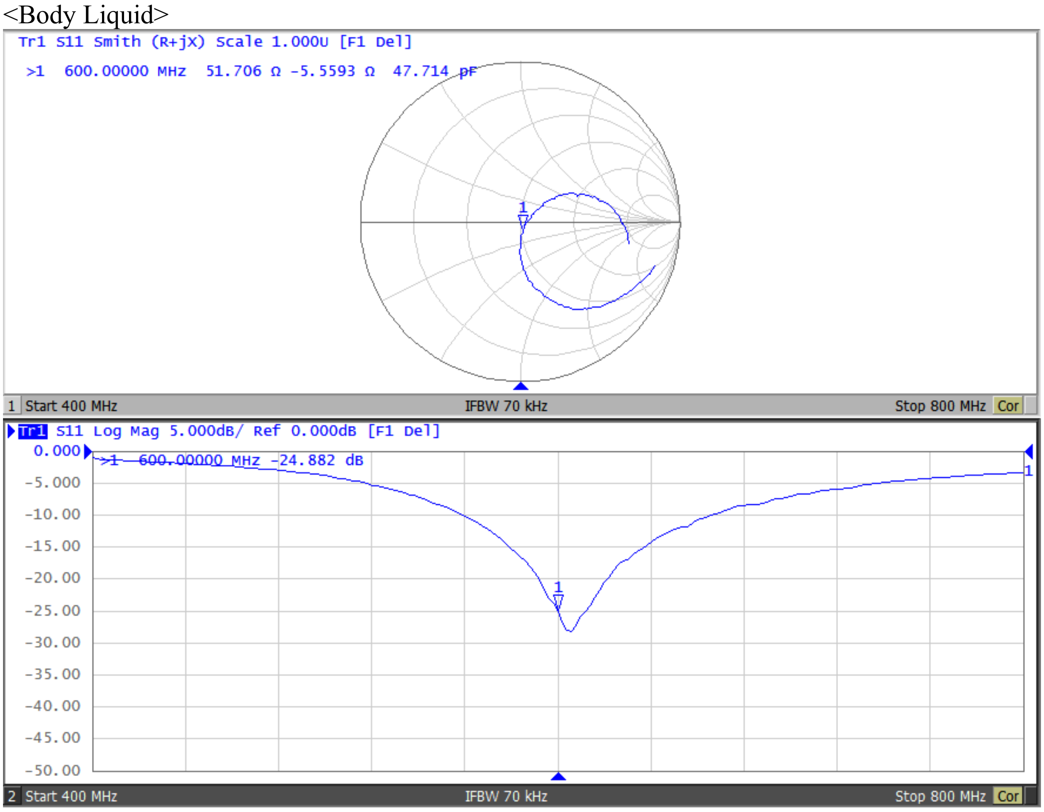

<Body Liquid>



Measurement Plots
October 1, 2021
<Head Liquid>




<Body Liquid>



**Dosimetric E-Field Probe Calibration Certificate (EX3DV4, S/N: 3745)**

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client RCC

Certificate No: EX3-3745_Apr22

# CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3745

Calibration procedure(s) QA CAL-01.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes

Calibration date: April 19, 2022

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 NRP | SN: 104778 | 04-Apr-22 (No. 217-03525/03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103244 | 04-Apr-22 (No. 217-03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103245 | 04-Apr-22 (No. 217-03525) | Apr-23 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 04-Apr-22 (No. 217-03527) | Apr-23 |
| DAE4 | SN: 660 | 13-Oct-21 (No. DAE4-660_Oct21) | Oct-22 |
| Reference Probe ES3DV2 | SN: 3013 | 27-Dec-21 (No. ES3-3013_Dec21) | Dec-22 |
| | | | |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-20) | In house check: Jun-22 |
| Network Analyzer E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-22 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Aidonia Georgiadou | Laboratory Technician | AJ Ex |
| Approved by: | Sven Kühn | Deputy Manager | S. K |

Issued: April 19, 2022

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

Certificate No: EX3-3745_Apr22 Page 1 of 24

**Calibration Laboratory of**
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

## Glossary:

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A, B, C, D | modulation dependent linearization parameters |
| Polarization φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

## Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

## Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the $E^2$-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Certificate No: EX3-3745_Apr22 Page 2 of 24

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|---|---|---|---|
| Norm ($\mu V/(V/m)^2$)[A] | 0.47 | 0.43 | 0.47 | ± 10.1 % |
| DCP (mV)[B] | 101.1 | 102.1 | 98.8 | |

## Calibration Results for Modulation Response

| UID | Communication System Name | | A dB | B dB√μV | C | D dB | VR mV | Max dev. | Max Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.00 | 0.00 | 1.00 | 0.00 | 157.1 | ± 2.5 % | ± 4.7 % |
| | | Y | 0.00 | 0.00 | 1.00 | | 156.7 | | |
| | | Z | 0.00 | 0.00 | 1.00 | | 158.1 | | |
| 10352-AAA | Pulse Waveform (200Hz, 10%) | X | 20.00 | 93.26 | 23.73 | 10.00 | 60.0 | ± 2.6 % | ± 9.6 % |
| | | Y | 20.00 | 94.13 | 23.26 | | 60.0 | | |
| | | Z | 20.00 | 93.68 | 25.11 | | 60.0 | | |
| 10353-AAA | Pulse Waveform (200Hz, 20%) | X | 20.00 | 93.53 | 22.56 | 6.99 | 80.0 | ± 1.2 % | ± 9.6 % |
| | | Y | 20.00 | 95.09 | 22.77 | | 80.0 | | |
| | | Z | 20.00 | 93.83 | 23.66 | | 80.0 | | |
| 10354-AAA | Pulse Waveform (200Hz, 40%) | X | 20.00 | 95.86 | 22.10 | 3.98 | 95.0 | ± 2.2 % | ± 9.6 % |
| | | Y | 20.00 | 99.74 | 23.77 | | 95.0 | | |
| | | Z | 20.00 | 95.66 | 22.76 | | 95.0 | | |
| 10355-AAA | Pulse Waveform (200Hz, 60%) | X | 20.00 | 97.10 | 21.20 | 2.22 | 120.0 | ± 2.6 % | ± 9.6 % |
| | | Y | 20.00 | 107.80 | 26.29 | | 120.0 | | |
| | | Z | 20.00 | 98.93 | 22.75 | | 120.0 | | |
| 10387-AAA | QPSK Waveform, 1 MHz | X | 1.88 | 66.08 | 15.45 | 1.00 | 150.0 | ± 1.9 % | ± 9.6 % |
| | | Y | 1.90 | 67.10 | 15.92 | | 150.0 | | |
| | | Z | 1.85 | 64.75 | 14.89 | | 150.0 | | |
| 10388-AAA | QPSK Waveform, 10 MHz | X | 2.52 | 69.19 | 16.14 | 0.00 | 150.0 | ± 0.9 % | ± 9.6 % |
| | | Y | 2.55 | 69.73 | 16.64 | | 150.0 | | |
| | | Z | 2.37 | 67.74 | 15.40 | | 150.0 | | |
| 10396-AAA | 64-QAM Waveform, 100 kHz | X | 3.92 | 72.97 | 19.65 | 3.01 | 150.0 | ± 0.7 % | ± 9.6 % |
| | | Y | 3.60 | 73.44 | 20.21 | | 150.0 | | |
| | | Z | 3.84 | 71.19 | 18.86 | | 150.0 | | |
| 10399-AAA | 64-QAM Waveform, 40 MHz | X | 3.72 | 67.80 | 16.06 | 0.00 | 150.0 | ± 1.3 % | ± 9.6 % |
| | | Y | 3.60 | 67.39 | 15.98 | | 150.0 | | |
| | | Z | 3.61 | 66.97 | 15.63 | | 150.0 | | |
| 10414-AAA | WLAN CCDF, 64-QAM, 40MHz | X | 5.00 | 65.45 | 15.41 | 0.00 | 150.0 | ± 2.7 % | ± 9.6 % |
| | | Y | 4.97 | 65.70 | 15.58 | | 150.0 | | |
| | | Z | 5.11 | 65.44 | 15.38 | | 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%.

[A] The uncertainties of Norm X,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

## Sensor Model Parameters

| | C1 fF | C2 fF | α $V^{-1}$ | T1 $ms.V^{-2}$ | T2 $ms.V^{-1}$ | T3 ms | T4 $V^{-2}$ | T5 $V^{-1}$ | T6 |
|---|---|---|---|---|---|---|---|---|---|
| X | 68.7 | 512.36 | 35.50 | 25.69 | 1.19 | 5.09 | 0.62 | 0.64 | 1.01 |
| Y | 54.9 | 403.84 | 34.71 | 25.52 | 0.33 | 5.10 | 1.75 | 0.25 | 1.01 |
| Z | 81.8 | 615.29 | 35.95 | 29.57 | 2.06 | 5.10 | 0.00 | 0.89 | 1.01 |

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | -121.8 |
| 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.

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

## Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha [G] | Depth [G] (mm) | Unc (k=2) |
|---|---|---|---|---|---|---|---|---|
| 450 | 43.5 | 0.87 | 9.78 | 9.78 | 9.78 | 0.16 | 1.30 | ± 13.3 % |
| 600 | 42.7 | 0.88 | 9.61 | 9.61 | 9.61 | 0.10 | 1.25 | ± 13.3 % |
| 750 | 41.9 | 0.89 | 9.35 | 9.35 | 9.35 | 0.50 | 0.80 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 8.97 | 8.97 | 8.97 | 0.53 | 0.80 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 8.70 | 8.70 | 8.70 | 0.46 | 0.80 | ± 12.0 % |
| 1450 | 40.5 | 1.20 | 7.62 | 7.62 | 7.62 | 0.48 | 0.80 | ± 12.0 % |
| 1640 | 40.2 | 1.31 | 7.83 | 7.83 | 7.83 | 0.37 | 0.86 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 7.64 | 7.64 | 7.64 | 0.39 | 0.86 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 7.53 | 7.53 | 7.53 | 0.37 | 0.86 | ± 12.0 % |
| 1950 | 40.0 | 1.40 | 7.36 | 7.36 | 7.36 | 0.35 | 0.86 | ± 12.0 % |
| 2300 | 39.5 | 1.67 | 7.21 | 7.21 | 7.21 | 0.30 | 0.90 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 6.86 | 6.86 | 6.86 | 0.38 | 0.90 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 6.73 | 6.73 | 6.73 | 0.38 | 0.90 | ± 12.0 % |
| 3500 | 37.9 | 2.91 | 6.43 | 6.43 | 6.43 | 0.30 | 1.35 | ± 13.1 % |
| 3700 | 37.7 | 3.12 | 6.20 | 6.20 | 6.20 | 0.30 | 1.35 | ± 13.1 % |
| 3900 | 37.5 | 3.32 | 5.95 | 5.95 | 5.95 | 0.40 | 1.60 | ± 13.1 % |
| 5250 | 35.9 | 4.71 | 4.73 | 4.73 | 4.73 | 0.40 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.33 | 4.33 | 4.33 | 0.40 | 1.80 | ± 13.1 % |
| 5750 | 35.4 | 5.22 | 4.36 | 4.36 | 4.36 | 0.40 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 4.32 | 4.32 | 4.32 | 0.40 | 1.80 | ± 13.1 % |
| 5850 | 35.2 | 5.32 | 4.23 | 4.23 | 4.23 | 0.40 | 1.80 | ± 13.1 % |

[C] 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. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters ($\varepsilon$ 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 ($\varepsilon$ and $\sigma$) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] 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.

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3745

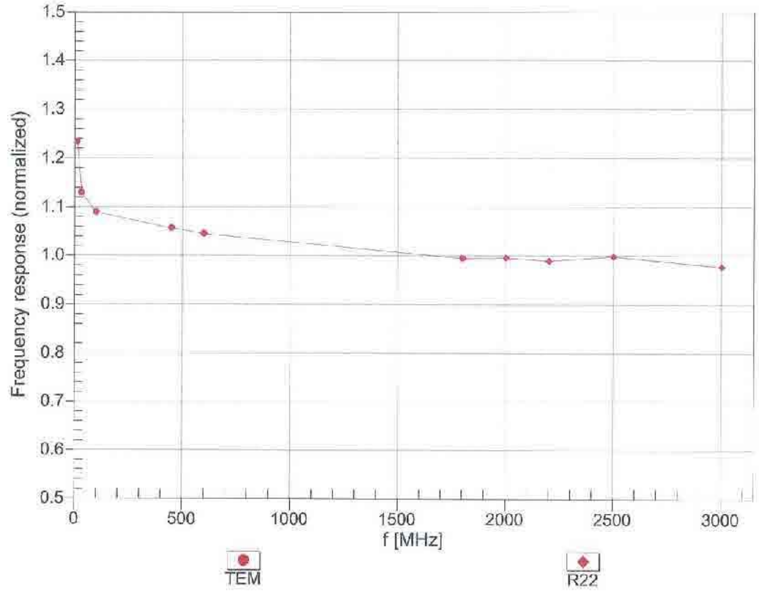
## Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha [G] | Depth [G] (mm) | Unc (k=2) |
|---|---|---|---|---|---|---|---|---|
| 450 | 56.7 | 0.94 | 10.22 | 10.22 | 10.22 | 0.11 | 1.20 | ± 13.3 % |
| 600 | 56.1 | 0.95 | 9.63 | 9.63 | 9.63 | 0.10 | 1.35 | ± 13.3 % |
| 750 | 55.5 | 0.96 | 9.12 | 9.12 | 9.12 | 0.40 | 0.80 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 8.96 | 8.96 | 8.96 | 0.41 | 0.90 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 9.00 | 9.00 | 9.00 | 0.47 | 0.85 | ± 12.0 % |
| 1640 | 53.7 | 1.42 | 7.88 | 7.88 | 7.88 | 0.47 | 0.86 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 7.50 | 7.50 | 7.50 | 0.46 | 0.86 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 7.26 | 7.26 | 7.26 | 0.46 | 0.86 | ± 12.0 % |
| 1950 | 53.3 | 1.52 | 7.49 | 7.49 | 7.49 | 0.41 | 0.86 | ± 12.0 % |
| 2300 | 52.9 | 1.81 | 7.06 | 7.06 | 7.06 | 0.45 | 0.90 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 6.92 | 6.92 | 6.92 | 0.43 | 0.90 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 6.77 | 6.77 | 6.77 | 0.32 | 0.90 | ± 12.0 % |
| 3500 | 51.3 | 3.31 | 6.05 | 6.05 | 6.05 | 0.40 | 1.35 | ± 13.1 % |
| 3700 | 51.0 | 3.55 | 5.82 | 5.82 | 5.82 | 0.40 | 1.35 | ± 13.1 % |
| 3900 | 50.8 | 3.78 | 5.47 | 5.47 | 5.47 | 0.40 | 1.70 | ± 13.1 % |
| 5250 | 48.9 | 5.36 | 4.02 | 4.02 | 4.02 | 0.50 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 3.65 | 3.65 | 3.65 | 0.50 | 1.90 | ± 13.1 % |
| 5750 | 48.3 | 5.94 | 3.84 | 3.84 | 3.84 | 0.50 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 3.80 | 3.80 | 3.80 | 0.50 | 1.90 | ± 13.1 % |
| 5850 | 48.1 | 6.06 | 3.76 | 3.76 | 3.76 | 0.50 | 1.90 | ± 13.1 % |

[C] 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. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters ($\varepsilon$ 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 ($\varepsilon$ and $\sigma$) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] 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.

# Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

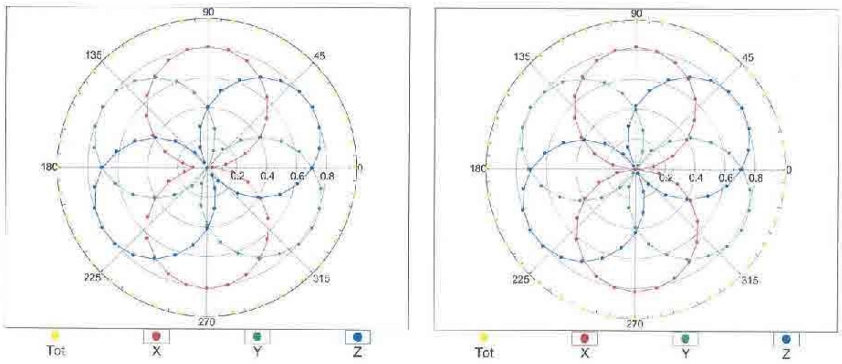


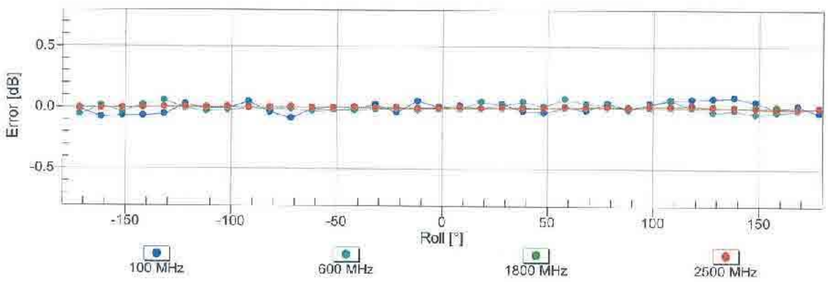

Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

EX3DV4– SN:3745 April 19, 2022

## Receiving Pattern (φ), $\vartheta = 0°$

f=600 MHz,TEM f=1800 MHz,R22



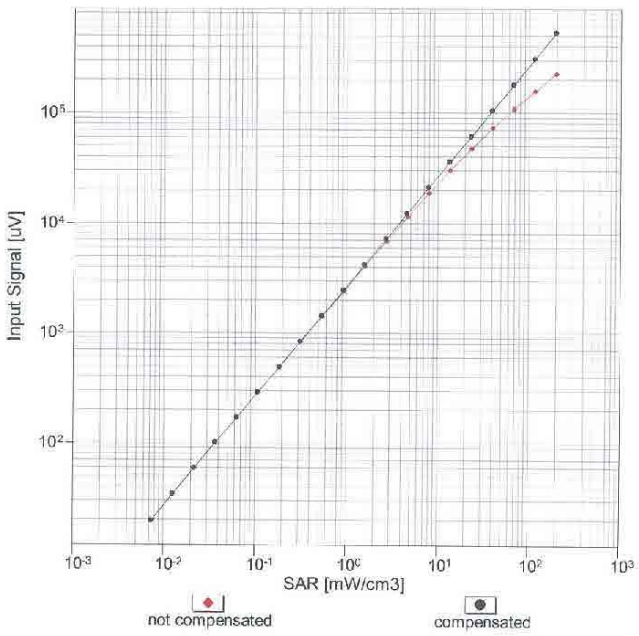



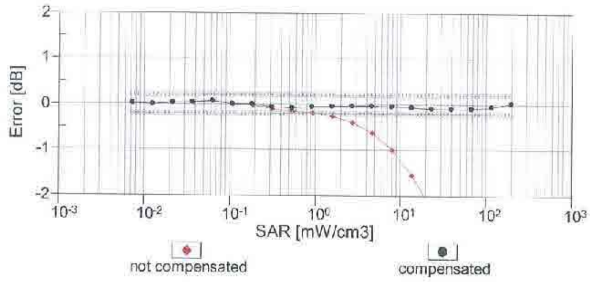

**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

Certificate No: EX3-3745_Apr22 Page 8 of 24

## Dynamic Range f($SAR_{head}$)

**(TEM cell , $f_{eval}$= 1900 MHz)**

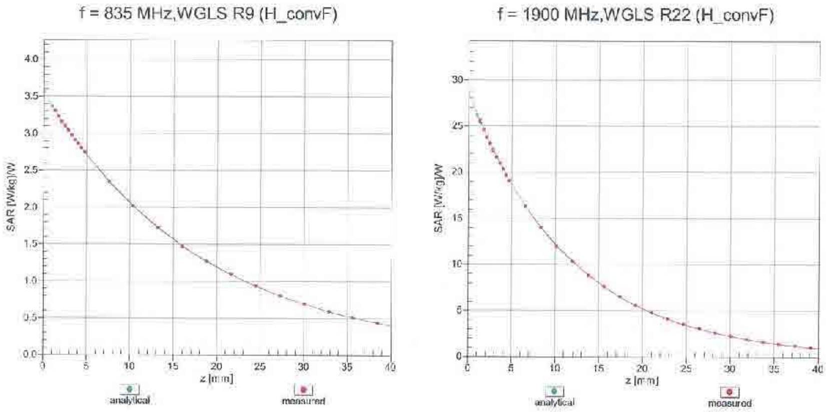



**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

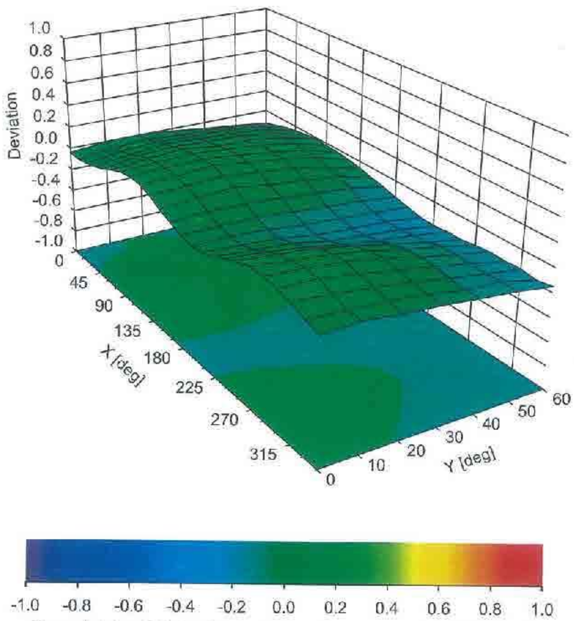
EX3DV4– SN:3745 April 19, 2022

## Conversion Factor Assessment




## Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz




Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

EX3DV4– SN:3745 April 19, 2022

## Appendix: Modulation Calibration Parameters

| UID | Rev | Communication System Name | Group | PAR (dB) | Unc[E] (k=2) |
|---|---|---|---|---|---|
| 0 | - | CW | CW | 0.00 | ± 4.7 % |
| 10010 | CAA | SAR Validation (Square, 100ms, 10ms) | Test | 10.00 | ± 9.6 % |
| 10011 | CAB | UMTS-FDD (WCDMA) | WCDMA | 2.91 | ± 9.6 % |
| 10012 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) | WLAN | 1.87 | ± 9.6 % |
| 10013 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps) | WLAN | 9.46 | ± 9.6 % |
| 10021 | DAC | GSM-FDD (TDMA, GMSK) | GSM | 9.39 | ± 9.6 % |
| 10023 | DAC | GPRS-FDD (TDMA, GMSK, TN 0) | GSM | 9.57 | ± 9.6 % |
| 10024 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1) | GSM | 6.56 | ± 9.6 % |
| 10025 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0) | GSM | 12.62 | ± 9.6 % |
| 10026 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1) | GSM | 9.55 | ± 9.6 % |
| 10027 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1-2) | GSM | 4.80 | ± 9.6 % |
| 10028 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1-2-3) | GSM | 3.55 | ± 9.6 % |
| 10029 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1-2) | GSM | 7.78 | ± 9.6 % |
| 10030 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH1) | Bluetooth | 5.30 | ± 9.6 % |
| 10031 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH3) | Bluetooth | 1.87 | ± 9.6 % |
| 10032 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5) | Bluetooth | 1.16 | ± 9.6 % |
| 10033 | CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1) | Bluetooth | 7.74 | ± 9.6 % |
| 10034 | CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3) | Bluetooth | 4.53 | ± 9.6 % |
| 10035 | CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5) | Bluetooth | 3.83 | ± 9.6 % |
| 10036 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH1) | Bluetooth | 8.01 | ± 9.6 % |
| 10037 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH3) | Bluetooth | 4.77 | ± 9.6 % |
| 10038 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH5) | Bluetooth | 4.10 | ± 9.6 % |
| 10039 | CAB | CDMA2000 (1xRTT, RC1) | CDMA2000 | 4.57 | ± 9.6 % |
| 10042 | CAB | IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate) | AMPS | 7.78 | ± 9.6 % |
| 10044 | CAA | IS-91/EIA/TIA-553 FDD (FDMA, FM) | AMPS | 0.00 | ± 9.6 % |
| 10048 | CAA | DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24) | DECT | 13.80 | ± 9.6 % |
| 10049 | CAA | DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12) | DECT | 10.79 | ± 9.6 % |
| 10056 | CAA | UMTS-TDD (TD-SCDMA, 1.28 Mcps) | TD-SCDMA | 11.01 | ± 9.6 % |
| 10058 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3) | GSM | 6.52 | ± 9.6 % |
| 10059 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps) | WLAN | 2.12 | ± 9.6 % |
| 10060 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps) | WLAN | 2.83 | ± 9.6 % |
| 10061 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps) | WLAN | 3.60 | ± 9.6 % |
| 10062 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps) | WLAN | 8.68 | ± 9.6 % |
| 10063 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps) | WLAN | 8.63 | ± 9.6 % |
| 10064 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps) | WLAN | 9.09 | ± 9.6 % |
| 10065 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps) | WLAN | 9.00 | ± 9.6 % |
| 10066 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps) | WLAN | 9.38 | ± 9.6 % |
| 10067 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps) | WLAN | 10.12 | ± 9.6 % |
| 10068 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps) | WLAN | 10.24 | ± 9.6 % |
| 10069 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps) | WLAN | 10.56 | ± 9.6 % |
| 10071 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps) | WLAN | 9.83 | ± 9.6 % |
| 10072 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps) | WLAN | 9.62 | ± 9.6 % |
| 10073 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps) | WLAN | 9.94 | ± 9.6 % |
| 10074 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps) | WLAN | 10.30 | ± 9.6 % |
| 10075 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps) | WLAN | 10.77 | ± 9.6 % |
| 10076 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps) | WLAN | 10.94 | ± 9.6 % |
| 10077 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps) | WLAN | 11.00 | ± 9.6 % |
| 10081 | CAB | CDMA2000 (1xRTT, RC3) | CDMA2000 | 3.97 | ± 9.6 % |
| 10082 | CAB | IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate) | AMPS | 4.77 | ± 9.6 % |
| 10090 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-4) | GSM | 6.56 | ± 9.6 % |
| 10097 | CAB | UMTS-FDD (HSDPA) | WCDMA | 3.98 | ± 9.6 % |
| 10098 | CAB | UMTS-FDD (HSUPA, Subtest 2) | WCDMA | 3.98 | ± 9.6 % |
| 10099 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-4) | GSM | 9.55 | ± 9.6 % |

Certificate No: EX3-3745_Apr22 Page 11 of 24