

SAR TEST REPORT

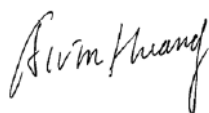
For

Swivl, Inc.

1450 El Camino Real Menlo Park, CA 94025

FCC ID: 2AX46-SWL100

IC: 26786-SWL100

| | | | |
|--|---|---|--|
| Report Type: Original Report | | Product Type: Swivl Link | |
| Report Number: | R2011043-20B | | |
| Report Date: | 2021-02-05 | | |
| Reviewed By: | Alvin Huang Lab Manager |  | |
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| Attestation of Test Results | | | |
|---|---|----------------------------------|--------------|
| EUT Information | EUT Description | Swivl Link | |
| | Tested Model | SWL100 | |
| | FCC ID | 2AX46-SWL100 | |
| | IC | 26786-SWL100 | |
| | Serial Number | R2011043-SA-S1 | |
| | Test Date | 2020/12/10 | |
| MODE | | Max. SAR Level(s) Reported(W/kg) | Limit (W/kg) |
| DECT(ANT 0) | 1g Body SAR | 0.10 | 1.6 |
| DECT(ANT 1) | 1g Body SAR | 0.21 | |
| Applicable Standards | FCC 47 CFR part 2.1093 Radiofrequency radiation exposure evaluation: portable devices | | |
| | IEEE1528:2013 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques | | |
| | RSS-102 Issue 5 March 2015 Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands). | | |
| | IEC 62209-2:2010 Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices-Human models, instrumentation, and procedures-Part 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) | | |
| | KDB procedures KDB 447498 D01 General RF Exposure Guidance v06. KDB 648474 D04 Handset SAR v01r03. KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04 KDB 865664 D02 RF Exposure Reporting v01r02 | | |
| Note: This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in FCC 47 CFR part 2.1093 and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures. The results and statements contained in this report pertain only to the device(s) evaluated. | | | |

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DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|-----------------|---------------|-------------------------|------------------|
| 0 | R2011043-20B | Original Report | 2021-02-05 |

EUT DESCRIPTION

This report has been prepared on behalf of *Swivl, Inc.* and their product *Swivl Link*, Model: *SWL100*, FCC ID: *2AX46-SWL100* ; IC: *26786-SWL100* or the EUT (Equipment under Test) as referred to in the rest of this report.

**All measurement and test data in this report was gathered from production sample serial number: R2011043-SA-S1 (Assigned by BACL, Shenzhen).The EUT supplied by the applicant was received on 2020/11/06.*

Technical Specification

| | |
|-------------------------------|--|
| Product Type | Portable |
| Exposure Category: | Population / Uncontrolled |
| Antenna Type(s): | Internal Antenna |
| Body-Worn Accessories: | None |
| Modulation: | GFSK |
| Frequency Band: | DECT: 1921.536-1928.448 MHz; |
| Conducted RF Power: | Peak power : 11.75 dBm(ANT 0);20.25 dBm(ANT 1) |
| Power Source: | 5 VDC From USB Port |
| Normal Operation: | Close to Body |

REFERENCE, STANDARDS, AND GUIDELINES

FCC:

The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

CE:

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by EN62209-1 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

SAR Limits**FCC&IC Limit**

| EXPOSURE LIMITS | SAR (W/kg) | |
|--|--|--|
| | (General Population / Uncontrolled Exposure Environment) | (Occupational / Controlled Exposure Environment) |
| Spatial Average (averaged over the whole body) | 0.08 | 0.4 |
| Spatial Peak (averaged over any 1 g of tissue) | 1.60 | 8.0 |
| Spatial Peak (hands/wrists/feet/ankles averaged over 10 g) | 4.0 | 20.0 |

CE Limit

| EXPOSURE LIMITS | SAR (W/kg) | |
|--|--|--|
| | (General Population / Uncontrolled Exposure Environment) | (Occupational / Controlled Exposure Environment) |
| Spatial Average (averaged over the whole body) | 0.08 | 0.4 |
| Spatial Peak (averaged over any 10 g of tissue) | 2.0 | 10 |
| Spatial Peak (hands/wrists/feet/ankles averaged over 10 g) | 4.0 | 20.0 |

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

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 Spatial Peak limit 1.6W/kg (FCC&IC) & 2 W/kg (CE) applied to the EUT.

FACILITIES

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 342867, the FCC Designation No. : CN1221.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier : CN0023.

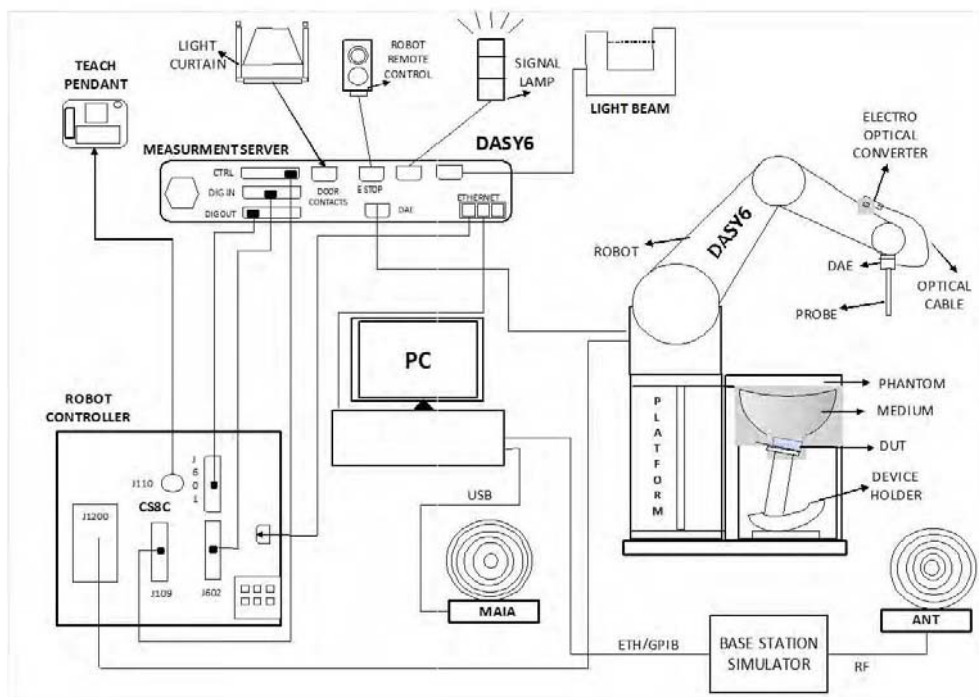
DESCRIPTION OF TEST SYSTEM

These measurements were performed with the automated near-field scanning system DASY6 from Schmid & Partner Engineering AG (SPEAG) which is the Fifth generation of the system shown in the figure hereinafter:



DASY6 System Description

The DASY6 system for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot (Staubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal application, 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.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- 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.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 professional operating system and the DASY52 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

DASY6 Measurement Server

The DASY6 measurement server is based on a PC/104 CPU board with a 400 MHz Intel ULV Celeron, 128 MB chip-disk and 128 MB RAM. The necessary circuits for communication with the DAE4 (or DAE3) electronics box, as well as the 16-bit AD converter system for optical detection and digital I/O interface are contained on the DASY6 I/O board, which is directly connected to the PC/104 bus of the CPU board.



The measurement server performs all real-time data evaluations of field measurements and surface detection, controls robot movements, and handles safety operations. The PC operating system cannot interfere with these time-critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port, which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Connection of devices from any other supplier could seriously damage the measurement server.

Data Acquisition Electronics

The data acquisition electronics (DAE4) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of both the DAE4 as well as of the DAE3 box is 200M Ω ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 E-Field Probes

| | |
|----------------------|---|
| Frequency | 10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz) |
| Directivity | ± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis) |
| Dynamic Range | 10 μ W/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/g) |
| Dimensions | Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm |
| Application | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |
| Compatibility | DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI |

SAM Twin Phantom

The SAM Twin Phantom (shown in front of DASY6) is a fiberglass shell phantom with shell thickness 2 mm, except in the ear region where the thickness is increased to 6 mm. The phantom has three measurement areas: 1) Left Head, 2) Right Head, and 3) Flat Section. For larger devices, the use of the ELI-Phantom (shown behind DASY6) is required. For devices such as glasses with a wireless link, the Face Down Phantom is the most suitable (between the SAM Twin and ELI phantoms).

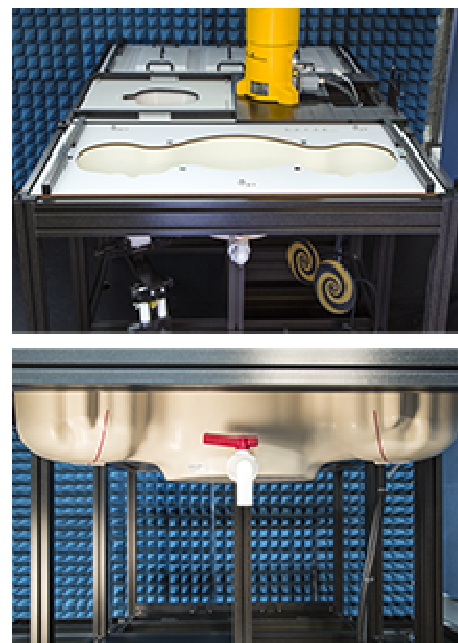
When the phantom is mounted inside allocated slot of the DASY6 platform, phantom reference points can be taught directly in the DASY5 V5.2 software. When the DASY6 platform is used to mount the

Phantom, some of the phantom teaching points cannot be reached by the robot in DASY5 V5.2. A special tool called P1a-P2aX-Former is provided to transform two of the three points, P1 and P2, to reachable locations. To use these new teaching points, a revised phantom configuration file is required. In addition to our standard broadband liquids, the phantom can be used with the following tissue simulating liquids:

Sugar-water-based liquids can be left permanently in the phantom. Always cover the liquid when the system is not in use to prevent changes in liquid parameters due to water evaporation.

DGBE-based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom, and the phantom should be dried when the system is not in use (desirable at least once a week).

Do not use other organic solvents without previously testing the solvent resistivity of the phantom. Approximately 25 liters of liquid is required to fill the SAM Twin phantom.



ELI Phantom

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI is fully compatible with the latest draft of the standard IEC 62209-2 and the use of all known tissue simulating liquids. ELI has been optimized for performance and can be integrated into a SPEAG standard phantom table. A cover is provided to prevent evaporation of water and changes in liquid parameters. 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 can be used with the following tissue simulating liquids:

- Sugar-water-based liquids can be left permanently in the phantom. Always cover the liquid when the system is not in use to prevent changes in liquid parameters due to water evaporation.
- DGBE-based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom, and the phantom should be dried when the system is not in use (desirable at least once a week).
- Do not use other organic solvents without previously testing the solvent resistivity of the phantom.

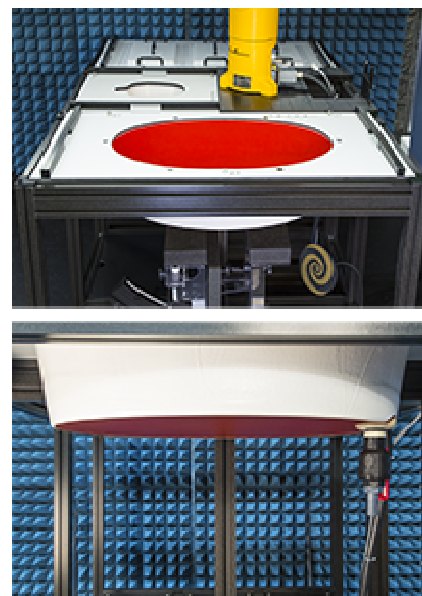
Approximately 25 liters of liquid is required to fill the ELI phantom.

Robots

The DASY6 system uses the high-precision industrial robots TX60L, TX90XL, and RX160L from Staubli SA (France). The TX robot family - the successor of the well-known RX robot family - continues to offer the features important for DASY6 applications:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchrony motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

The robots are controlled by the Staubli CS8c robot controllers. All information regarding the use and maintenance of the robot arm and the robot controller is provided



Calibration Frequency Points for EX3DV4 E-Field Probes SN: 7522 Calibrated: 2020/04/01

| Calibration Frequency Point(MHz) | Frequency Range(MHz) | | Conversion Factor | | |
|----------------------------------|----------------------|------|-------------------|------|------|
| | From | To | X | Y | Z |
| 750 Head | 650 | 850 | 9.92 | 9.92 | 9.92 |
| 900 Head | 850 | 1000 | 9.4 | 9.4 | 9.4 |
| 1750 Head | 1650 | 1850 | 8.21 | 8.21 | 8.21 |
| 1900 Head | 1850 | 2000 | 7.95 | 7.95 | 7.95 |
| 2300 Head | 2200 | 2400 | 7.53 | 7.53 | 7.53 |
| 2450 Head | 2400 | 2550 | 7.15 | 7.15 | 7.15 |
| 2600 Head | 2550 | 2700 | 7.04 | 7.04 | 7.04 |
| 5200 Head | 5090 | 5250 | 5.2 | 5.2 | 5.2 |
| 5300 Head | 5250 | 5410 | 4.96 | 4.96 | 4.96 |
| 5600 Head | 5490 | 5700 | 4.55 | 4.55 | 4.55 |
| 5800 Head | 5700 | 5910 | 4.65 | 4.65 | 4.65 |

Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 15mm 2 step integral, with 1.5mm interpolation used to locate the peak SAR area used for zoom scan assessments.

Where the system identifies multiple SAR peaks (which are within 25% of peak value) the system will provide the user with the option of assessing each peak location individually for zoom scan averaging.

Zoom Scan (Cube Scan Averaging)

The averaging zoom scan volume utilized in the DASY5 software is in the shape of a cube and the side dimension of a 1 g or 10 g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000 kg/m³ is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side length of the 10g cube is 21.5mm.

When the cube intersects with the surface of the phantom, it is oriented so that 3 vertices touch the surface of the shell or the center of a face is tangent to the surface. The face of the cube closest to the surface is modified in order to conform to the tangent surface.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 7 x 7 x 7 (5mmx5mmx5mm) providing a volume of 30 mm in the X & Y & Z axis.

Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEC 62209-1:2016

Recommended Tissue Dielectric Parameters for Head and Body

Table A.3 – Dielectric properties of the head tissue-equivalent liquid

| Frequency MHz | Relative permittivity ϵ_r | Conductivity (σ) S/m |
|------------------|---------------------------------------|----------------------------------|
| 300 | 45,3 | 0,87 |
| 450 | 43,5 | 0,87 |
| <i>750</i> | <i>41,9</i> | <i>0,89</i> |
| 835 | 41,5 | 0,90 |
| 900 | 41,5 | 0,97 |
| 1 450 | 40,5 | 1,20 |
| <i>1 500</i> | <i>40,4</i> | <i>1,23</i> |
| <i>1 640</i> | <i>40,2</i> | <i>1,31</i> |
| <i>1 750</i> | <i>40,1</i> | <i>1,37</i> |
| 1 800 | 40,0 | 1,40 |
| 1 900 | 40,0 | 1,40 |
| 2 000 | 40,0 | 1,40 |
| <i>2 100</i> | <i>39,8</i> | <i>1,49</i> |
| <i>2 300</i> | <i>39,5</i> | <i>1,67</i> |
| 2 450 | 39,2 | 1,80 |
| <i>2 600</i> | <i>39,0</i> | <i>1,96</i> |
| 3 000 | 38,5 | 2,40 |
| <i>3 500</i> | <i>37,9</i> | <i>2,91</i> |
| <i>4 000</i> | <i>37,4</i> | <i>3,43</i> |
| <i>4 500</i> | <i>36,8</i> | <i>3,94</i> |
| <i>5 000</i> | <i>36,2</i> | <i>4,45</i> |
| <i>5 200</i> | <i>36,0</i> | <i>4,66</i> |
| <i>5 400</i> | <i>35,8</i> | <i>4,86</i> |
| <i>5 600</i> | <i>35,5</i> | <i>5,07</i> |
| <i>5 800</i> | <i>35,3</i> | <i>5,27</i> |
| 6 000 | 35,1 | 5,48 |

NOTE For convenience, permittivity and conductivity values at those frequencies which are not part of the original data provided by Drossos et al. [33] or the extension to 5 800 MHz are provided (i.e. the values shown *in italics*). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6 000 MHz that were linearly extrapolated from the values at 3 000 MHz and 5 800 MHz.

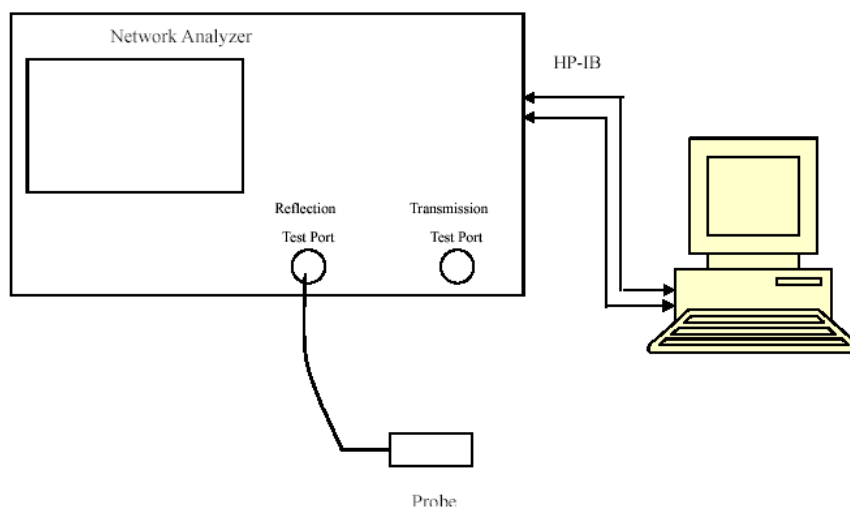
EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Information

| Equipment | Model | S/N | Calibration Date | Calibration Due Date |
|------------------------------------|-----------------|---------------|------------------|----------------------|
| DASY5 Test Software | DASY52 52.10.2 | N/A | NCR | NCR |
| DASY6 Measurement Server | DASY6 6.0.31 | N/A | NCR | NCR |
| Data Acquisition Electronics | DAE4 | 1562 | 2020/03/03 | 2021/03/02 |
| E-Field Probe | EX3DV4 | 7522 | 2020/04/01 | 2021/03/31 |
| Mounting Device | MD4HHTV5 | SD 000 H01 KA | NCR | NCR |
| SAM Twin Phantom | SAM-Twin V8.0 | 1962 | NCR | NCR |
| Dipole, 1900MHz | D1900V2 | 5d231 | 2020/01/14 | 2023/01/13 |
| Tissue Liquid Head | HBBL600-10000V6 | 180622-2 | Each Time | / |
| Network Analyzer | 8753D | 3410A08288 | 2020/07/31 | 2021/07/30 |
| Dielectric Assessment Kit | DAK-3.5 | 1248 | NCR | NCR |
| MXG Analog Signal Generator | N5181A | MY48180408 | 2020/07/31 | 2021/07/30 |
| USB wideband power sensor | U2021XA | MY54250003 | 2020/07/31 | 2021/07/30 |
| Power Amplifier | 5S1G4 | 71377 | NCR | NCR |
| Directional Coupler | Oct-42 | 3307 | NCR | NCR |
| Attenuator | 6dB | 773-6 | NCR | NCR |
| Digital Radio Communication Tester | CMD60 | 830553/018 | 2020/07/31 | 2021/07/30 |

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

| Frequency (MHz) | Liquid Type | Liquid Parameter | | Target Value | | Delta (%) | | Tolerance (%) |
|-----------------|--------------------|------------------|----------------|--------------|----------------|--------------------|----------------------|---------------|
| | | ϵ_r | σ (S/m) | ϵ_r | σ (S/m) | $\Delta\epsilon_r$ | $\Delta\sigma$ (S/m) | |
| 1900 | Tissue Liquid Head | 39.604 | 1.369 | 40.0 | 1.40 | -0.99 | -2.21 | ± 5 |
| 1921.536 | Tissue Liquid Head | 39.871 | 1.39 | 40.0 | 1.40 | -0.32 | -0.71 | ± 5 |
| 1924.992 | Tissue Liquid Head | 39.725 | 1.391 | 40.0 | 1.40 | -0.69 | -0.64 | ± 5 |
| 1928.448 | Tissue Liquid Head | 40.017 | 1.409 | 40.0 | 1.40 | 0.04 | 0.64 | ± 5 |

*Liquid Verification above was performed on 2020/12/10.

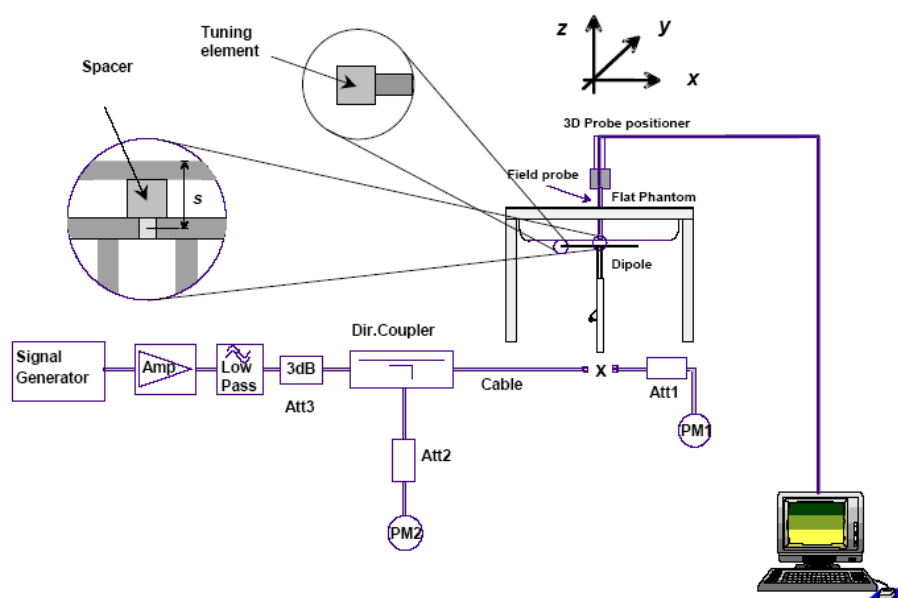
System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of $\pm 10\%$. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

The spacing distances in the **System Verification Setup Block Diagram** is given by the following:

- $s = 15 \text{ mm} \pm 0,2 \text{ mm}$ for $300 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$ for $1\,000 \text{ MHz} < f \leq 3\,000 \text{ MHz}$;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$ for $3\,000 \text{ MHz} < f \leq 6\,000 \text{ MHz}$.

System Verification Setup Block Diagram



System Accuracy Check Results

| Date | Frequency Band (MHz) | Liquid Type | Input Power (mW) | Measured SAR (W/kg) | | Normalized to 1W (W/kg) | Target Value (W/Kg) | Delta (%) | Tolerance (%) |
|------------|----------------------|-------------|------------------|---------------------|------|-------------------------|---------------------|-----------|---------------|
| 2020/12/10 | 1900 | Head | 100 | 1g | 4.12 | 41.2 | 40.3 | 2.233 | ± 10 |

*The SAR values above are normalized to 1 Watt forward power.

SAR SYSTEM VALIDATION DATA**System Performance 1900 MHz Head****DUT: Dipole 1900MHz; Type: D1900V2; Serial: 5d231**

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.369$ S/m; $\epsilon_r = 39.604$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1900 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Head 1900MHz Pin=100mW/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 4.75 W/kg

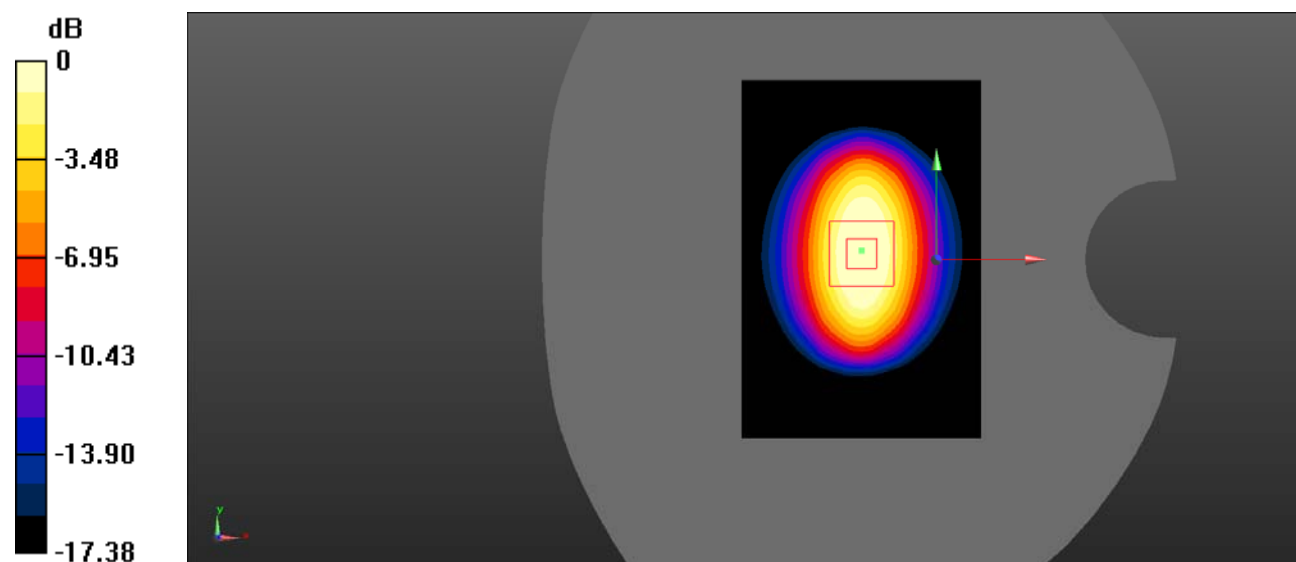
Head 1900MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.26 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 5.32 W/kg

SAR(1 g) = 4.12 W/kg; SAR(10 g) = 2.14W/kg

Maximum value of SAR (measured) = 4.32 W/kg



0 dB = 4.32 W/kg = 6.35 dBW/kg

EUT TEST STRATEGY AND METHODOLOGY

Test positions for body-worn and other configurations

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.

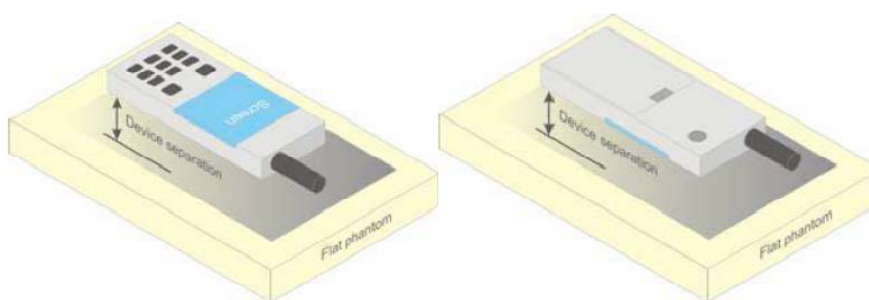


Figure 5 – Test positions for body-worn devices

Test Distance for SAR Evaluation

For this case the EUT(Equipment Under Test) is set 5mm away from the phantom, the test distance is 5mm.

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or radiating structures of the EUT, the horizontal grid spacing was 15 mm x 15 mm, and the SAR distribution was determined by integrated grid of 1.5mm x 1.5mm. Based on these data, the area of the maximum absorption was determined by spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7x 7 x 7 points. 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 1.2 mm 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 averages.

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

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

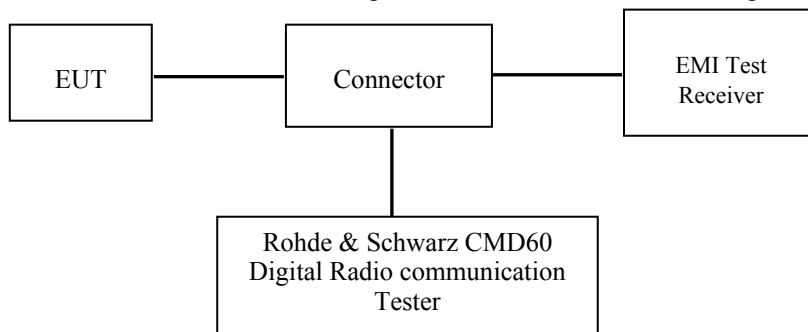
CONDUCTED OUTPUT POWER MEASUREMENT

Provision Applicable

The measured peak output power should be greater and within 5% than EMI measurement.

Test Procedure

The RF output of the transmitter was connected to the input of the EMI Test Receiver through Connector.



Maximum Target Average Output Power

| Max Target Power(dBm) | | | |
|-----------------------|---------|--------|------|
| Mode/Band | Channel | | |
| | Low | Middle | High |
| DECT(ANT 0) | 12.0 | 12.0 | 12.0 |
| DECT(ANT 1) | 20.5 | 20.5 | 20.5 |

Test Results:**DECT:****ANT0:**

| Mode | Frequency (MHz) | RF Output Peak Power (dBm) | RF Output Peak Power (W) |
|------|-----------------|----------------------------|--------------------------|
| DECT | 1921.536 | 11.33 | 0.014 |
| | 1924.992 | 11.75 | 0.015 |
| | 1928.448 | 11.37 | 0.014 |

ANT1:

| Mode | Frequency (MHz) | RF Output Peak Power (dBm) | RF Output Peak Power (W) |
|------|-----------------|----------------------------|--------------------------|
| DECT | 1921.536 | 20.24 | 0.106 |
| | 1924.992 | 20.12 | 0.103 |
| | 1928.448 | 20.25 | 0.106 |

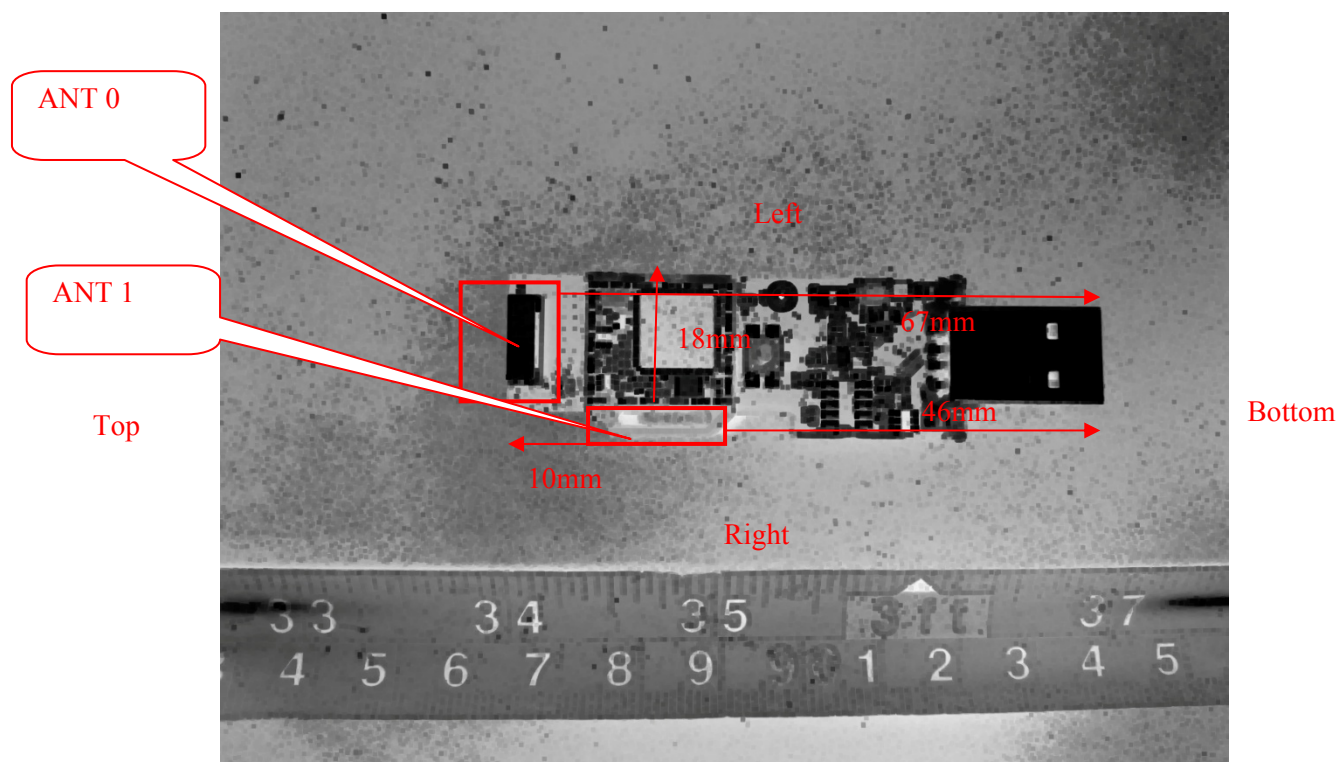
Note:

1. Rohde & Schwarz Radio Communication Tester (CMD60) was used for the measurement of DECT peak output power.
2. Duty Cycle=1/24 (From Radio report)
3. The EUT belongs to a low duty cycle device.
4. Per KDB 447498 D01, **1 Channel** shall be tested; the middle channel was selected to test:

$$N_c = \text{Round} \left\{ \left[100(f_{\text{high}} - f_{\text{low}}) / f_c \right]^{0.5} \times (f_c / 100)^{0.2} \right\},$$

where f_{high} is the highest frequency in the band and f_{low} is the lowest f_c is the center frequency in the band.

Antennas Location



Antenna Distance To Edge

| Antenna Distance To Edge(mm) | | | | | | |
|------------------------------|-------|------|------|-------|--------|-----|
| Antenna | Front | Back | Left | Right | Bottom | Top |
| ANT 0 | < 5 | < 5 | 18 | < 5 | 46 | 10 |
| ANT 1 | < 5 | < 5 | < 5 | < 5 | 67 | < 5 |

Note: Bottom for USB interface, don't do the test.

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

SAR Test Data

Environmental Conditions

| | |
|--------------------|--------------|
| Temperature: | 21.8-22.8 °C |
| Relative Humidity: | 42-56 % |
| ATM Pressure: | 101.3 kPa |
| Test Date: | 2020/12/10 |

Testing was performed by Ricardo Lan.

ANT0:

| EUT Position | Frequency (MHz) | Test Mode | Max. Meas. Power (dBm) | Max. Rated Power (dBm) | 1g SAR (W/Kg), Limited=1.6W/kg | | | | |
|--------------|-----------------|-----------|------------------------|------------------------|--------------------------------|-----------|------------|-------------|------|
| | | | | | Scaled Factor | Meas. SAR | Scaled SAR | Correct SAR | Plot |
| Body Front | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 11.75 | 12.0 | 1.059 | 0.052 | 0.06 | 0.06 | 1# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Back | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 11.75 | 12.0 | 1.059 | 0.085 | 0.09 | 0.09 | 2# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Left | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 11.75 | 12.0 | 1.059 | 0.028 | 0.03 | 0.03 | 3# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Right | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 11.75 | 12.0 | 1.059 | 0.094 | 0.10 | 0.10 | 4# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Top | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 11.75 | 12.0 | 1.059 | 0.037 | 0.04 | 0.04 | 5# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |

ANT1:

| EUT Position | Frequency (MHz) | Test Mode | Max. Meas. Power (dBm) | Max. Rated Power (dBm) | 1g SAR (W/Kg), Limited=1.6W/kg | | | | |
|--------------|-----------------|-----------|------------------------|------------------------|--------------------------------|-----------|------------|-------------|------|
| | | | | | Scaled Factor | Meas. SAR | Scaled SAR | Correct SAR | Plot |
| Body Front | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 20.12 | 20.5 | 1.091 | 0.035 | 0.03 | 0.03 | 6# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Back | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 20.12 | 20.5 | 1.091 | 0.128 | 0.14 | 0.14 | 7# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Left | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 20.12 | 20.5 | 1.091 | 0.196 | 0.21 | 0.21 | 8# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Right | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 20.12 | 20.5 | 1.091 | 0.030 | 0.03 | 0.03 | 9# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |
| Body Top | 1921.536 | GFSK | / | / | / | / | / | / | / |
| | 1924.992 | GFSK | 20.12 | 20.5 | 1.091 | 0.031 | 0.03 | 0.03 | 10# |
| | 1928.448 | GFSK | / | / | / | / | / | / | / |

Note:

1. When the SAR value is less than half of the limit, testing for other channels are optional.
2. When SAR or MPE is not measured at the maximum power level allowed for production to the individual channels tested to determine compliance.

Corrected SAR Evaluation

62209-2 © IEC:2010

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Annex F
(normative)**SAR correction for deviations of complex permittivity from targets****F.2 SAR correction formula**

From [13] and [14], a linear relationship was found between the percent change in SAR (denoted ΔSAR) and the percent change in the permittivity and conductivity from the target values in Table 1 (denoted $\Delta\epsilon_r$ and $\Delta\sigma$, respectively). This linear relationship agrees with the results of Kuster and Balzano [48] and Bit-Babik et al. [2]. The relationship is given by:

$$\Delta\text{SAR} = c_\epsilon \Delta\epsilon_r + c_\sigma \Delta\sigma \quad (\text{F.1})$$

where

$c_\epsilon = \partial(\Delta\text{SAR})/\partial(\Delta\epsilon)$ is the coefficients representing the sensitivity of SAR to permittivity where SAR is normalized to output power;

$c_\sigma = \partial(\Delta\text{SAR})/\partial(\Delta\sigma)$ is the coefficients representing the sensitivity of SAR to conductivity, where SAR is normalized to output power.

The values of c_ϵ and c_σ have a simple relationship with frequency that can be described using polynomial equations. For the 1 g averaged SAR c_ϵ and c_σ are given by

$$c_\epsilon = -7,854 \times 10^{-4} f^3 + 9,402 \times 10^{-3} f^2 - 2,742 \times 10^{-2} f - 0,202 \ 6 \quad (\text{F.2})$$

$$c_\sigma = 9,804 \times 10^{-3} f^3 - 8,661 \times 10^{-2} f^2 + 2,981 \times 10^{-2} f + 0,782 \ 9 \quad (\text{F.3})$$

where

f is the frequency in GHz.

For the 10 g averaged SAR, the variables c_ϵ and c_σ are given by:

$$c_\epsilon = 3,456 \times 10^{-3} f^3 - 3,531 \times 10^{-2} f^2 + 7,675 \times 10^{-2} f - 0,186 \ 0 \quad (\text{F.4})$$

$$c_\sigma = 4,479 \times 10^{-3} f^3 - 1,586 \times 10^{-2} f^2 - 0,197 \ 2 f + 0,771 \ 7 \quad (\text{F.5})$$

| Calibrate Date | Liquid Type | Frequency (MHz) | C_{ε} | $\Delta \varepsilon_r$ | C_{δ} | $\Delta \delta$ | ΔSAR |
|----------------|-------------|-----------------|-------------------|------------------------|--------------|-----------------|---------------------|
| 2020/12/10 | Head | 1900 | -0.226 | -0.99 | 0.594 | -2.21 | -1.089 |
| | | 1921.536 | -0.226 | -0.32 | 0.590 | -0.71 | -0.347 |
| | | 1924.992 | -0.226 | -0.69 | 0.589 | -0.64 | -0.221 |
| | | 1928.448 | -0.226 | 0.04 | 0.589 | 0.64 | 0.368 |

SAT Test Plots:**Plot 1#****DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Front/DECT ANT0 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.150 W/kg

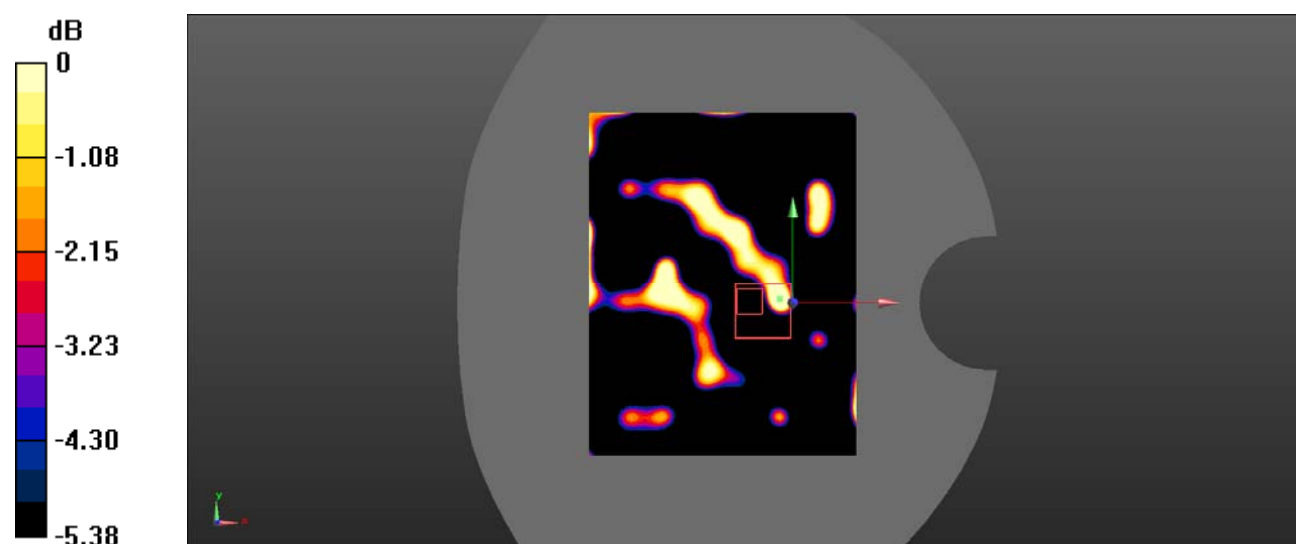
Body Front/DECT ANT0 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.305 V/m; Power Drift = -2.44 dB

Peak SAR (extrapolated) = 0.0770 W/kg

SAR(1 g) = 0.052 W/kg; SAR(10 g) = 0.046 W/kg

Maximum value of SAR (measured) = 0.0768 W/kg



0 dB = 0.0768 W/kg = -11.15 dBW/kg

Plot 2#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Back/DECT ANT0 Mid 2/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.229 W/kg

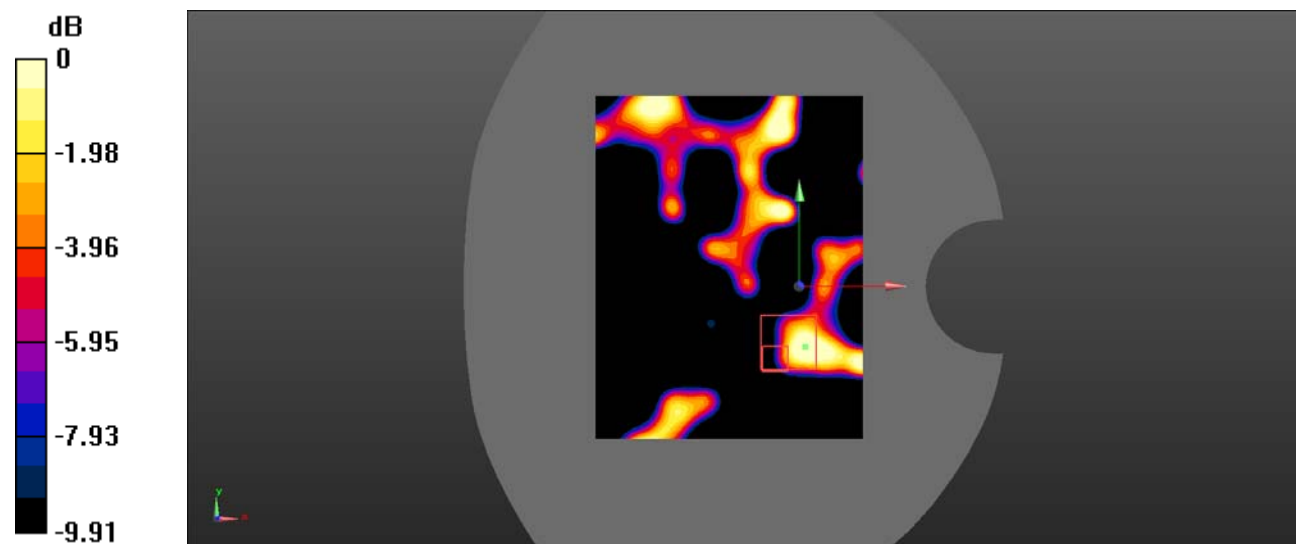
Body Back/DECT ANT0 Mid 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.635 V/m; Power Drift = -2.03 dB

Peak SAR (extrapolated) = 0.250 W/kg

SAR(1 g) = 0.085 W/kg; SAR(10 g) = 0.047 W/kg

Maximum value of SAR (measured) = 0.144 W/kg



0 dB = 0.144 W/kg = -8.42 dBW/kg

Plot 3#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Left/DECT ANT0 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.192 W/kg

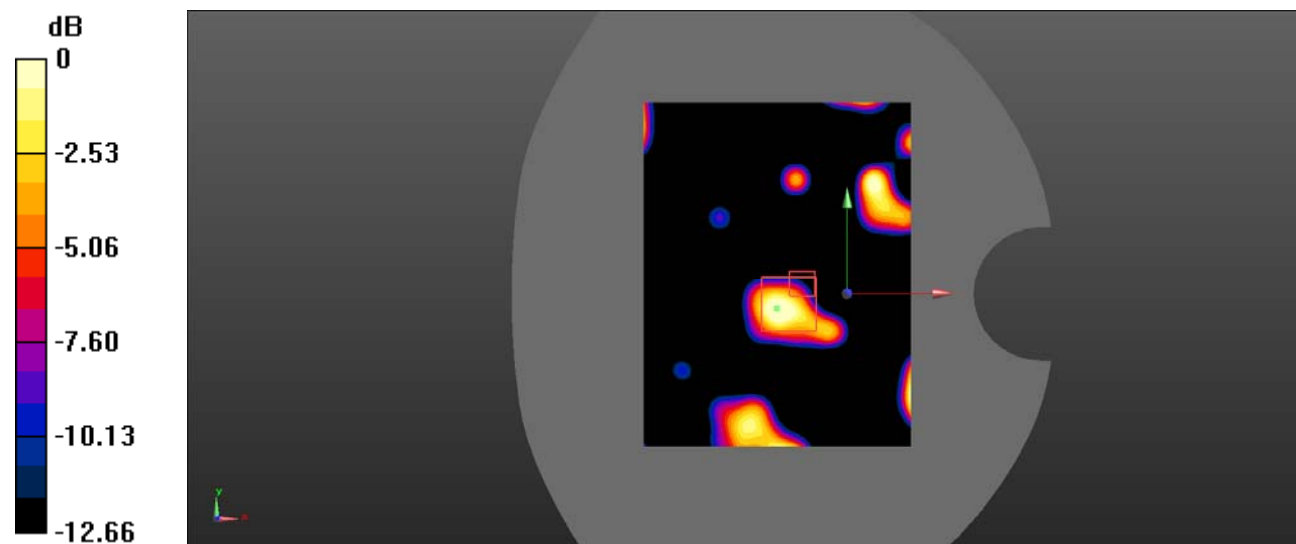
Body Left/DECT ANT0 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.784 V/m; Power Drift = -0.43 dB

Peak SAR (extrapolated) = 0.139 W/kg

SAR(1 g) = 0.028 W/kg; SAR(10 g) = 0.013 W/kg

Maximum value of SAR (measured) = 0.139 W/kg



0 dB = 0.139 W/kg = -8.57 dBW/kg

Plot 4#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Right/DECT ANT0 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.161 W/kg

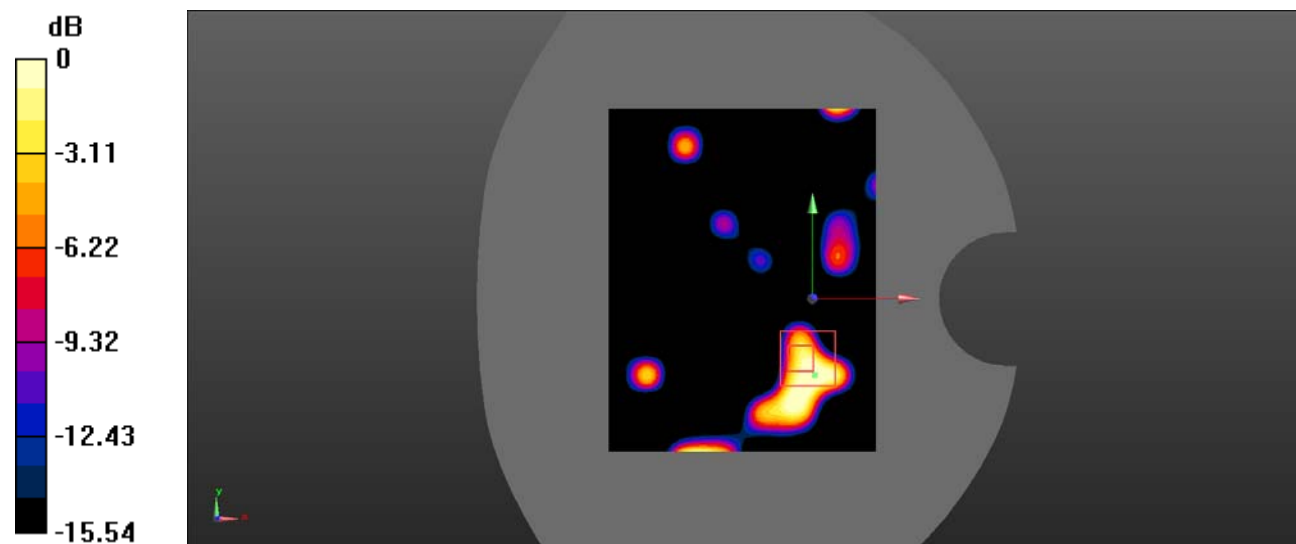
Body Right/DECT ANT0 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.983 V/m; Power Drift = -2.23 dB

Peak SAR (extrapolated) = 0.137 W/kg

SAR(1 g) = 0.094 W/kg; SAR(10 g) = 0.044 W/kg

Maximum value of SAR (measured) = 0.133 W/kg



Plot 5#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Top/DECT ANT0 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.0812 W/kg

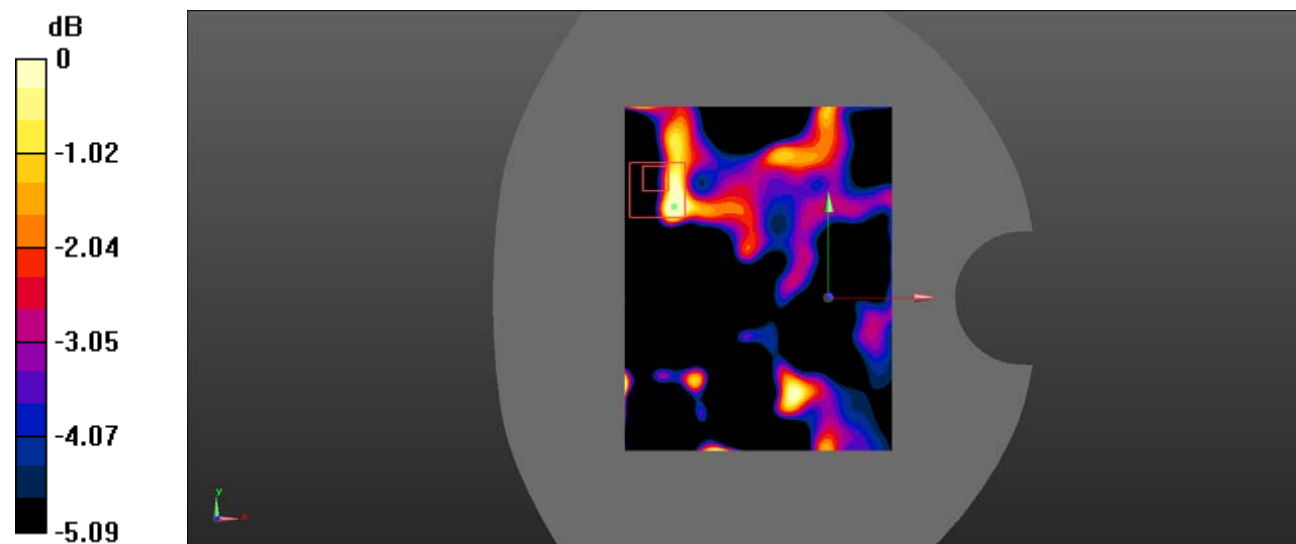
Body Top/DECT ANT0 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.156 V/m; Power Drift = 0.52 dB

Peak SAR (extrapolated) = 0.0730 W/kg

SAR(1 g) = 0.037 W/kg; SAR(10 g) = 0.030 W/kg

Maximum value of SAR (measured) = 0.0612 W/kg



0 dB = 0.0612 W/kg = -12.13 dBW/kg

Plot 6#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Front/DECT ANT1 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.173 W/kg

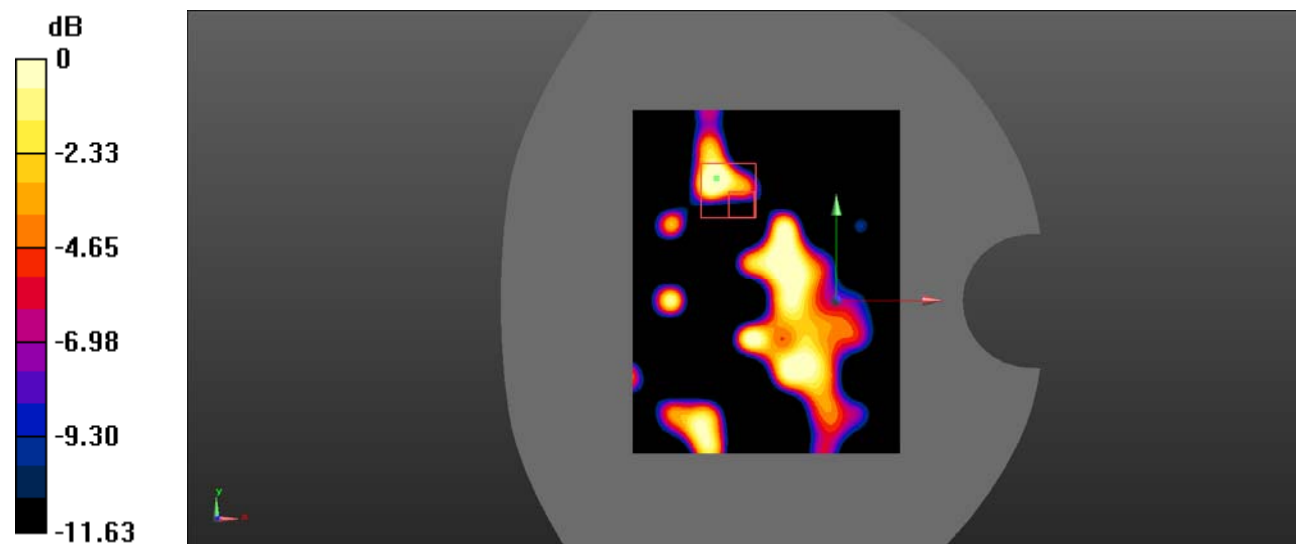
Body Front/DECT ANT1 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.407 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.113 W/kg

SAR(1 g) = 0.035 W/kg; SAR(10 g) = 0.0082 W/kg

Maximum value of SAR (measured) = 0.103 W/kg



0 dB = 0.103 W/kg = -9.87 dBW/kg

Plot 7#**DUT: Swivl Link; Type: SWL100; R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Back/DECT ANT1 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.245 W/kg

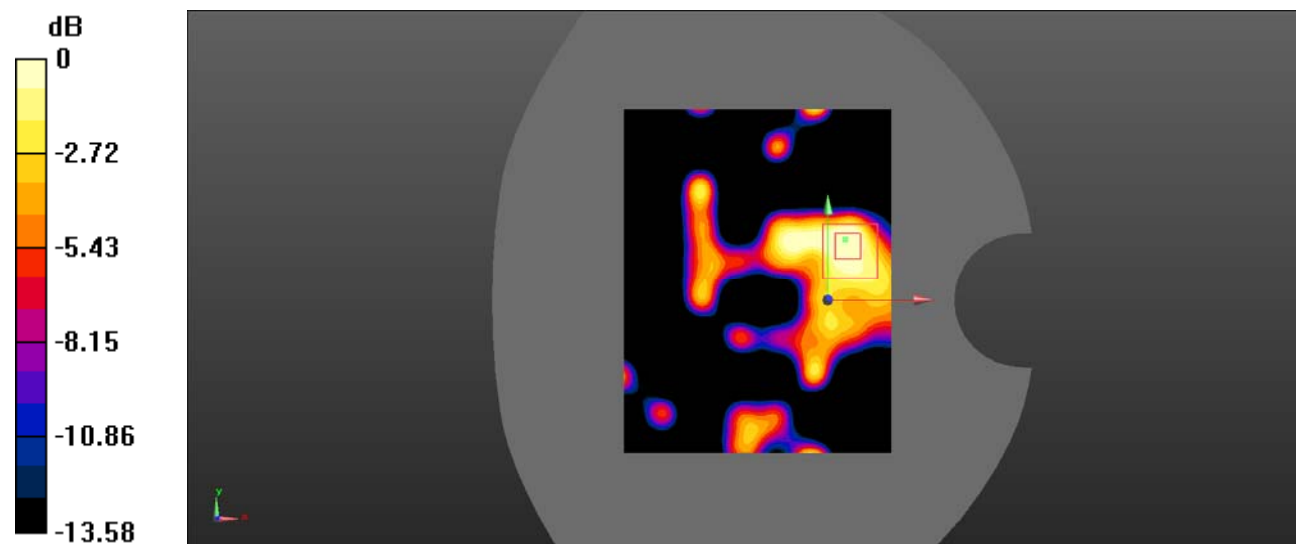
Body Back/DECT ANT1 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.717 V/m; Power Drift = -0.61 dB

Peak SAR (extrapolated) = 0.267 W/kg

SAR(1 g) = 0.128 W/kg; SAR(10 g) = 0.057 W/kg

Maximum value of SAR (measured) = 0.174 W/kg



0 dB = 0.174 W/kg = -7.59 dBW/kg

Plot 8#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Left/DECT ANT1 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.334 W/kg

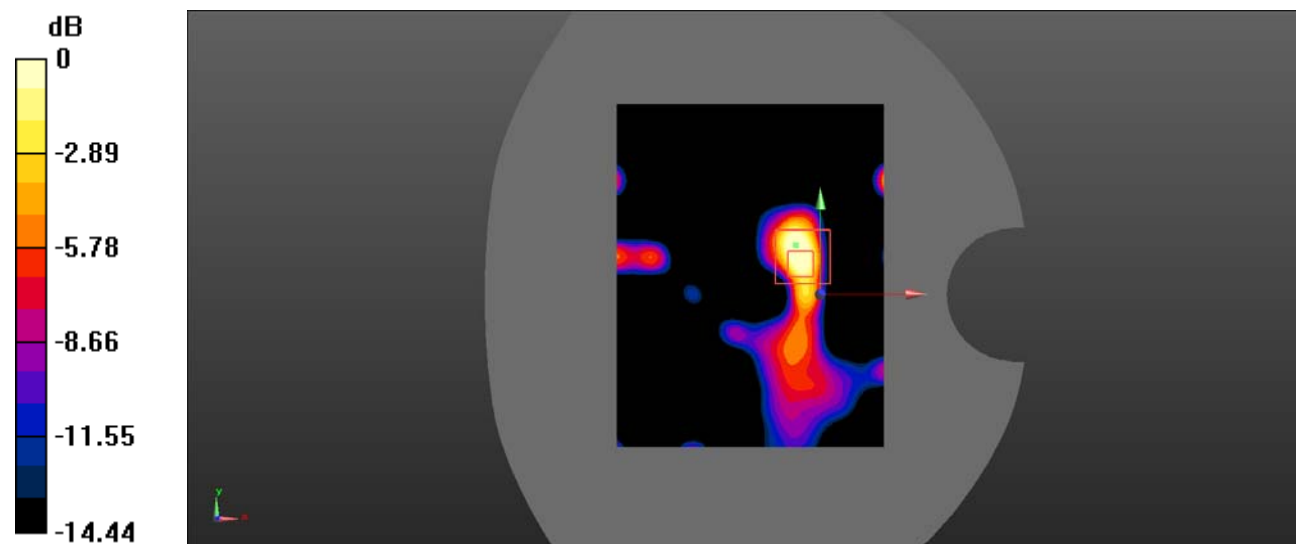
Body Left/DECT ANT1 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.703 V/m; Power Drift = 0.52 dB

Peak SAR (extrapolated) = 0.399 W/kg

SAR(1 g) = 0.196 W/kg; SAR(10 g) = 0.091 W/kg

Maximum value of SAR (measured) = 0.237 W/kg



0 dB = 0.237 W/kg = -6.25 dBW/kg

Plot 9#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Right/DECT ANT1 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.168 W/kg

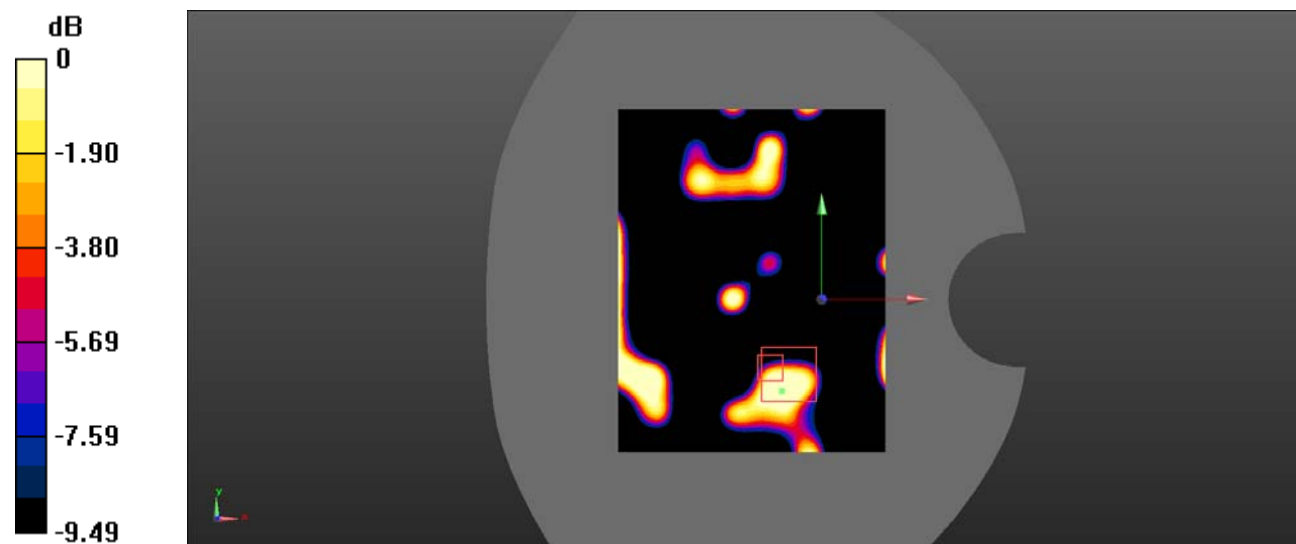
Body Right/DECT ANT1 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.706 V/m; Power Drift = 1.08 dB

Peak SAR (extrapolated) = 0.0710 W/kg

SAR(1 g) = 0.030 W/kg; SAR(10 g) = 0.012 W/kg

Maximum value of SAR (measured) = 0.0688 W/kg



0 dB = 0.0688 W/kg = -11.62 dBW/kg

Plot 10#**DUT: Swivl Link; Type: SWL100; Serial: R2011043-SA-S1**

Communication System: UID 0, DECT (0); Frequency: 1924.99 MHz; Duty Cycle: 1:24

Medium parameters used (interpolated): $f = 1924.99$ MHz; $\sigma = 1.391$ S/m; $\epsilon_r = 39.725$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7522; ConvF(7.95, 7.95, 7.95) @ 1924.99 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 3/3/2020
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Body Top/DECT ANT1 Mid/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.0661 W/kg

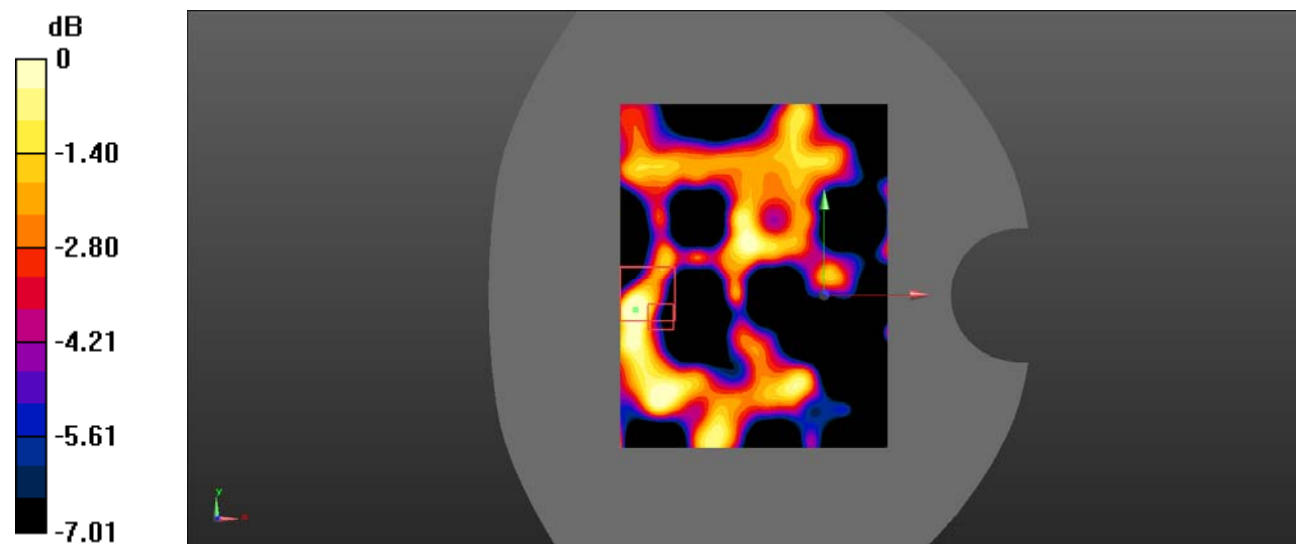
Body Top/DECT ANT1 Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.724 V/m; Power Drift = 0.23 dB

Peak SAR (extrapolated) = 0.0470 W/kg

SAR(1 g) = 0.031 W/kg; SAR(10 g) = 0.014 W/kg

Maximum value of SAR (measured) = 0.0511 W/kg



0 dB = 0.0511 W/kg = -12.92 dBW/kg

SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results

- 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 .

Note: The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The Highest Measured SAR Configuration in Each Frequency Band

Body

| SAR probe calibration point | Frequency Band | Freq.(MHz) | EUT Position | Meas. SAR (W/kg) | | Largest to Smallest SAR Ratio |
|-----------------------------|----------------|------------|--------------|------------------|----------|-------------------------------|
| | | | | Original | Repeated | |
| / | / | / | / | / | / | / |

Note:

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20 .
2. The measured SAR results **do not** have to be scaled to the maximum tune-up tolerance to determine if repeated measurements are required.
3. SAR measurement variability must be assessed for each frequency band, which is determined by the **SAR probe calibration point and tissue-equivalent medium** used for the device measurements..

APPENDIX A MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the measurement system and is given in the following Table.

Measurement uncertainty evaluation for IEEE1528-2013 SAR test

| Source of uncertainty | Tolerance/ uncertainty ± % | Probability distribution | Divisor | ci (1 g) | ci (10 g) | Standard uncertainty ± %, (1 g) | Standard uncertainty ± %, (10 g) |
|---|----------------------------------|-----------------------------|------------|-------------|--------------|---------------------------------------|--|
| Measurement system | | | | | | | |
| Probe calibration | 6.55 | N | 1 | 1 | 1 | 6.6 | 6.6 |
| Axial Isotropy | 4.7 | R | $\sqrt{3}$ | 1 | 1 | 2.7 | 2.7 |
| Hemispherical Isotropy | 9.6 | R | $\sqrt{3}$ | 0 | 0 | 0.0 | 0.0 |
| Boundary effect | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| Linearity | 4.7 | R | $\sqrt{3}$ | 1 | 1 | 2.7 | 2.7 |
| Detection limits | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| Readout electronics | 0.3 | N | 1 | 1 | 1 | 0.3 | 0.3 |
| Response time | 0.0 | R | $\sqrt{3}$ | 1 | 1 | 0.0 | 0.0 |
| Integration time | 0.0 | R | $\sqrt{3}$ | 1 | 1 | 0.0 | 0.0 |
| RF ambient conditions – noise | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| RF ambient conditions–reflections | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| Probe positioner mech. Restrictions | 0.8 | R | $\sqrt{3}$ | 1 | 1 | 0.5 | 0.5 |
| Probe positioning with respect to phantom shell | 6.7 | R | $\sqrt{3}$ | 1 | 1 | 3.9 | 3.9 |
| Post-processing | 2.0 | R | $\sqrt{3}$ | 1 | 1 | 1.2 | 1.2 |
| Test sample related | | | | | | | |
| Test sample positioning | 2.8 | N | 1 | 1 | 1 | 2.8 | 2.8 |
| Device holder uncertainty | 6.3 | N | 1 | 1 | 1 | 6.3 | 6.3 |
| Drift of output power | 5.0 | R | $\sqrt{3}$ | 1 | 1 | 2.9 | 2.9 |
| Phantom and set-up | | | | | | | |
| Phantom uncertainty (shape and thickness tolerances) | 4.0 | R | $\sqrt{3}$ | 1 | 1 | 2.3 | 2.3 |
| Liquid conductivity target) | 5.0 | R | $\sqrt{3}$ | 0.64 | 0.43 | 1.8 | 1.2 |
| Liquid conductivity meas.) | 2.5 | N | 1 | 0.64 | 0.43 | 1.6 | 1.1 |
| Liquid permittivity target) | 5.0 | R | $\sqrt{3}$ | 0.6 | 0.49 | 1.7 | 1.4 |
| Liquid permittivity meas.) | 2.5 | N | 1 | 0.6 | 0.49 | 1.5 | 1.2 |
| Combined standard uncertainty | | RSS | | | | 12.2 | 12.0 |
| Expanded uncertainty 95 % confidence interval) | | | | | | 24.3 | 23.9 |

Measurement uncertainty evaluation for IEC62209-2 SAR test

| Source of uncertainty | Tolerance/ uncertainty ± % | Probability distribution | Divisor | ci (1 g) | ci (10 g) | Standard uncertainty ± %, (1 g) | Standard uncertainty ± %, (10 g) |
|---|----------------------------------|-----------------------------|------------|-------------|-----------------|---------------------------------------|--|
| Measurement system | | | | | | | |
| Probe calibration | 6.55 | N | 1 | 1 | 1 | 6.6 | 6.6 |
| Axial Isotropy | 4.7 | R | $\sqrt{3}$ | 1 | 1 | 2.7 | 2.7 |
| Hemispherical Isotropy | 9.6 | R | $\sqrt{3}$ | 0 | 0 | 0.0 | 0.0 |
| Linearity | 4.7 | R | $\sqrt{3}$ | 1 | 1 | 2.7 | 2.7 |
| Modulation Response | 0.0 | R | $\sqrt{3}$ | 1 | 1 | 0.0 | 0.0 |
| Detection limits | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| Boundary effect | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| Readout electronics | 0.3 | N | 1 | 1 | 1 | 0.3 | 0.3 |
| Response time | 0.0 | R | $\sqrt{3}$ | 1 | 1 | 0.0 | 0.0 |
| Integration time | 0.0 | R | $\sqrt{3}$ | 1 | 1 | 0.0 | 0.0 |
| RF ambient conditions – noise | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| RF ambient conditions–reflections | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.6 | 0.6 |
| Probe positioner mech. Restrictions | 0.8 | R | $\sqrt{3}$ | 1 | 1 | 0.5 | 0.5 |
| Probe positioning with respect to phantom shell | 6.7 | R | $\sqrt{3}$ | 1 | 1 | 3.9 | 3.9 |
| Post-processing | 2.0 | R | $\sqrt{3}$ | 1 | 1 | 1.2 | 1.2 |
| Test sample related | | | | | | | |
| Device holder Uncertainty | 6.3 | N | 1 | 1 | 1 | 6.3 | 6.3 |
| Test sample positioning | 2.8 | N | 1 | 1 | 1 | 2.8 | 2.8 |
| Power scaling | 4.5 | R | $\sqrt{3}$ | 1 | 1 | 2.6 | 2.6 |
| Drift of output power | 5.0 | R | $\sqrt{3}$ | 1 | 1 | 2.9 | 2.9 |
| Phantom and set-up | | | | | | | |
| Phantom uncertainty (shape and thickness tolerances) | 4.0 | R | $\sqrt{3}$ | 1 | 1 | 2.3 | 2.3 |
| Algorithm for correcting SAR for deviations in permittivity and conductivity | 1.9 | N | 1 | 1 | 0.84 | 1.1 | 0.9 |
| Liquid conductivity (meas.) | 2.5 | N | 1 | 0.64 | 0.43 | 1.6 | 1.1 |
| Liquid permittivity (meas.) | 2.5 | N | 1 | 0.6 | 0.49 | 1.5 | 1.2 |
| Temp. unc. - Conductivity | 1.7 | R | $\sqrt{3}$ | 0.78 | 0.71 | 0.8 | 0.7 |
| Temp. unc. - Permittivity | 0.3 | R | $\sqrt{3}$ | 0.23 | 0.26 | 0.0 | 0.0 |
| Combined standard uncertainty | | RSS | | | | 12.2 | 12.1 |
| Expanded uncertainty 95 % confidence interval) | | | | | | 24.5 | 24.2 |

APPENDIX B EUT TEST POSITION PHOTOS

Please Refer to the Attachment.

APPENDIX C PROBE CALIBRATION CERTIFICATES



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

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Client

BACL

Certificate No: Z20-60085

CALIBRATION CERTIFICATE

Object

EX3DV4 - SN : 7522

Calibration Procedure(s)

FF-Z11-004-01

Calibration Procedures for Dosimetric E-field Probes

Calibration date:

April 01, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|--------------------------|-------------|--|-----------------------|
| Power Meter NRP2 | 101919 | 18-Jun-19(CTTL, No.J19X05125) | Jun-20 |
| Power sensor NRP-Z91 | 101547 | 18-Jun-19(CTTL, No.J19X05125) | Jun-20 |
| Power sensor NRP-Z91 | 101548 | 18-Jun-19(CTTL, No.J19X05125) | Jun-20 |
| Reference 10dBAttenuator | 18N50W-10dB | 10-Feb-20(CTTL, No.J20X00525) | Feb-22 |
| Reference 20dBAttenuator | 18N50W-20dB | 10-Feb-20(CTTL, No.J20X00526) | Feb-22 |
| Reference Probe EX3DV4 | SN 7307 | 24-May-19(SPEAG, No.EX3-7307_May19/2) | May-20 |
| DAE4 | SN 1525 | 26-Aug-19(SPEAG, No.DAE4-1525_Aug19) | Aug-20 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| SignalGenerator MG3700A | 6201052605 | 18-Jun-19(CTTL, No.J19X05127) | Jun-20 |
| Network Analyzer E5071C | MY46110673 | 10-Feb-20(CTTL, No.J20X00515) | Feb-21 |

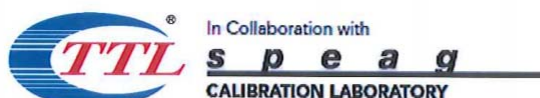
| | Name | Function | Signature |
|----------------|-------------|--------------------|-----------|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Lin Hao | SAR Test Engineer | |
| Approved by: | Qi Dianyuan | SAR Project Leader | |

Issued: April 03, 2020

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

Certificate No: Z20-60085

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Glossary:

| | |
|-----------------------|---|
| TSL | tissue simulating liquid |
| NORM _{x,y,z} | sensitivity in free space |
| ConvF | sensitivity in TSL / NORM _{x,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 $\theta=0$ 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:

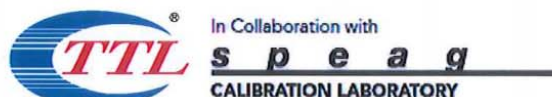
- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR)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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\theta=0$ ($f \leq 900\text{MHz}$ in TEM-cell; $f > 1800\text{MHz}$: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,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.
- DCP_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep (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.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}:** A,B,C 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 $f \leq 800\text{MHz}$) and inside waveguide using analytical field distributions based on power measurements for $f > 800\text{MHz}$. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,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 $\pm 50\text{MHz}$ to $\pm 100\text{MHz}$.
- 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 NORM_x (no uncertainty required).

Certificate No: Z20-60085

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7522

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--|----------|----------|----------|--------------|
| Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.43 | 0.44 | 0.51 | $\pm 10.0\%$ |
| DCP(mV) ^B | 99.1 | 99.3 | 102.4 | |

Modulation Calibration Parameters

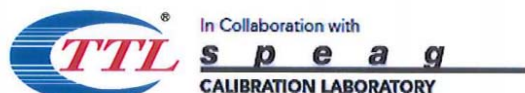
| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|------|---------------------------|-----|------|-------|------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 149.8 | $\pm 2.7\%$ |
| | | Y | 0.0 | 0.0 | 1.0 | | 153.0 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 174.8 | |

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 E²-field uncertainty inside TSL (see Page 4).

^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.



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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7522

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) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750 | 41.9 | 0.89 | 9.92 | 9.92 | 9.92 | 0.40 | 0.75 | ±12.1% |
| 900 | 41.5 | 0.97 | 9.40 | 9.40 | 9.40 | 0.13 | 1.95 | ±12.1% |
| 1750 | 40.1 | 1.37 | 8.21 | 8.21 | 8.21 | 0.22 | 1.08 | ±12.1% |
| 1900 | 40.0 | 1.40 | 7.95 | 7.95 | 7.95 | 0.21 | 1.22 | ±12.1% |
| 2300 | 39.5 | 1.67 | 7.53 | 7.53 | 7.53 | 0.44 | 0.81 | ±12.1% |
| 2450 | 39.2 | 1.80 | 7.15 | 7.15 | 7.15 | 0.48 | 0.79 | ±12.1% |
| 2600 | 39.0 | 1.96 | 7.04 | 7.04 | 7.04 | 0.59 | 0.72 | ±12.1% |
| 5200 | 36.0 | 4.66 | 5.20 | 5.20 | 5.20 | 0.45 | 1.75 | ±13.3% |
| 5300 | 35.9 | 4.76 | 4.96 | 4.96 | 4.96 | 0.45 | 1.75 | ±13.3% |
| 5600 | 35.5 | 5.07 | 4.55 | 4.55 | 4.55 | 0.45 | 1.60 | ±13.3% |
| 5800 | 35.3 | 5.27 | 4.65 | 4.65 | 4.65 | 0.45 | 1.65 | ±13.3% |

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

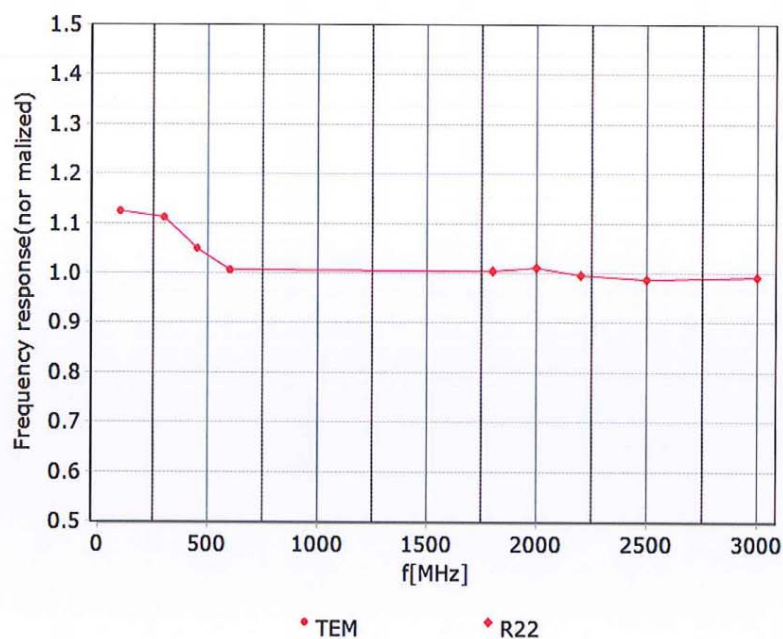
^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ ($k=2$)

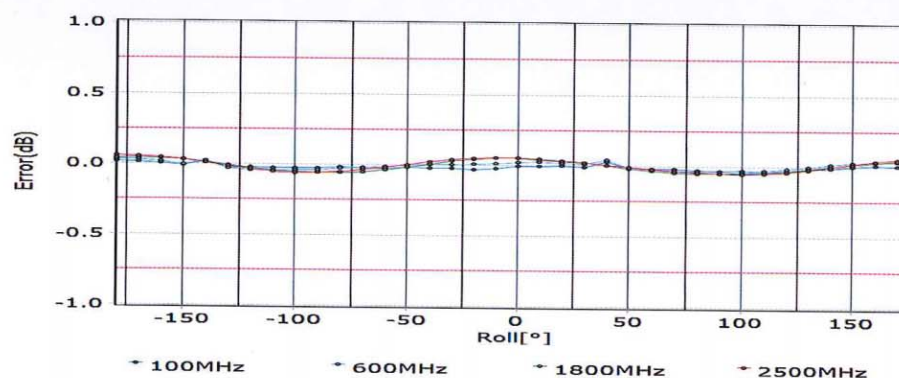
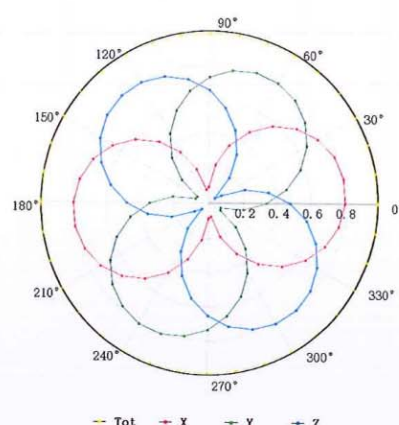
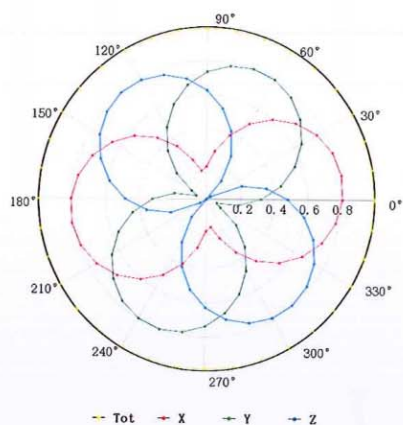


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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM

f=1800 MHz, R22

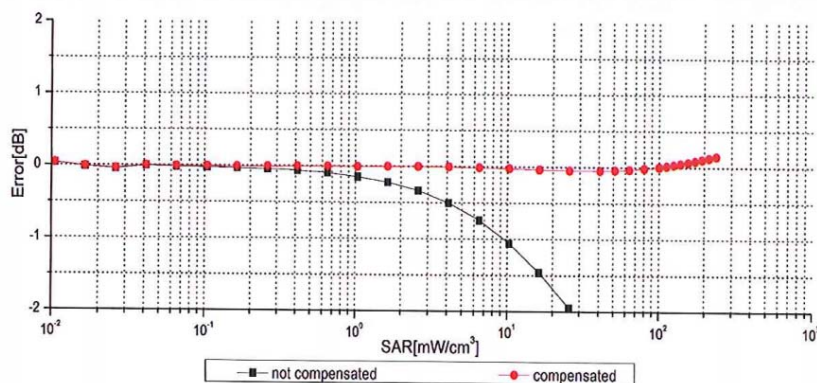
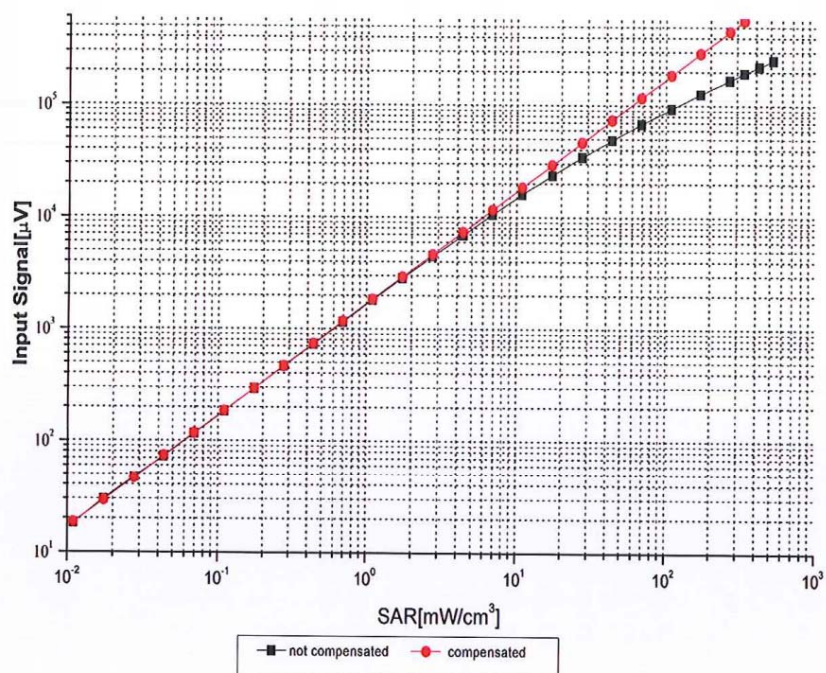


Uncertainty of Axial Isotropy Assessment: $\pm 1.2\%$ ($k=2$)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: $\pm 0.9\%$ ($k=2$)

Certificate No: Z20-60085

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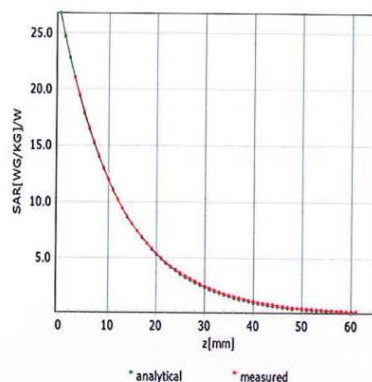
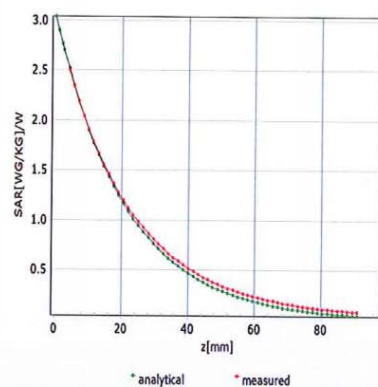


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E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

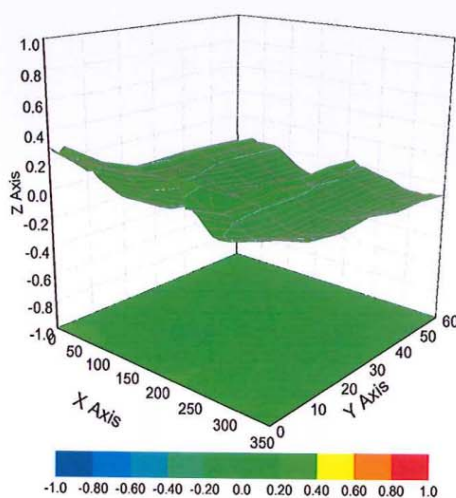
Conversion Factor Assessment

f=750 MHz,WGLS R9(H_convF)

f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 3.2\%$ (K=2)

Certificate No:Z20-60085

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E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY/EASY – Parameters of Probe: EX3DV4 – SN:7522

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 31.2 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disable |
| Probe Overall Length | 337mm |
| Probe Body Diameter | 10mm |
| Tip Length | 10mm |
| Tip Diameter | 2.5mm |
| Probe Tip to Sensor X Calibration Point | 1mm |
| Probe Tip to Sensor Y Calibration Point | 1mm |
| Probe Tip to Sensor Z Calibration Point | 1mm |
| Recommended Measurement Distance from Surface | 1.4mm |

APPENDIX D DIPOLE CALIBRATION CERTIFICATES

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



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

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

Accreditation No.: **SCS 0108**

Client **BACL USA**

Certificate No: **D1900V2-5d231_Jan20**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d231**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **January 14, 2020**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP | SN: 104778 | 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: 5058 (20k) | 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: 7349 | 31-Dec-19 (No. EX3-7349_Dec19) | Dec-20 |
| DAE4 | SN: 601 | 27-Dec-19 (No. DAE4-601_Dec19) | Dec-20 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------------|----------------|-----------------------------------|------------------------|
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Feb-19) | In house check: Oct-20 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-18) | In house check: Oct-20 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-19) | In house check: Oct-20 |

Calibrated by: **Name** **Function**
Claudio Leubler **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: January 15, 2020

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

Certificate No: D1900V2-5d231_Jan20

Page 1 of 6

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



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
C 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:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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 | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1900 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|---------------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 40.0 | 1.40 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 41.4 \pm 6 % | 1.39 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|---|--------------------|--|
| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 9.96 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 40.3 W/kg \pm 17.0 % (k=2) |

| | | |
|---|--------------------|--|
| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
| SAR measured | 250 mW input power | 5.19 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 20.9 W/kg \pm 16.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with Head TSL**

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.5 Ω + 4.3 j Ω |
| Return Loss | - 26.9 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.200 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: 14.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d231

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.39$ S/m; $\epsilon_r = 41.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.6, 8.6, 8.6) @ 1900 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 110.0 V/m; Power Drift = -0.01 dB

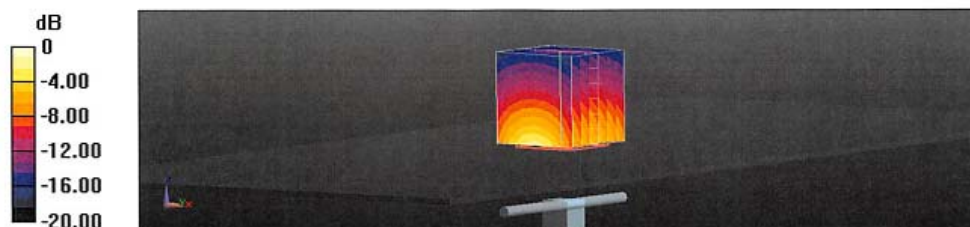
Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 9.96 W/kg; SAR(10 g) = 5.19 W/kg

Smallest distance from peaks to all points 3 dB below = 9.8 mm

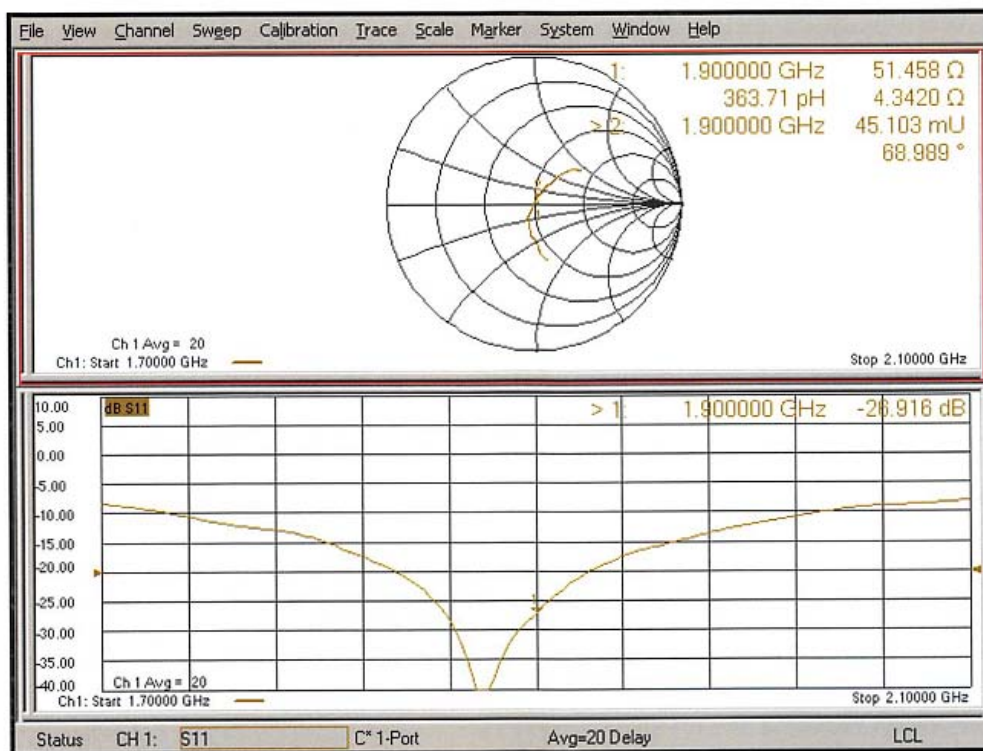
Ratio of SAR at M2 to SAR at M1 = 53.9%

Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

Impedance Measurement Plot for Head TSL



***** END OF REPORT *****