# TEST REPORT

| | | |
|---|---|---|
| **Report No. ....................................... :** | **CHTEW21120017** | Report verificaiton: |
| **Project No. ....................................... :** | **SHT2111022702EW** | |
| **FCC ID ............................................. :** | **2ARTX-HERO600** | |
| **Applicant's name ........................... :** | **LAVA International Limited** | |
| Address.............................................: | A-56, Sector 64, Noida 201301 | |
| **Test item description .................... :** | **Mobile phone** | |
| Trade Mark ......................................: | LAVA | |
| Model/Type reference........................: | HERO 600+ | |
| Listed Model(s) .................................: | - | |
| **Standard ......................................... :** | **FCC 47 CFR Part2.1093**<br>**IEEE Std C95.1, 1999 Edition**<br>**IEEE 1528: 2013** | |
| Date of receipt of test sample……….: | Nov.18, 2021 | |
| Date of testing………………………...: | Nov.18, 2021- Nov.29, 2021 | |
| Date of issue…………………………: | Nov.30, 2021 | |
| **Result.................. ……………………..:** | **PASS** | |

| | | |
|---|---|---|
| Compiled by<br>( position+printed name+signature)..: | File administrators Fanghui Zhu | Fanghui Zhu |
| Supervised by<br>( position+printed name+signature)..: | Project Engineer Patrick Qiu | Patrick . Qiu |
| Approved by<br>( position+printedname+signature)...: | Manager: Hans Hu | Hans Hu |

| | |
|---|---|
| **Testing Laboratory Name ............. :** | **Shenzhen Huatongwei International Inspection Co., Ltd** |
| Address.............................................: | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China |

# Contents

# 1 . Statement of Compliance

| Maximum Reported SAR (W/kg @1g) | |
|---|---|
| RF Exposure Conditions | PCE |
| Head | 0.330 |
| Body-worn(Dist.= 15mm) | 0.343 |

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

# 2 . Test Standards and Report version

## 2.1. Test Standards

The tests were performed according to following standards:

FCC 47 Part 2.1093: Radiofrequency radiation exposure evaluation: portable devices.
IEEE Std C95.1, 1999 Edition: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

FCC published RF exposure KDB procedures:
865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz
865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations
447498 D01 General RF Exposure Guidance v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
248227 D01 802 11 Wi-Fi SAR v02r02: SAR Measurement Proceduresfor802.11 a/b/g Transmitters
648474 D04 Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets
941225 D01 3G SAR Procedures v03r01: SAR Measurement Procedures for 3G Devices
941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices
941225 D06 Hotspot Mode v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

TCB workshop April, 2019; Page 19, Tissue Simulating Liquids (TSL)

## 2.2. Report version

| Revision No. | Date of issue | Description |
|---|---|---|
| N/A | 2021-11-30 | Original |
| | | |
| | | |
| | | |
| | | |

# 3. Summary

## 3.1. Client Information

| | |
|---|---|
| Applicant: | LAVA International Limited |
| Address: | A-56, Sector 64, Noida 201301 |
| Manufacturer: | LAVA INTERNATIONAL LTD |
| Address: | A-154 D, Sector-63, Noida, Gautam Buddha Nagar, Uttar Pradesh, 201301 |
| Factory: | LAVA INTERNATIONAL LTD |
| Address: | A-154 D, Sector-63, Noida, Gautam Buddha Nagar, Uttar Pradesh, 201301 |

## 3.2. Product Description

| **Main unit** | |
|---|---|
| Name of EUT: | Mobile phone |
| Trade Mark: | LAVA |
| Model No.: | HERO 600+ |
| Listed Model(s): | - |
| Power supply: | DC3.8V |
| Device Category: | Portable |
| Product stage: | Production unit |
| RF Exposure Environment: | General Population/Uncontrolled |
| HTW test sample No.: | YPHT21110227001 |
| Hardware version: | IL1801 PCB_V2.2 4 |
| Software version: | Bmobile_Hero600P |
| Device Dimension: | Overall (Length x Width x Thickness): 110X45X15mm |

## 3.3. RF Specification Description

| **GSM** | |
|---|---|
| Operation Band: | GSM850<br>PCS1900 |
| Support Network: | GSM |
| Operating Mode: | GSM:GMSK |
| Device Class: | B |
| Antenna Type: | GSM |
| Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No | |

| **Bluetooth** | |
|---|---|
| Bluetooth version: | V3.0 |
| Support function: | EDR |
| Operating Mode: | GFSK<br>π/4DQPSK<br>8DPSK |
| Antenna Type: | Monopole Wireway Antenna |
| Does this device support Bluetooth Tethering? ☒ Yes ☐ No | |
| *Remark:*<br>*1. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power.*<br>*2. The Test EUT support two SIM card(SIM1,SIM2),so all the tests are performed at each SIM card (SIM1,SIM2) mode, the datum recorded is the worst case for all the mode at SIM1 Card mode.* | |

## 3.4. Testing Laboratory Information

| Laboratory Name | Shenzhen Huatongwei International Inspection Co., Ltd. | |
|---|---|---|
| Laboratory Location | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China | |
| Connect information: | Tel: 86-755-26715499<br>E-mail: cs@szhtw.com.cn<br>http://www.szhtw.com.cn | |
| Qualifications | Type | Accreditation Number |
| | FCC | 762235 |

## 3.5. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

| | |
|---|---|
| Ambient temperature | 18 °C to 25 °C |
| Ambient humidity | 30%RH to 70%RH |
| Air Pressure | 950-1050mbar |

## 4. Equipments Used during the Test

| Used | Test Equipment | Manufacturer | Model No. | Serial No. | Cal. date (YY-MM-DD) | Due date (YY-MM-DD) |
|---|---|---|---|---|---|---|
| ● | Data Acquisition Electronics DAEx | SPEAG | DAE4 | 1549 | 2021/03/23 | 2022/03/22 |
| ● | E-field Probe | SPEAG | EX3DV4 | 7494 | 2021/04/09 | 2022/04/08 |
| ● | Universal Radio Communication Tester | R&S | CMW500 | 137681 | 2021/05/27 | 2022/05/26 |
| ● Tissue-equivalent liquids Validation | | | | | | |
| ● | Dielectric Assessment Kit | SPEAG | DAK-3.5 | 1267 | N/A | N/A |
| ○ | Dielectric Assessment Kit | SPEAG | DAK-12 | 1130 | N/A | N/A |
| ● | Network analyzer | Keysight | E5071C | MY46733048 | 2021/09/17 | 2022/09/16 |
| ● System Validation | | | | | | |
| ○ | System Validation Antenna | SPEAG | CLA-150 | 4024 | 2021/01/25 | 2024/01/24 |
| ○ | System Validation Dipole | SPEAG | D450V3 | 1102 | 2021/01/20 | 2024/01/19 |
| ○ | System Validation Dipole | SPEAG | D750V3 | 1180 | 2021/01/22 | 2024/01/21 |
| ● | System Validation Dipole | SPEAG | D835V2 | 4d238 | 2021/01/22 | 2024/01/21 |
| ○ | System Validation Dipole | SPEAG | D1750V2 | 1164 | 2021/01/22 | 2024/01/21 |
| ● | System Validation Dipole | SPEAG | D1900V2 | 5d226 | 2021/01/22 | 2024/01/21 |
| ○ | System Validation Dipole | SPEAG | D2450V2 | 1009 | 2021/01/25 | 2024/01/24 |
| ○ | System Validation Dipole | SPEAG | D2600V2 | 1150 | 2021/01/25 | 2024/01/24 |
| ○ | System Validation Dipole | SPEAG | D5GHzV2 | 1273 | 2021/01/26 | 2024/01/25 |
| ● | Signal Generator | R&S | SMB100A | 114360 | 2021/08/05 | 2022/08/04 |
| ● | Power Viewer for Windows | R&S | N/A | N/A | N/A | N/A |
| ● | Power sensor | R&S | NRP18A | 101010 | 2021/08/05 | 2022/08/04 |
| ● | Power sensor | R&S | NRP18A | 101386 | 2021/05/27 | 2022/05/26 |
| ● | Power Amplifier | BONN | BLWA 0160-2M | 1811887 | 2021/11/11 | 2022/11/10 |
| ● | Dual Directional Coupler | Mini-Circuits | ZHDC-10-62-S+ | F975001814 | 2021/11/11 | 2022/11/10 |
| ● | Attenuator | Mini-Circuits | VAT-3W2+ | 1819 | 2021/11/11 | 2022/11/10 |
| ● | Attenuator | Mini-Circuits | VAT-10W2+ | 1741 | 2021/11/11 | 2022/11/10 |

*Note:*

1. *The Probe,Dipole and DAE calibration reference to the Appendix E and F.*
2. *Referring to KDB865664 D01, the dipole calibration interval can be extended to 3 years with justifcatio. The dipole are also not physically damaged or repaired during the interval.*

## 5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ⩽ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.

# 6. SAR Measurements System Configuration

## 6.1. SAR Measurement Set-up

The DASY5 system for performing compliance tests consists of the following items:

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

A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

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.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY5 software and SEMCAD data evaluation software.

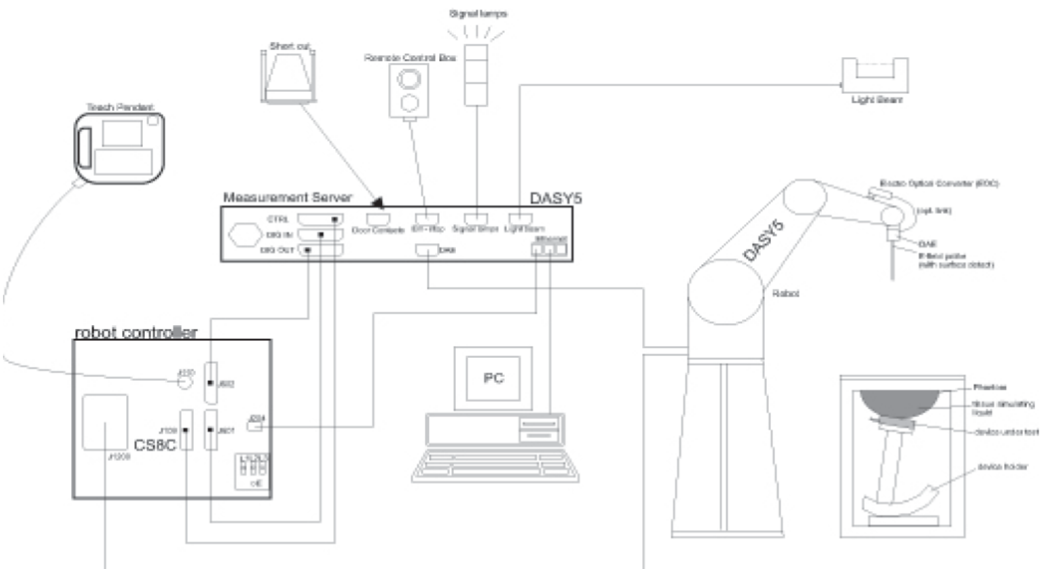
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld Mobile Phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



## 6.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

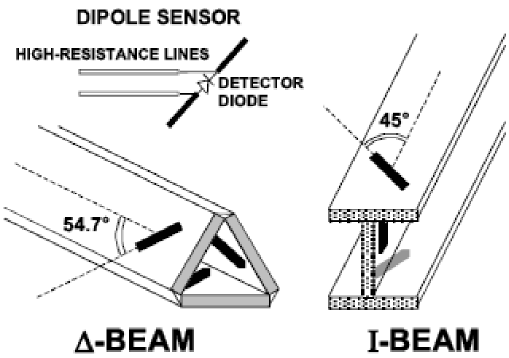
- **Probe Specification**

| | |
|---|---|
| Construction | Symmetrical design with triangular core<br>Interleaved sensors<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Calibration | ISO/IEC 17025 calibration service available. |
| Frequency | 4 MHz to 10 GHz;<br>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 to probe axis) |
| Dynamic Range | 10 µW/g to > 100 W/kg;<br>Linearity: ± 0.2 dB |
| Dimensions | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 1.0 mm |
| Application | General dosimetry up to 6 GHz<br>Dosimetry in strong gradient fields<br>Compliance tests of Mobile Phones |
| Compatibility | DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI |

- **Isotropic E-Field Probe**

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



## 6.3. Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM-Twin Phantom

## 6.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

# 7. SAR Test Procedure

## 7.1. Scanning Procedure

**Step 1: Power Reference Measurement**

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. Measure the local SAR at a test point within 8 mm of the phantom inner surface that is closest to the DUT. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

**Step 2: Area Scan**

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

**Area Scan Resolutions per FCC KDB Publication 865664 D01v04**

| | ≤ 3 GHz | > 3 GHz |
|---|---|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 mm ± 1 mm | $\frac{1}{2}\cdot\delta\cdot\ln(2)$ mm ± 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | 30° ± 1° | 20° ± 1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm |
| | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | |

**Step 3: Zoom Scan**

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1g and 10g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

**Zoom Scan Resolutions per FCC KDB Publication 865664 D01v04**

<table>
<tr><td colspan="3">Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$</td><td>≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*<br>4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm<br>4 – 5 GHz: ≤ 3 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.<br>* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

**Step 4: Power drift measurement**

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1. The SAR drift shall be kept within ± 5 %.

## 7.2. Data Storage and Evaluation

### Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors),s together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [W/kg], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### Data Evaluation

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

| | | |
|---|---|---|
| Probe parameters: | Sensitivity: | Normi, ai0, ai1, ai2 |
| | Conversion factor: | ConvFi |
| | Diode compression point: | Dcpi |
| Device parameters: | Frequency: | f |
| | Crest factor: | cf |
| Media parameters: | Conductivity: | σ |
| | Density: | ρ |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

Vi: compensated signal of channel ( i = x, y, z )
Ui: input signal of channel ( i = x, y, z )
cf: crest factor of exciting field (DASY parameter)
dcpi: diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E} - \text{fieldprobes :} \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes :} \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

Vi: compensated signal of channel ( i = x, y, z )
Normi: sensor sensitivity of channel ( i = x, y, z ), [mV/(V/m)2] for E-field Probes
ConvF: sensitivity enhancement in solution
aij: sensor sensitivity factors for H-field probes
f: carrier frequency [GHz]
Ei: electric field strength of channel i in V/m
Hi: magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

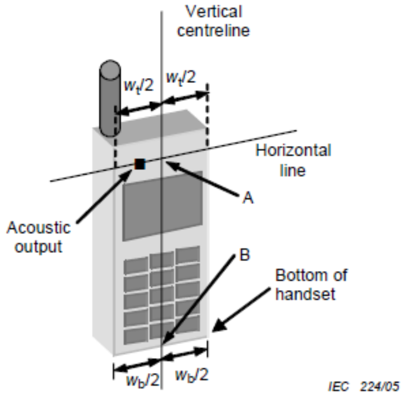
SAR: local specific absorption rate in W/kg
Etot: total field strength in V/m
σ: conductivity in [mho/m] or [Siemens/m]
ρ: equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

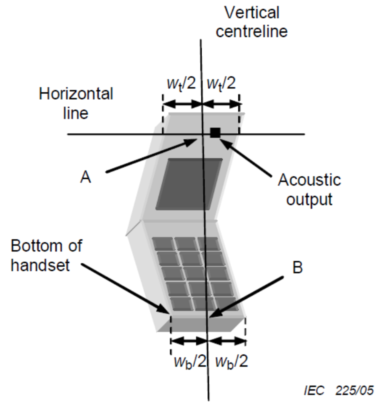
# 8. Position of the wireless device in relation to the phantom

## 8.1. Head Position

The wireless device define two imaginary lines on the handset, the vertical centreline and the horizontal line, for the handset in vertical orientation as shown in Figures 5a and 5b.
**The vertical centreline** passes through two points on the front side of the handset: the midpoint of the width $W_t$ of the handset at the level of the acoustic output (point A in Figures 5a and 5b), and the midpoint of the width $W_b$ of the bottom of the handset (point B).
**The horizontal line** is perpendicular to the vertical centreline and passes through the centre of the acoustic output (see Figures 5a and 5b). The two lines intersect at point A.
Note that for many handsets, point A coincides with the centre of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centreline is not necessarily parallel to the front face of the handset (see Figure 5b), especially for clam-shell handsets, handsets with flip cover pieces, and other irregularly shaped handsets.



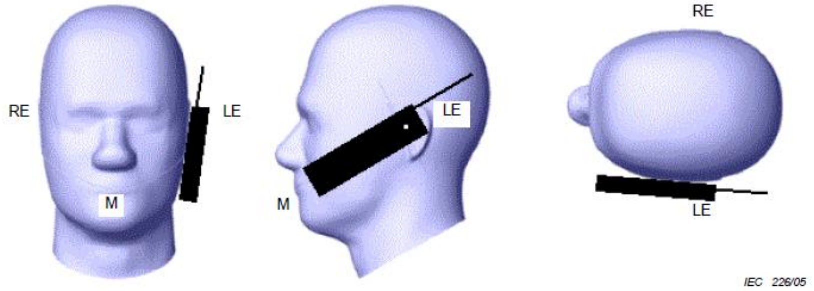

Figures 5a




Figures 5b

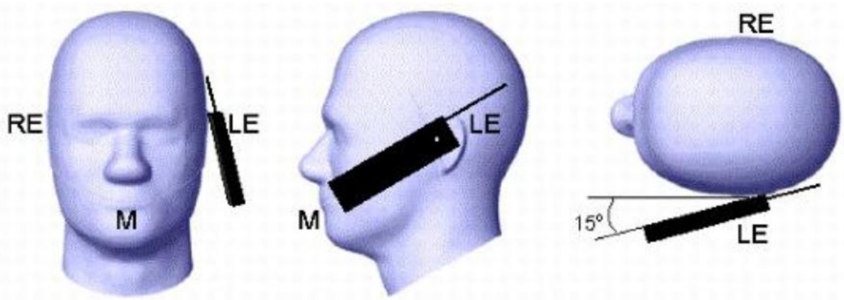
| | |
|---|---|
| $W_t$ | Width of the handset at the level of the acoustic |
| $W_b$ | Width of the bottom of the handset |
| A | Midpoint of the widthwt of the handset at the level of the acoustic output |
| B | Midpoint of the width wb of the bottom of the handset |

**Cheek position**




Picture 2 Cheek position of the wireless device on the left side of SAM

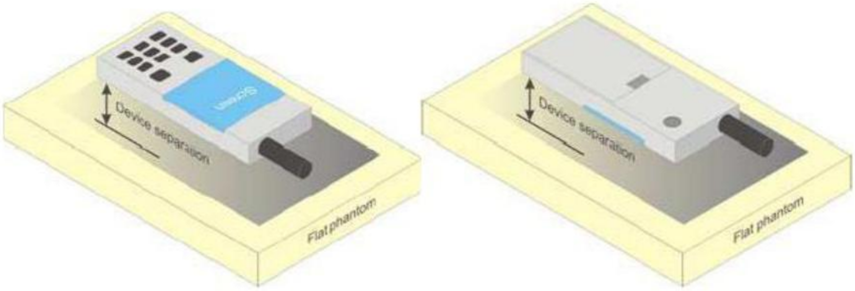
**Tilt position**




Picture 3 Tilt position of the wireless device on the left side of SAM

## 8.2. Body Position

Devices that support transmission while used with body-worn accessories must be tested for body-worn accessory SAR compliance, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics.
Devices that are designed to operate on the body of users using lanyards and straps or without requiring additional body-worn accessories must be tested for SAR compliance using a conservative minimum test separation distance ≤ 5mm to support compliance.




Picture 4 Test positions for body-worn devices

# 9. Dielectric Property Measurements & System Check

## 9.1. Tissue Dielectric Parameters

The temperature of the tissue-equivalent medium used during measurement must also be within 18℃ to 25℃ and within ± 2℃ of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3-4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

The dielectric constant ($\varepsilon_r$) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for $\varepsilon_r$ and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

**Tissue Dielectric Parameters**

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

| Tissue dielectric parameters for Head and Body | | | | |
|---|---|---|---|---|
| Target Frequency (MHz) | Head | | Body | |
| | $\varepsilon_r$ | σ(S/m) | $\varepsilon_r$ | σ(S/m) |
| 835 | 41.5 | 0.90 | 55.2 | 0.97 |
| 1800-2000 | 40.0 | 1.40 | 53.3 | 1.52 |

**IEEE Std 1528-2013**

Refer to Table 3 within the IEEE Std 1528-2013

**Dielectric Property Measurements Results:**

| **Dielectric performance of Head tissue simulating liquid** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | $\varepsilon_r$ | | σ(S/m) | | Delta ($\varepsilon_r$) | Delta (σ) | Limit | Temp (℃) | Date |
| | Target | Measured | Target | Measured | | | | | |
| 835 | 41.50 | 42.26 | 0.900 | 0.940 | 1.83% | 4.44% | ±5% | 22.0 | 2021/11/26 |
| 1900 | 40.00 | 40.74 | 1.400 | 1.464 | 1.85% | 4.57% | ±5% | 22.0 | 2021/11/26 |

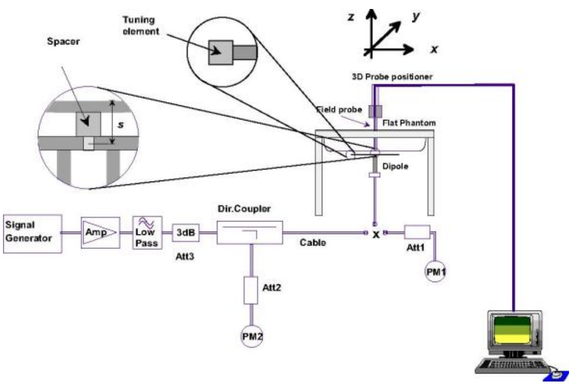
## 9.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

**System Performance Check Measurement Conditions:**

- 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 for SAR measurements ≤ 3 GHz

  and ≥10.0 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) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm 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.
- The results are normalized to 1 W input power.




System Performance Check Setup

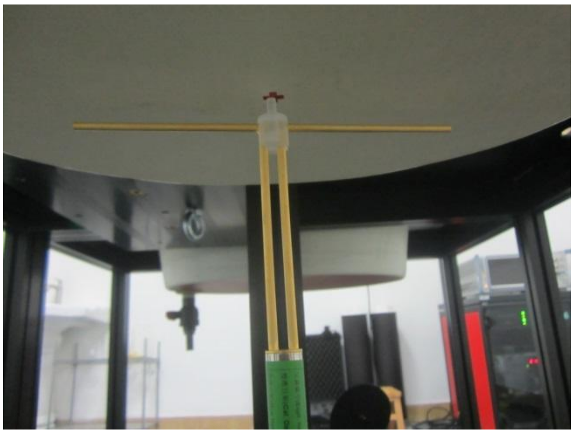


Photo of Dipole Setup

**System Check Result:**
The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within ±10% of the manufacturer calibrated dipole SAR target.

| Head | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | 1g SAR | | | 10g SAR | | | Delta (1g) | Delta (10g) | Limit | Temp (℃) | Date |
| | Target 1W | Normalize to 1W | Measured 250mW | Target 1W | Normalize to 1W | Measured 250mW | | | | | |
| 835 | 9.39 | 9.76 | 2.44 | 6.14 | 6.40 | 1.60 | 3.94% | 4.23% | ±10% | 22.4 | 2021/11/26 |
| 1900 | 39.80 | 40.00 | 10.00 | 20.30 | 21.04 | 5.26 | 0.50% | 3.65% | ±10% | 22.4 | 2021/11/26 |

## Plots of System Performance Check

### System Performance Check-Head 835MHz

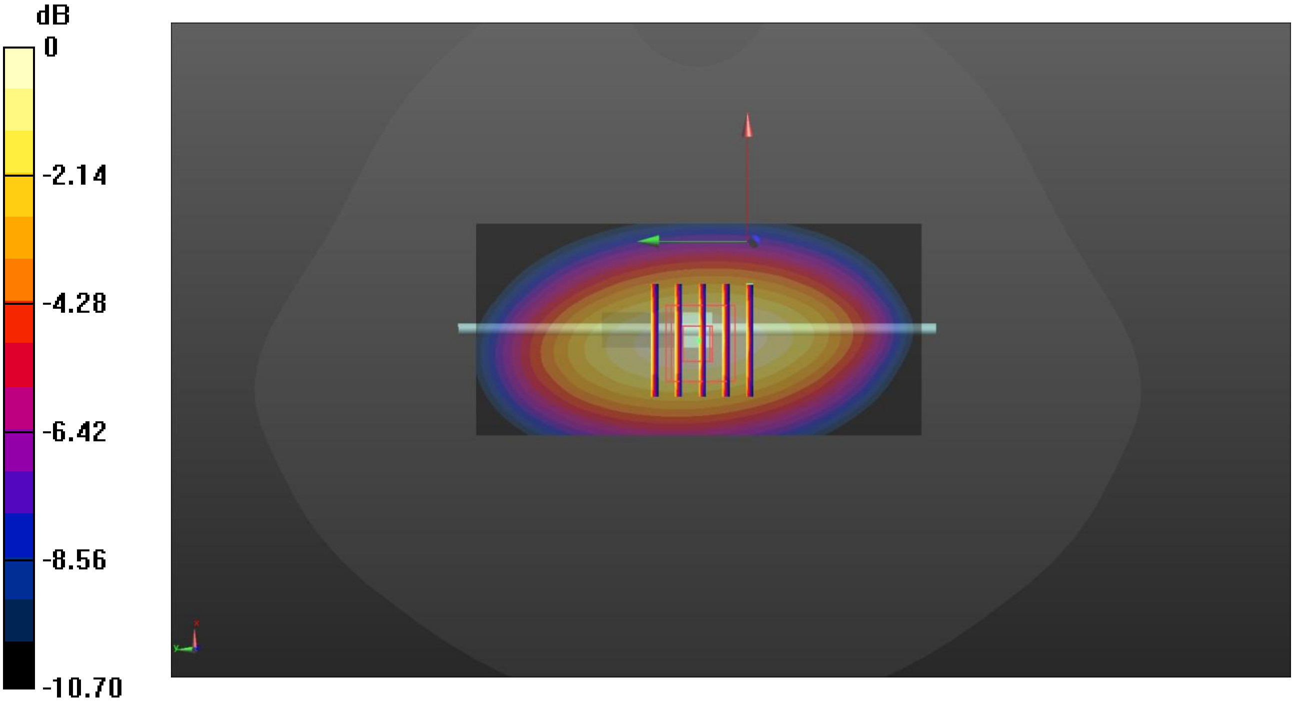
DUT: D835V2; Type: D835V2; Serial: 4d238
Date: 2021-11-26
Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; $\sigma$ = 0.949 S/m; $\varepsilon_r$ = 42.456; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Ambient Temperature:22.4℃;Liquid Temperature:22.2℃;

**DASY Configuration:**

- Probe: EX3DV4 - SN7494; ConvF(10.41, 10.41, 10.41) @ 835 MHz; Calibrated: 4/9/2021
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/23/2021
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Head/d=15mm, Pin=250mW/Area Scan (41x101x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.84 W/kg

**Head/d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 54.22 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.63 W/kg
**SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.6 W/kg**
Maximum value of SAR (measured) = 2.85 W/kg




0 dB = 2.85 W/kg = 4.55 dBW/kg

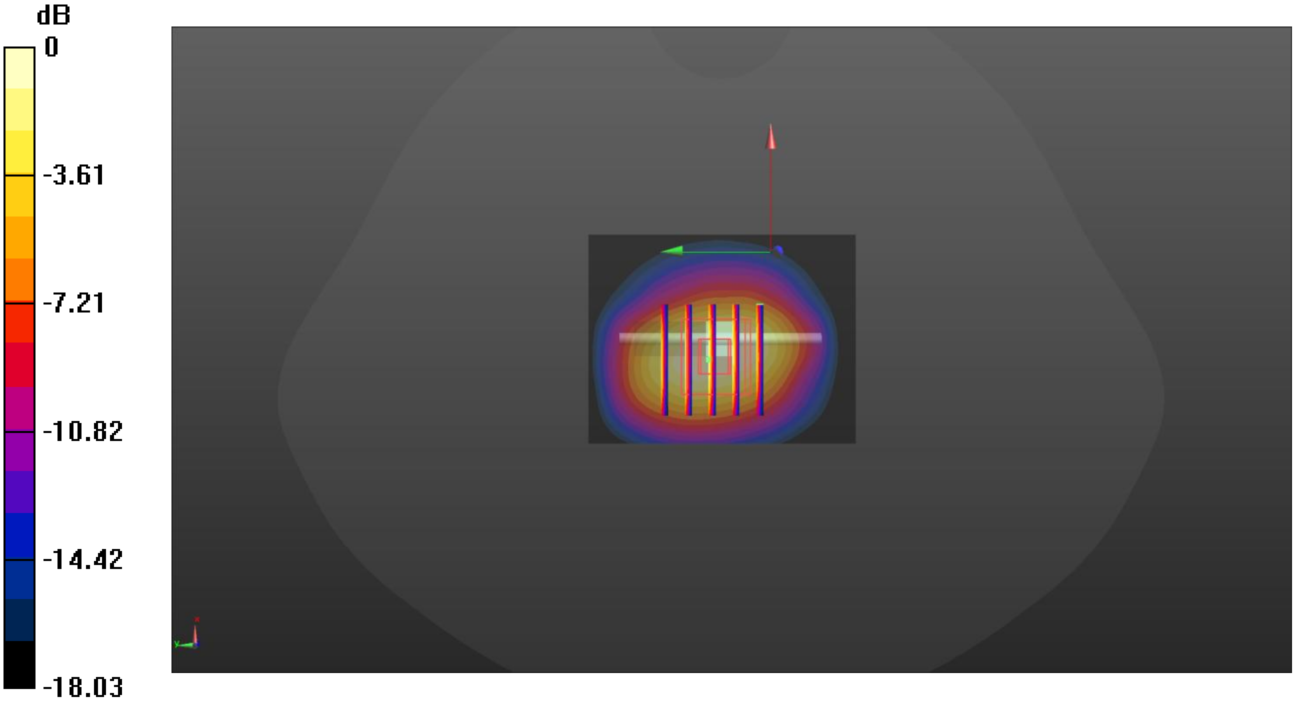
**System Performance Check-Head 1900MHz**

DUT: D1900V2; Type: D1900V2; Serial: 5d226
Date: 2021-11-26
Communication System: UID 0, CW (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.464 S/m; $\varepsilon_r$ = 40.735; ρ = 1000 kg/$m^3$
Phantom section: Flat Section
Ambient Temperature:22.4℃;Liquid Temperature:22.2℃;

**DASY Configuration:**

- Probe: EX3DV4 - SN7494; ConvF(8.55, 8.55, 8.55) @ 1900 MHz; Calibrated: 4/9/2021
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/23/2021
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Head/d=10mm,Pin=250mW/Area Scan (41x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.2 W/kg
**Head/d=10mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 90.40V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 18.1 W/kg
**SAR(1 g) = 10 W/kg; SAR(10 g) = 5.26 W/kg**
Maximum value of SAR (measured) = 12.5 W/kg




0 dB = 12.5 W/kg = 10.97 dBW/kg

# 10. SAR Exposure Limits

SAR assessments have been made in line with the requirements of FCC 47 CFR § 2.1093.

| Type Exposure | Limit (W/kg) | |
|---|---|---|
| | General Population/ Uncontrolled Exposure Environment | Occupational/ Controlled Exposure Environment |
| Spatial Average SAR (whole body) | 0.08 | 0.4 |
| Spatial Peak SAR (1g cube tissue for head and trunk) | 1.6 | 8.0 |
| Spatial Peak SAR (10g for limb) | 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).

# 11. Conducted Power Measurement Results and Tune-up

## 11.1. GSM

1. *Per KDB 447498 D01, the maximum output power channel is used for SAR testing and further SAR test reduction.*
2. *Per KDB 941225 D01, considering the possibility of e.g. 3rd party VoIP operation for Head and Body-worn SAR test reduction for GSM and GPRS modes is determined by the source-base time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.*
3. *Per KDB941225 D01, for hotspot SAR test reduction for GPRS modes is determined by the source-based time-averaged output power including tune-up tolerance, For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.*

Please refer to appendix A

Note:
1) Division Factors
To Frame-Average Power, the division factor is as follows:
1TX-slot = 1 transmit time slot out of 8 time slots=> Burst Average Power divided by (8/1) => -9.03dB
2TX-slots = 2 transmit time slots out of 8 time slots=> Burst Average Power divided by (8/2) => -6.02dB
3TX-slots = 3 transmit time slots out of 8 time slots=> Burst Average Power divided by (8/3) => -4.26dB
4TX-slots = 4 transmit time slots out of 8 time slots=> Burst Average Power divided by (8/4) => -3.01dB

## 11.2. Bluetooth

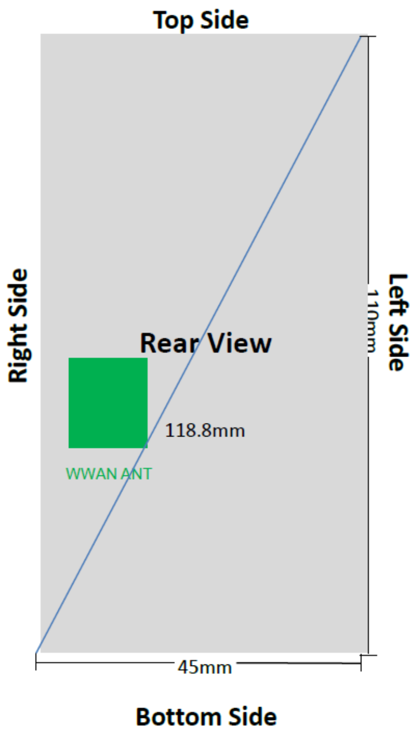
Please refer to appendix A

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≦50mm 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

| Band/Mode | F(GHz) | Position | Separation Distance (mm) | Exclusion Thresholds | SAR test exclusion |
|---|---|---|---|---|---|
| Bluetooth | 2.45 | Head | 0 | 1.1 | YES |
| | | Body | 15 | 0.4 | YES |

Per KDB 447498 D01, when the minimum test separation distance is <5mm, a distance of 5mm is applied to determine SAR test exclusion.
The test exclusion thereshold is ≦3, SAR testing is not required.

# 12. Antenna Location




# 13. Measured and Reported SAR Results

**SAR Test Reduction criteria are as follows:**

- Reported SAR(W/kg) for WWAN = Measured SAR *Tune-up Scaling Factor
- Reported SAR(W/kg) for Wi-Fi and Bluetooth = Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor
- Duty Cycle scaling factor = 1 / Duty cycle (%)

**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

**KDB 648474 D04 Handset SAR:**

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset. Additional 1-g SAR testing at 5 mm is not required when hotspot mode 10-g extremity SAR is not required for the surfaces and edges; since all 1-g reported SAR < 1.2 W/kg.

**KDB 941225 D01 SAR test for 3G SAR Test Reduction Procedure:**

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

**GSM Guidance**

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output

power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Please refer to section 9. for GSM power verification.
SAR is not required for EDGE (8PSK) mode because the maximum output power and tune-up limit is ≤ 1/4dB higher than GPRS/EDGE (GMSK) or the adjusted SAR of the highest reported SAR of GPRS/EDGE (GMSK) is ≤ 1.2W/kg.

## 13.1. Head SAR

Please refer to appendix B

## 13.2. Body SAR

Please refer to appendix B

# 14. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. 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 <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), 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 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

| Band | Test Position | Frequency | | Highest Measured SAR (W/kg) | First Repeated | | Second Repeated | |
|---|---|---|---|---|---|---|---|---|
| | | CH | MHz | | Measured SAR(W/kg) | Largest to Smallest SAR Ratio | Measured SAR(W/kg) | Largest to Smallest SAR Ratio |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

# 15. Simultaneous Transmission analysis

| No. | Simultaneous Transmission Configurations | Head | Body-worn | Hotspot | Note |
|---|---|---|---|---|---|
| 1 | GSM(voice) + Bluetooth (data) | Yes | Yes | | |

General note:

1. Bluetooth share the same antenna, and cannot transmit simultaneously.
2. EUT will choose either GSM according to the network signal condition; therefore, they will not operate simultaneously at any moment.
3. The reported SAR summation is calculated based on the same configuration and test position
4. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 based on the formula below
   a) [(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)/x]W/kg for test separation distances ≦50mm; whetn x=7.5 for 1-g SAR, and x=18.75 for 10-g SAR.
   b) When the minimum separation distance is <5mm, the distance is used 5mm to determine SAR test exclusion
   c) 0.4 W/kg for 1-g SAR and 1.0W/kg for 10-g SAR, when the test separation distances is >50mm.

| Bluetooth Max power | Exposure position | Head | Body-worn |
|---|---|---|---|
| | Test separation | 0mm | 15mm |
| 5.50dBm | Estimated SAR (W/kg) | 0.148 | 0.049 |

## 15.1. Head

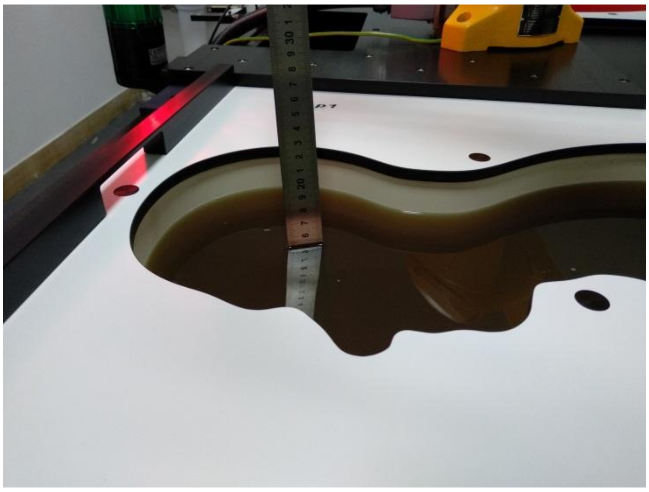
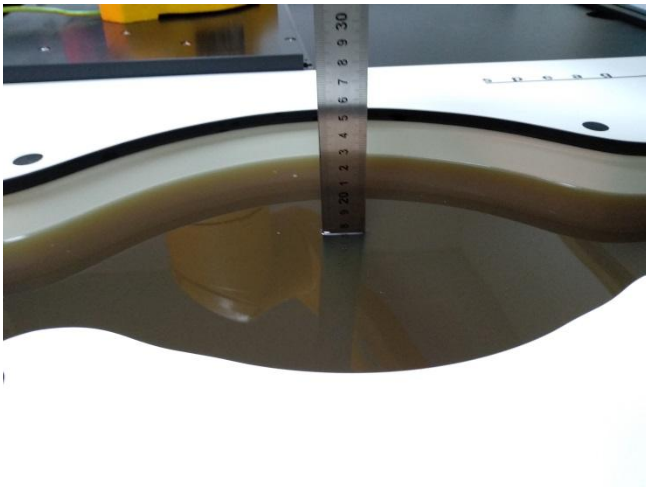
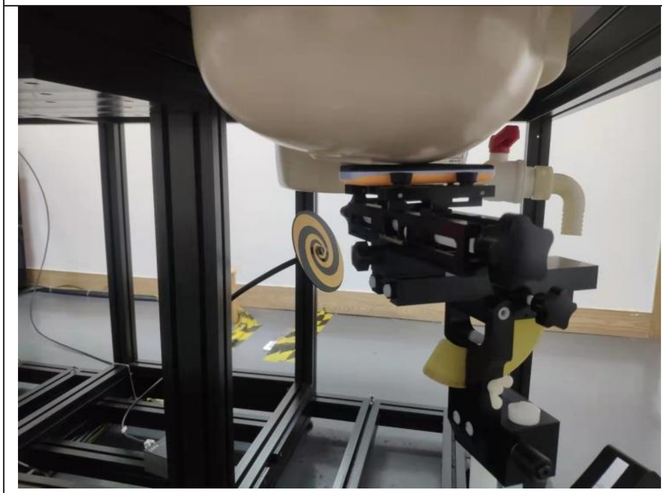
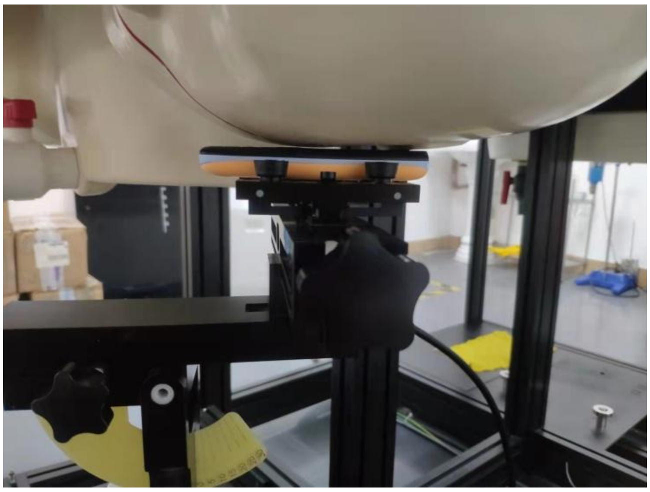
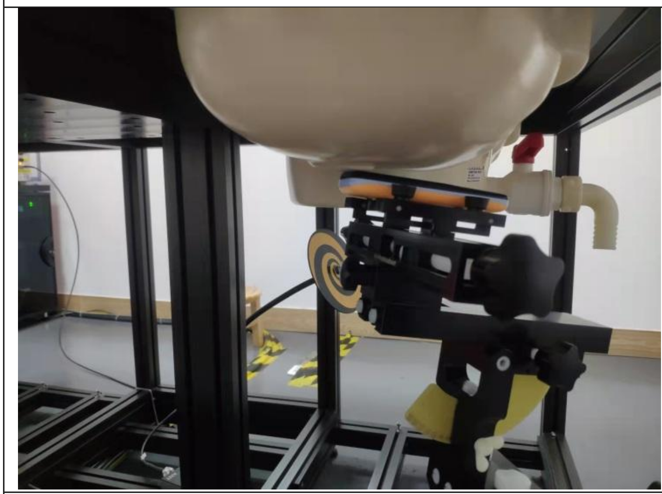
Please refer to appendix C

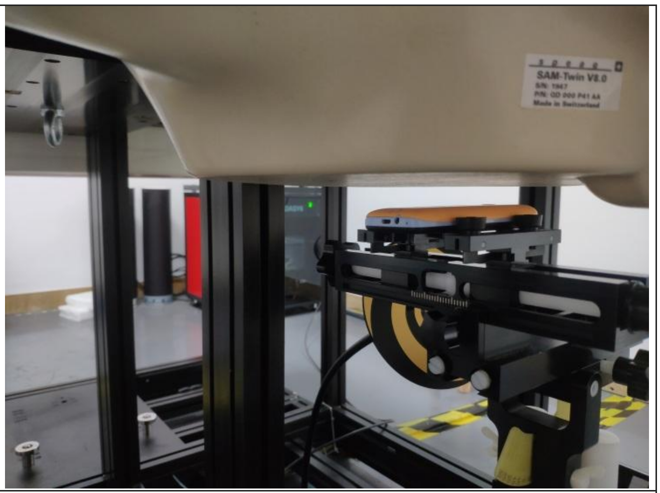
## 15.2. Body-worn

Please refer to appendix C

SAR Test Data Plots to the Appendix D.

# 16. TestSetup Photos

| | |
|---|---|
|  |  |
| Liquid depth in the Head phantom | Liquid depth in the Body phantom |
|  |  |
| Left Head Touch | Right Head Touch |
|  |  |
| Left Head Tilt ($15^o$) | Right Head Tilt ($15^o$) |

| | |
|---|---|
|  |  |
| Front (15mm) | Rear (15mm) |

## 17. <u>External and Internal Photos of the EUT</u>

Please reference to the report No.: CHTEW21110221

***---------End of Report----------***

**Appendix A:Conducted Power Measurement Results-GSM**

| GSM850 | Burst Average Power (dBm) | | | Tune-up limit (dBm) | Division Factors | Frame-Average Power (dBm) | | | Tune-up limit (dBm) |
|---|---|---|---|---|---|---|---|---|---|
| | CH128 | CH190 | CH251 | | | CH128 | CH190 | CH251 | |
| | 824.2MHz | 836.6MHz | 848.8MHz | | | 824.2MHz | 836.6MHz | 848.8MHz | |
| GSM | 31.69 | 31.64 | 31.29 | 32.00 | -9.03 | 22.66 | 22.61 | 22.26 | 22.97 |

| GSM1900 | Burst Average Power (dBm) | | | Tune-up limit (dBm) | Division Factors | Frame-Average Power (dBm) | | | Tune-up limit (dBm) |
|---|---|---|---|---|---|---|---|---|---|
| | CH512 | CH661 | CH810 | | | CH512 | CH661 | CH810 | |
| | 1850.2MHz | 1880MHz | 1909.8MHz | | | 1850.2MHz | 1880.0MHz | 1909.8MHz | |
| GSM | 28.71 | 28.68 | 28.46 | 29.00 | -9.03 | 19.68 | 19.65 | 19.43 | 19.97 |

| Bluetooth | | | | | | |
|---|---|---|---|---|---|---|
| Mode | | Channel | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) | Tune-up limit (dBm) |
| EDR | GFSK | 0 | 2402 | 5.03 | 4.98 | 5.00 |
| | | 39 | 2441 | 4.05 | 4.02 | 4.50 |
| | | 78 | 2480 | 3.07 | 3.04 | 3.50 |
| | π/4QPSK | 0 | 2402 | 5.02 | 4..99 | 5.00 |
| | | 39 | 2441 | 3.85 | 3.79 | 4.00 |
| | | 78 | 2480 | 2.55 | 2.50 | 2.50 |
| | 8DPSK | 0 | 2402 | 5.33 | 5.31 | 5.50 |
| | | 39 | 2441 | 4.20 | 4.16 | 4.50 |
| | | 78 | 2480 | 2.86 | 2.87 | 3.00 |

## Appendix B:SAR Measurement Results-Head

| GSM850 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mode | Test Position | Frequency | | Conducted Power (dBm) | Tune-up limit (dBm) | Tune-up scaling factor | Power Drift(dB) | Measured SAR(1g) | Report SAR(1g) | Plot No. |
| | | CH | MHz | | | | | (W/kg) | (W/kg) | |
| GSM Voice | Left-Cheek | 128 | 824.2 | 31.69 | 32.00 | 1.074 | -0.10 | 0.307 | 0.330 | 1 |
| | | 190 | 836.6 | 31.64 | 32.00 | 1.086 | - | - | - | - |
| | | 251 | 848.8 | 31.29 | 32.00 | 1.178 | - | - | - | - |
| | Left-Tilt | 128 | 824.2 | 31.69 | 32.00 | 1.074 | 0.06 | 0.288 | 0.309 | - |
| | | 190 | 836.6 | 31.64 | 32.00 | 1.086 | - | - | - | - |
| | | 251 | 848.8 | 31.29 | 32.00 | 1.178 | - | - | - | - |
| | Right-Cheek | 128 | 824.2 | 31.69 | 32.00 | 1.074 | -0.04 | 0.295 | 0.317 | - |
| | | 190 | 836.6 | 31.64 | 32.00 | 1.086 | - | - | - | - |
| | | 251 | 848.8 | 31.29 | 32.00 | 1.178 | - | - | - | - |
| | Right-Tilt | 128 | 824.2 | 31.69 | 32.00 | 1.074 | -0.03 | 0.244 | 0.262 | - |
| | | 190 | 836.6 | 31.64 | 32.00 | 1.086 | - | - | - | - |
| | | 251 | 848.8 | 31.29 | 32.00 | 1.178 | - | - | - | - |

| GSM1900 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mode | Test Position | Frequency | | Conducted Power (dBm) | Tune-up limit (dBm) | Tune-up scaling factor | Power Drift(dB) | Measured SAR(1g) | Report SAR(1g) | Plot No. |
| | | CH | MHz | | | | | (W/kg) | (W/kg) | |
| GSM Voice | Left-Cheek | 512 | 1850.2 | 28.71 | 29.00 | 1.069 | -0.07 | 0.233 | 0.249 | 2 |
| | | 661 | 1880.0 | 28.68 | 29.00 | 1.076 | - | - | - | - |
| | | 810 | 1909.8 | 28.46 | 29.00 | 1.132 | - | - | - | - |
| | Left-Tilt | 512 | 1850.2 | 28.71 | 29.00 | 1.069 | 0.05 | 0.188 | 0.201 | - |
| | | 661 | 1880.0 | 28.68 | 29.00 | 1.076 | - | - | - | - |
| | | 810 | 1909.8 | 28.46 | 29.00 | 1.132 | - | - | - | - |
| | Right-Cheek | 512 | 1850.2 | 28.71 | 29.00 | 1.069 | -0.06 | 0.215 | 0.230 | - |
| | | 661 | 1880.0 | 28.68 | 29.00 | 1.076 | - | - | - | - |
| | | 810 | 1909.8 | 28.46 | 29.00 | 1.132 | - | - | - | - |
| | Right-Tilt | 512 | 1850.2 | 28.71 | 29.00 | 1.069 | -0.11 | 0.174 | 0.186 | - |
| | | 661 | 1880.0 | 28.68 | 29.00 | 1.076 | - | - | - | - |
| | | 810 | 1909.8 | 28.46 | 29.00 | 1.132 | - | - | - | - |

## Appendix B:SAR Measurement Results-Body

| GSM850 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mode | Test Position | Frequency | | Conducted Power (dBm) | Tune-up limit (dBm) | Tune-up scaling factor | Power Drift(dB) | Measured SAR(1g) | Report SAR(1g) | Plot No. |
| | | CH | MHz | | | | | (W/kg) | (W/kg) | |
| GSM Voice | Front | 128 | 824.2 | 31.69 | 32.00 | 1.074 | 0.08 | 0.162 | 0.174 | - |
| | | 190 | 836.6 | 31.64 | 32.00 | 1.086 | - | - | - | - |
| | | 251 | 848.8 | 31.29 | 32.00 | 1.178 | - | - | - | - |
| | Rear | 128 | 824.2 | 31.69 | 32.00 | 1.074 | -0.13 | 0.319 | 0.343 | 3 |
| | | 190 | 836.6 | 31.64 | 32.00 | 1.086 | - | - | - | - |
| | | 251 | 848.8 | 31.29 | 32.00 | 1.178 | - | - | - | - |

| GSM1900 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mode | Test Position | Frequency | | Conducted Power (dBm) | Tune-up limit (dBm) | Tune-up scaling factor | Power Drift(dB) | Measured SAR(1g) | Report SAR(1g) | Plot No. |
| | | CH | MHz | | | | | (W/kg) | (W/kg) | |
| GSM Voice | Front | 512 | 1850.2 | 28.71 | 29.00 | 1.069 | -0.06 | 0.184 | 0.197 | - |
| | | 661 | 1880.0 | 28.68 | 29.00 | 1.076 | - | - | - | - |
| | | 810 | 1909.8 | 28.46 | 29.00 | 1.132 | - | - | - | - |
| | Rear | 512 | 1850.2 | 28.71 | 29.00 | 1.069 | -0.13 | 0.255 | 0.273 | 4 |
| | | 661 | 1880.0 | 28.68 | 29.00 | 1.076 | - | - | - | - |
| | | 810 | 1909.8 | 28.46 | 29.00 | 1.132 | - | - | - | - |

**Appendix C: Simultaneous Transmission analysis-Head**

| PCE + Bluetooth | | | | | |
|---|---|---|---|---|---|
| WWAN Band | | Exposure Position | Max SAR (W/kg) | | Summed SAR (W/kg) |
| | | | PCE | BT | |
| GSM | GSM850 | Left Cheek | 0.330 | 0.148 | 0.478 |
| | | Left Tilted | 0.309 | 0.148 | 0.457 |
| | | Right Cheek | 0.317 | 0.148 | 0.465 |
| | | Right Tilted | 0.262 | 0.148 | 0.410 |
| | PCS1900 | Left Cheek | 0.249 | 0.148 | 0.397 |
| | | Left Tilted | 0.201 | 0.148 | 0.349 |
| | | Right Cheek | 0.230 | 0.148 | 0.378 |
| | | Right Tilted | 0.186 | 0.148 | 0.334 |

**Appendix C: Simultaneous Transmission analysis-Body**

| PCE + BT | | | | | |
|---|---|---|---|---|---|
| WWAN Band | | Exposure Position | Max SAR (W/kg) | | Summed SAR |
| | | | PCE | BT | (W/kg) |
| GSM | GSM850 | Front | 0.174 | 0.049 | 0.223 |
| | | Rear | 0.343 | 0.049 | 0.392 |
| | PCS1900 | Front | 0.197 | 0.049 | 0.246 |
| | | Rear | 0.273 | 0.049 | 0.322 |

Test Laboratory: Huatongwei International Inspection Co., Ltd.,SAR Lab Date: 11/26/2021

## GSM 850-L-Head

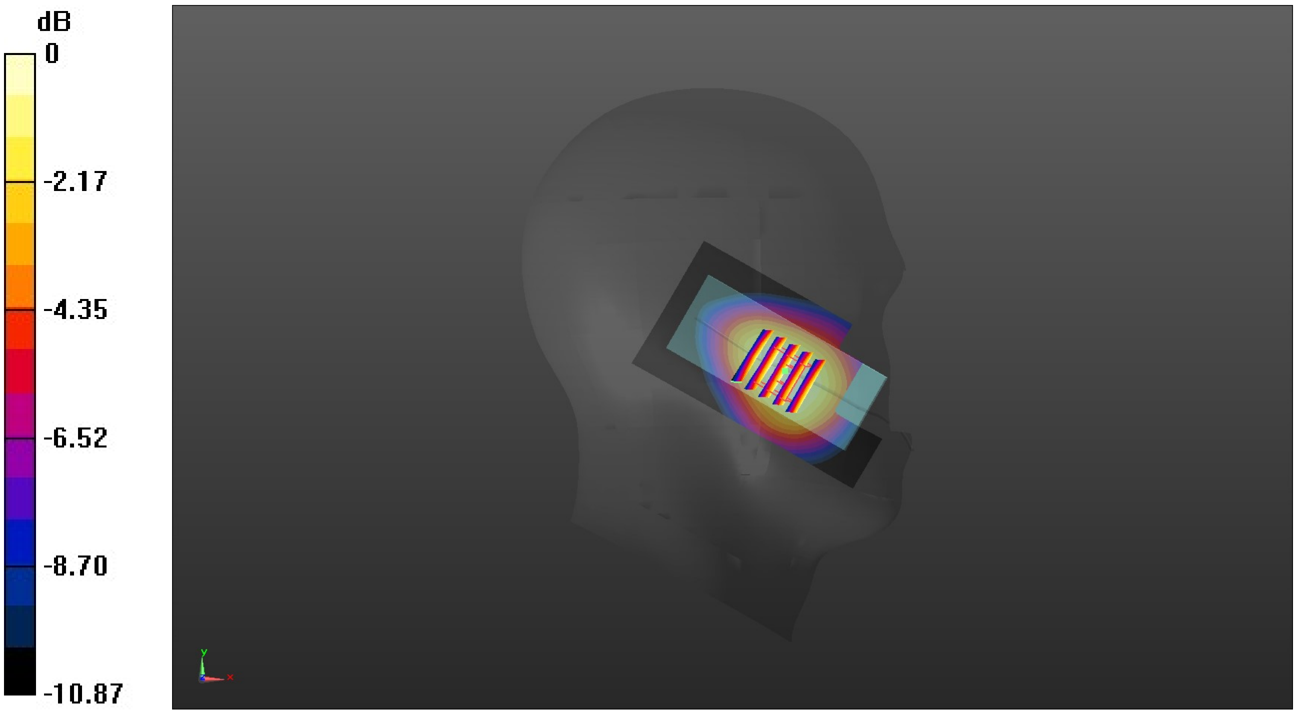
Communication System: UID 0, Generic GPRS(TDMA, GMSK, TN 0-1-2) (0); Frequency: 824.2 MHz;Duty Cycle: 1:2.66993
Medium parameters used: f = 825 MHz; $\sigma$ = 0.945 S/m; $\varepsilon_r$ = 42.499; $\rho$ = 1000 kg/m$^3$
Phantom section: Left Section
Ambient Temperature:22.3°C;Liquid Temperature:22.1°C;

DASY Configuration:

- Probe: EX3DV4 - SN7494; ConvF(10.41, 10.41, 10.41) @ 824.2 MHz; Calibrated: 4/9/2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/23/2021
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Rear/CH 128/Area Scan (51x91x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.407 W/kg

**Rear/CH 128/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.668 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.432 W/kg
**SAR(1 g) = 0.307 W/kg; SAR(10 g) = 0.213 W/kg**
Maximum value of SAR (measured) = 0.384 W/kg




0 dB = 0.384 W/kg = -4.16 dBW/kg

Test Laboratory: Huatongwei International Inspection Co., Ltd.,SAR Lab Date: 11/26/2021

## GSM 1900-L-Head

Communication System: UID 0, Generic GPRS(TDMA, GMSK, TN 0-1-2-3) (0); Frequency: 1850.2 MHz;Duty Cycle: 1:2.00447
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.439 S/m; $\varepsilon_r$ = 40.855; ρ = 1000 kg/m$^3$

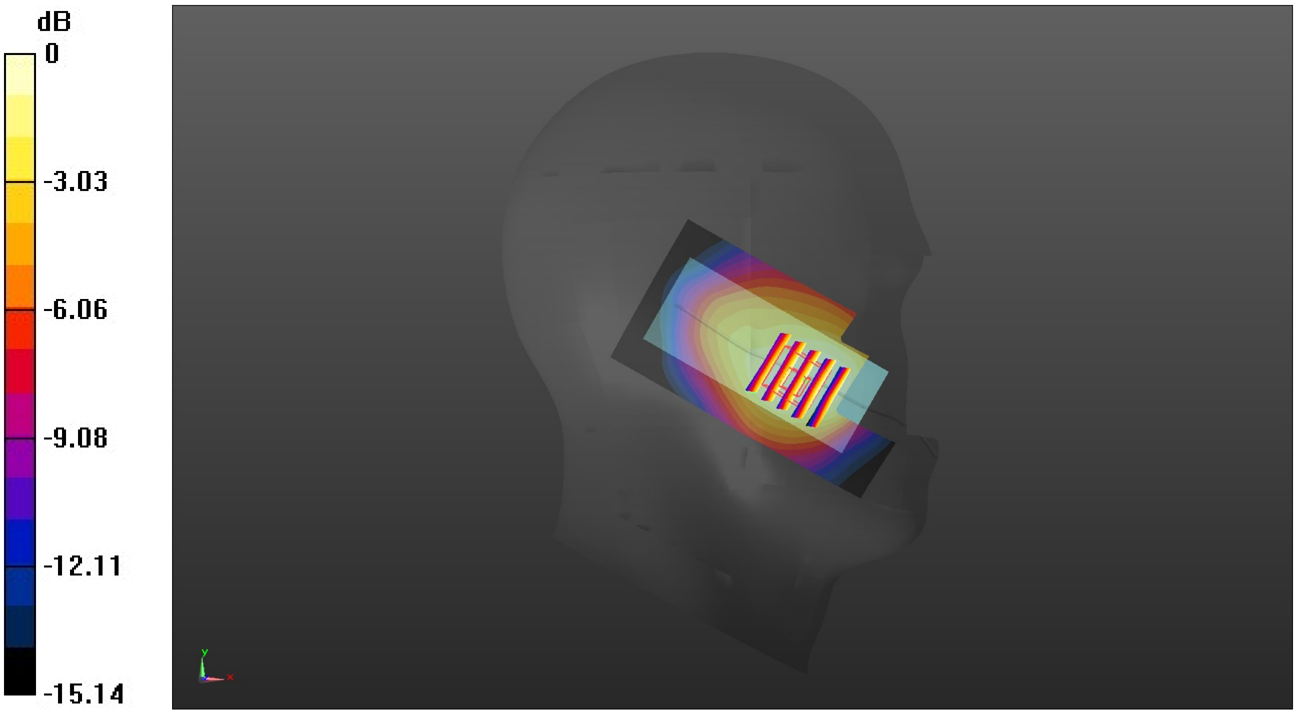
Phantom section: Left Section
Ambient Temperature:22.3℃;Liquid Temperature:22.1℃;

DASY Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.55, 8.55, 8.55) @ 1850.2 MHz; Calibrated: 4/9/2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/23/2021
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Rear/CH 512/Area Scan (51x91x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.339 W/kg

**Rear/CH 512/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.079 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.354 W/kg
**SAR(1 g) = 0.233 W/kg; SAR(10 g) = 0.156 W/kg**
Maximum value of SAR (measured) = 0.304 W/kg




0 dB = 0.304 W/kg = -5.17 dBW/kg

Test Laboratory: Huatongwei International Inspection Co., Ltd.,SAR Lab Date: 11/26/2021

## GSM 850-L-Body worn

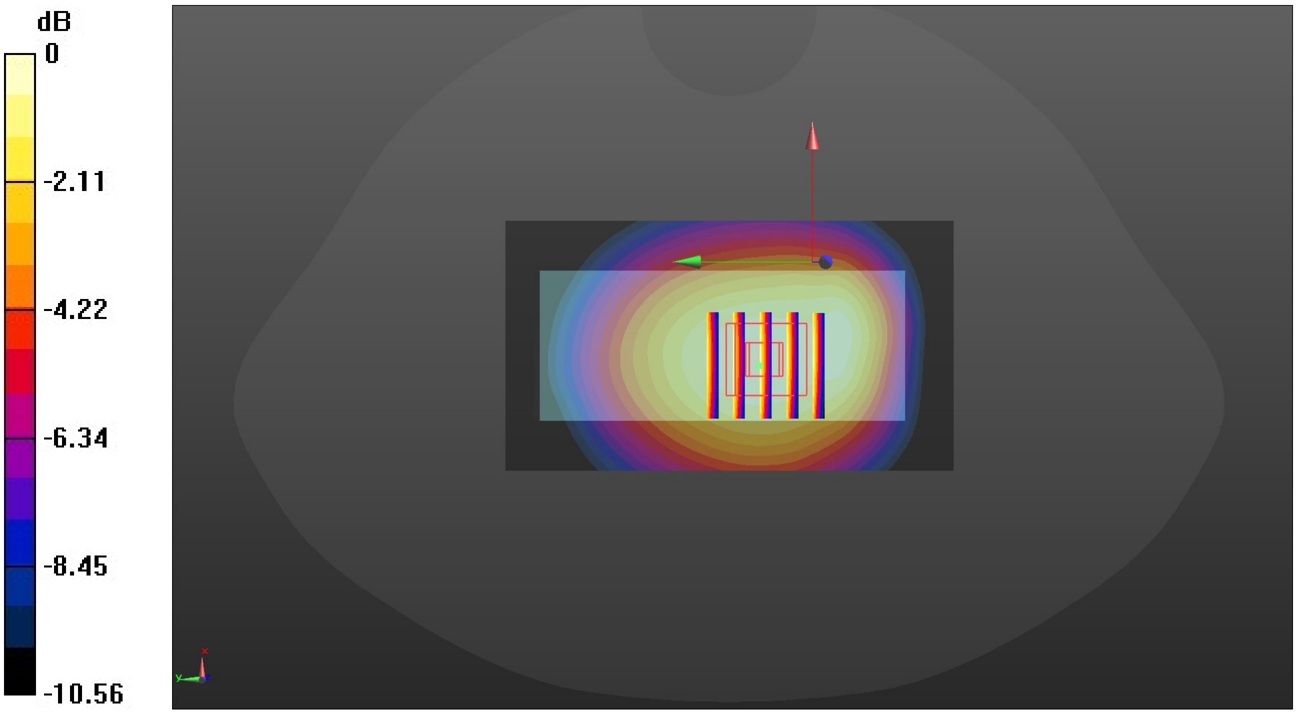
Communication System: UID 0, Generic GPRS(TDMA, GMSK, TN 0-1-2) (0); Frequency: 824.2 MHz;Duty Cycle: 1:2.66993
Medium parameters used: f = 825 MHz; σ = 0.945 S/m; $\varepsilon_r$ = 42.499; ρ = 1000 kg/m$^3$
Phantom section: Flat Section
Ambient Temperature:22.2°C;Liquid Temperature:22.0°C;

DASY Configuration:

- Probe: EX3DV4 - SN7494; ConvF(10.41, 10.41, 10.41) @ 824.2 MHz; Calibrated: 4/9/2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/23/2021
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Rear/CH 128/Area Scan (51x91x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.424 W/kg

**Rear/CH 128/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.90 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.472 W/kg
**SAR(1 g) = 0.319 W/kg; SAR(10 g) = 0.225 W/kg**
Maximum value of SAR (measured) = 0.415 W/kg




0 dB = 0.415 W/kg = -3.82 dBW/kg

Test Laboratory: Huatongwei International Inspection Co., Ltd.,SAR Lab Date: 11/26/2021

## GSM 1900-L-Body worn

Communication System: UID 0, Generic GPRS(TDMA, GMSK, TN 0-1-2-3) (0); Frequency: 1850.2 MHz;Duty Cycle: 1:2.00447
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.439 S/m; $\varepsilon_r$ = 40.855; ρ = 1000 kg/m$^3$

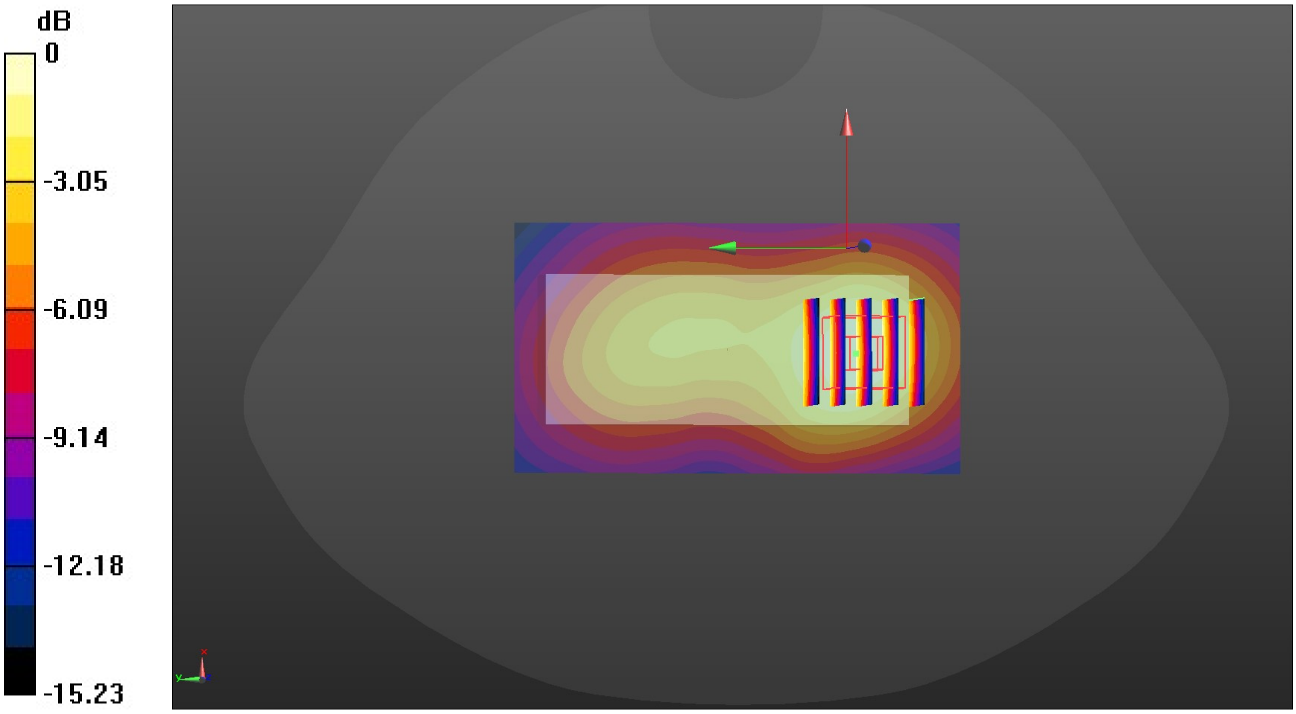
Phantom section: Flat Section
Ambient Temperature:22.5℃;Liquid Temperature:22.3℃;

DASY Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.55, 8.55, 8.55) @ 1850.2 MHz; Calibrated: 4/9/2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/23/2021
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Rear/CH 512/Area Scan (51x91x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.374 W/kg

**Rear/CH 512/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.63 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.437 W/kg
**SAR(1 g) = 0.255 W/kg; SAR(10 g) = 0.152 W/kg**
Maximum value of SAR (measured) = 0.369 W/kg




0 dB = 0.369 W/kg = -4.33 dBW/kg

## 1.1.1. DAE4 Calibration Certificate

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校准
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CNAS L0570

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E-mail: cttl@chinattl.com Http://www.chinattl.cn

Client : HTW

Certificate No: Z21-60063

### CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SN: 1549 |
| Calibration Procedure(s) | FF-Z11-002-01<br>Calibration Procedure for the Data Acquisition Electronics (DAEx) |
| Calibration date: | March 23, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Process Calibrator 753 | 1971018 | 16-Jun-20 (CTTL, No.J20X04342) | Jun-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: March 25, 2021

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**Glossary:**

| | |
|---|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

**Methods Applied and Interpretation of Parameters:**

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.

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## DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

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

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

| Calibration Factors | X | Y | Z |
|---|---|---|---|
| High Range | 406.327 ± 0.15% (k=2) | 406.003 ± 0.15% (k=2) | 406.159 ± 0.15% (k=2) |
| Low Range | 3.98410 ± 0.7% (k=2) | 3.99112 ± 0.7% (k=2) | 3.99200 ± 0.7% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 19° ± 1 ° |

## 1.2. Probe Calibration Certificate

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中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client HTW | Certificate No: Z21-60064

# CALIBRATION CERTIFICATE

Object: EX3DV4 - SN : 7494

Calibration Procedure(s): FF-Z11-004-02
Calibration Procedures for Dosimetric E-field Probes

Calibration date: April 09, 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)℃ 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 | 16-Jun-20(CTTL, No.J20X04344) | Jun-21 |
| Power sensor NRP-Z91 | 101547 | 16-Jun-20(CTTL, No.J20X04344) | Jun-21 |
| Power sensor NRP-Z91 | 101548 | 16-Jun-20(CTTL, No.J20X04344) | Jun-21 |
| 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 | 29-May-20(SPEAG, No.EX3-7307_May20) | May-21 |
| DAE4 | SN 1555 | 25-Aug-20(SPEAG, No.DAE4-1555_Aug20) | Aug-21 |

| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| SignalGenerator MG3700A | 6201052605 | 23-Jun-20(CTTL, No.J20X04343) | Jun-21 |
| Network Analyzer E5071C | MY46110673 | 21-Jan-21(CTTL, No.J20X00515) | Jan-22 |

| | 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 11, 2021

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**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 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) 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"

**Methods Applied and Interpretation of Parameters:**

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect 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 (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; VRx,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≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. 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 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±50MHz to±100MHz.
- *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).

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# DASY/EASY – Parameters of Probe: EX3DV4 – SN:7494

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc ($k$=2) |
|---|---|---|---|---|
| Norm($\mu V/(V/m)^2$)[A] | 0.41 | 0.47 | 0.41 | ±10.0% |
| DCP(mV)[B] | 98.9 | 100.2 | 99.0 | |

## Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB√μV | C | D dB | VR mV | Unc[E] ($k$=2) |
|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 151.2 | ±2.0% |
| | | Y | 0.0 | 0.0 | 1.0 | | 164.8 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 151.0 | |

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 Page 4).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly 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:7494

## 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 | 10.70 | 10.70 | 10.70 | 0.40 | 0.75 | ±12.1% |
| 835 | 41.5 | 0.90 | 10.41 | 10.41 | 10.41 | 0.13 | 1.39 | ±12.1% |
| 1750 | 40.1 | 1.37 | 8.88 | 8.88 | 8.88 | 0.20 | 1.14 | ±12.1% |
| 1900 | 40.0 | 1.40 | 8.55 | 8.55 | 8.55 | 0.22 | 1.08 | ±12.1% |
| 2000 | 40.0 | 1.40 | 8.60 | 8.60 | 8.60 | 0.17 | 1.28 | ±12.1% |
| 2300 | 39.5 | 1.67 | 8.30 | 8.30 | 8.30 | 0.62 | 0.62 | ±12.1% |
| 2450 | 39.2 | 1.80 | 7.97 | 7.97 | 7.97 | 0.48 | 0.74 | ±12.1% |
| 2600 | 39.0 | 1.96 | 7.68 | 7.68 | 7.68 | 0.40 | 0.85 | ±12.1% |
| 5250 | 35.9 | 4.71 | 5.65 | 5.65 | 5.65 | 0.45 | 1.35 | ±13.3% |
| 5600 | 35.5 | 5.07 | 4.95 | 4.95 | 4.95 | 0.55 | 1.35 | ±13.3% |
| 5750 | 35.4 | 5.22 | 4.86 | 4.86 | 4.86 | 0.50 | 1.50 | ±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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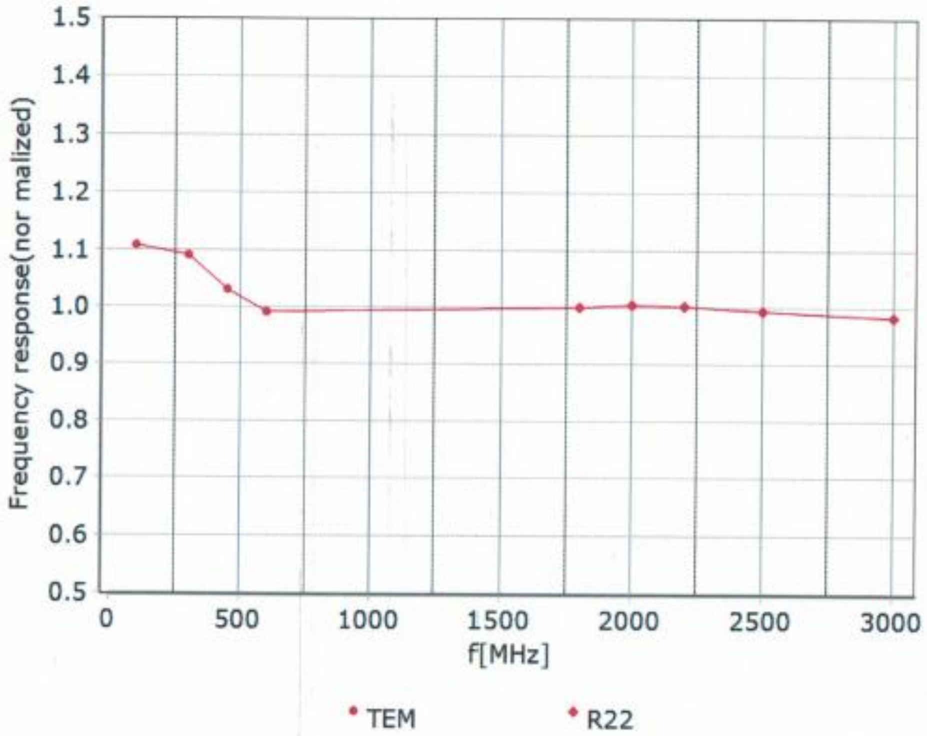
## Frequency Response of E-Field
## (TEM-Cell: ifi110 EXX, Waveguide: R22)




**Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)**

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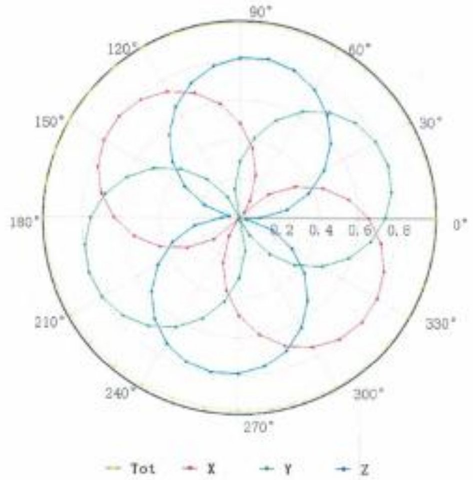
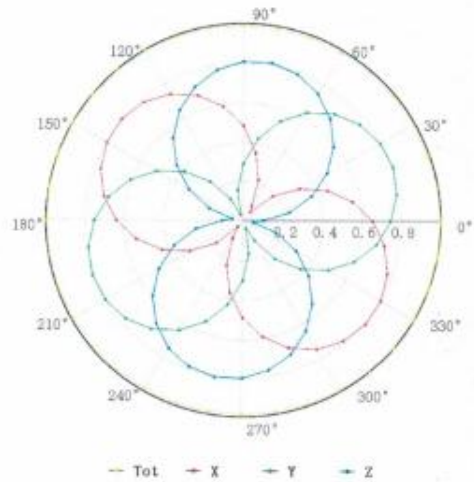
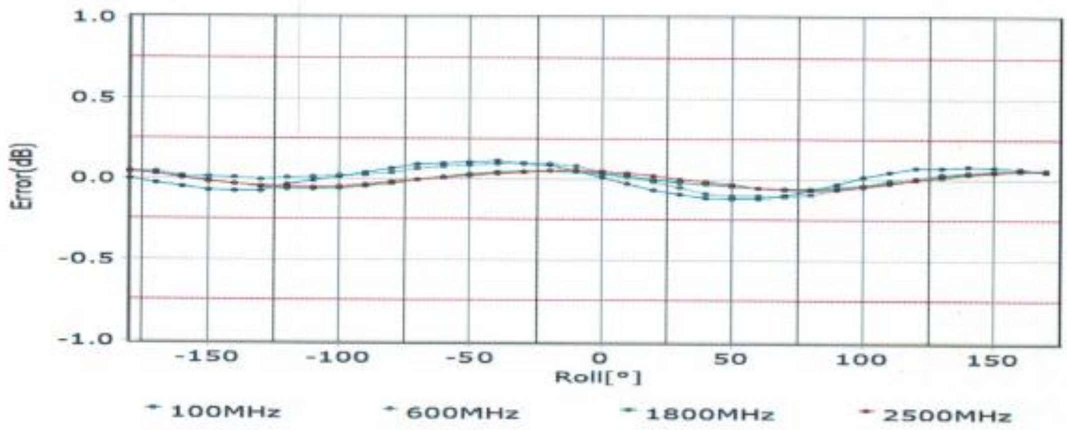
# Receiving Pattern (Φ), θ=0°

## f=600 MHz, TEM




## f=1800 MHz, R22




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

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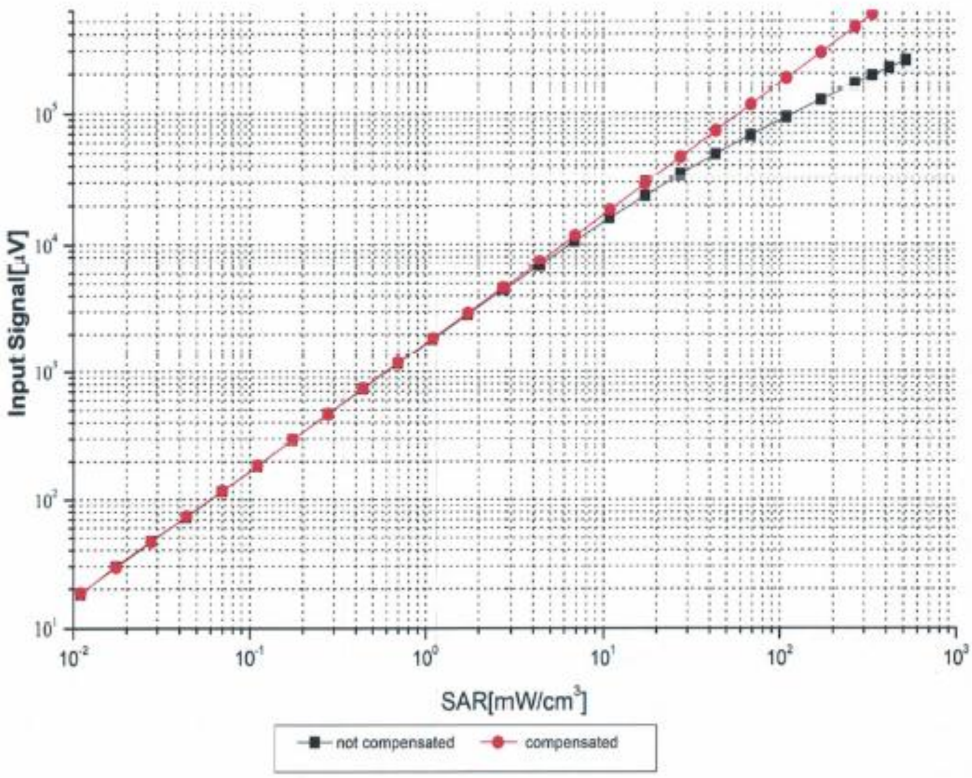
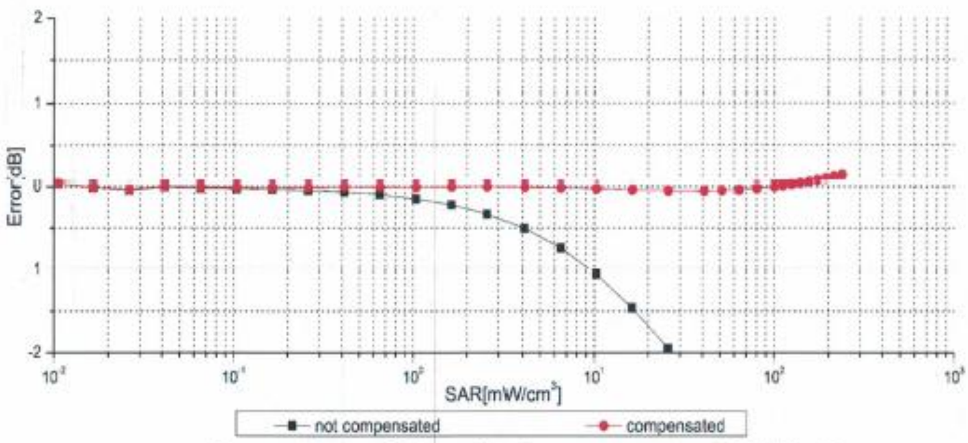
## Dynamic Range f(SAR$_{head}$)
## (TEM cell, f = 900 MHz)




**Uncertainty of Linearity Assessment: ±0.9% (*k*=2)**

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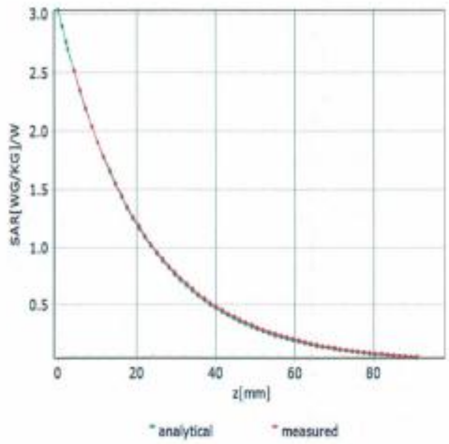
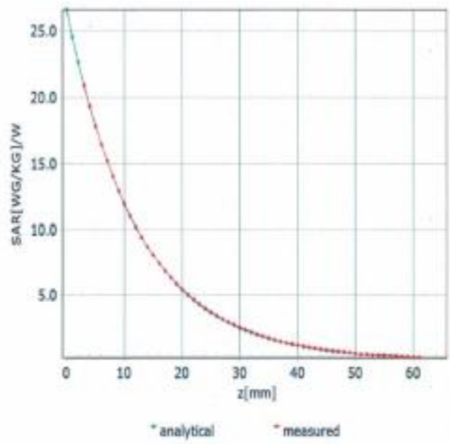
# Conversion Factor Assessment

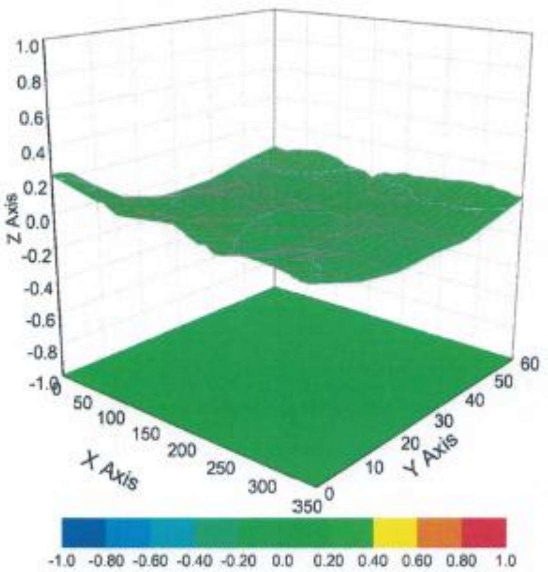
**f=750 MHz,WGLS R9(H_convF)**




**f=1750 MHz,WGLS R22(H_convF)**




# Deviation from Isotropy in Liquid




**Uncertainty of Spherical Isotropy Assessment: ±3.2% (*k*=2)**

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# DASY/EASY – Parameters of Probe: EX3DV4 – SN:7494

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 22.2 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disable |
| Probe Overall Length | 337mm |
| Probe Body Diameter | 10mm |
| Tip Length | 9mm |
| 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 |

## 1.1. D835V2 Dipole Calibration Certificate

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Client HTW Certificate No: Z21-60017

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D835V2 - SN: 4d238 |
| Calibration Procedure(s) | FF-Z11-003-01<br>Calibration Procedures for dipole validation kits |
| Calibration date: | January 22, 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)℃ 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 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| ReferenceProbe EX3DV4 | SN 7600 | 30-Nov-20(CTTL-SPEAG,No.Z20-60421) | Nov-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |

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

Issued: January 29, 2021



Certificate No: Z21-60017 Page 1 of 6

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**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| ConvF | sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, 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%.

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## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY52 | V52.10.4 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | Triple Flat Phantom 5.1C | |
| **Distance Dipole Center - TSL** | 15 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 835 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 41.5 | 0.90 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 41.3 ± 6 % | 0.89 mho/m ± 6 % |
| **Head TSL temperature change during test** | <1.0 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 2.32 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **9.39 W/kg ± 18.8 % (*k*=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | Condition | |
| SAR measured | 250 mW input power | 1.52 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **6.14 W/kg ± 18.7 % (*k*=2)** |

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## Appendix (Additional assessments outside the scope of CNAS L0570)

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 51.5Ω- 3.95jΩ |
| Return Loss | - 27.6dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.298 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 |

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**DASY5 Validation Report for Head TSL** Date: 01.22.2021

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d238**

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; $\sigma$ = 0.885 S/m; $\varepsilon_r$ = 41.32; $\rho$ = 1000 kg/m$^3$

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7600; ConvF(10.88, 10.88, 10.88) @ 835 MHz; Calibrated: 2020-11-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.12 V/m; Power Drift = -0.01 dB

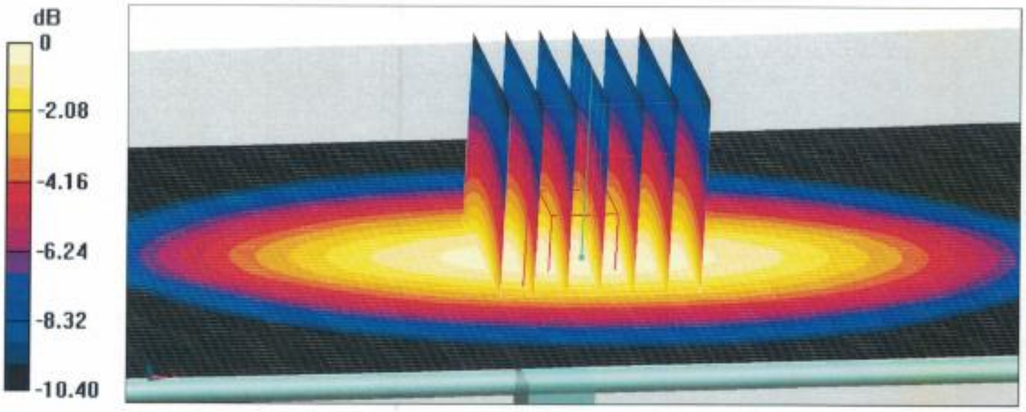
Peak SAR (extrapolated) = 3.58 W/kg

**SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.52 W/kg**

Smallest distance from peaks to all points 3 dB below = 19.8 mm

Ratio of SAR at M2 to SAR at M1 = 64.9%

Maximum value of SAR (measured) = 3.14 W/kg




**0 dB = 3.14 W/kg = 4.97 dBW/kg**

Certificate No: Z21-60017 Page 5 of 6

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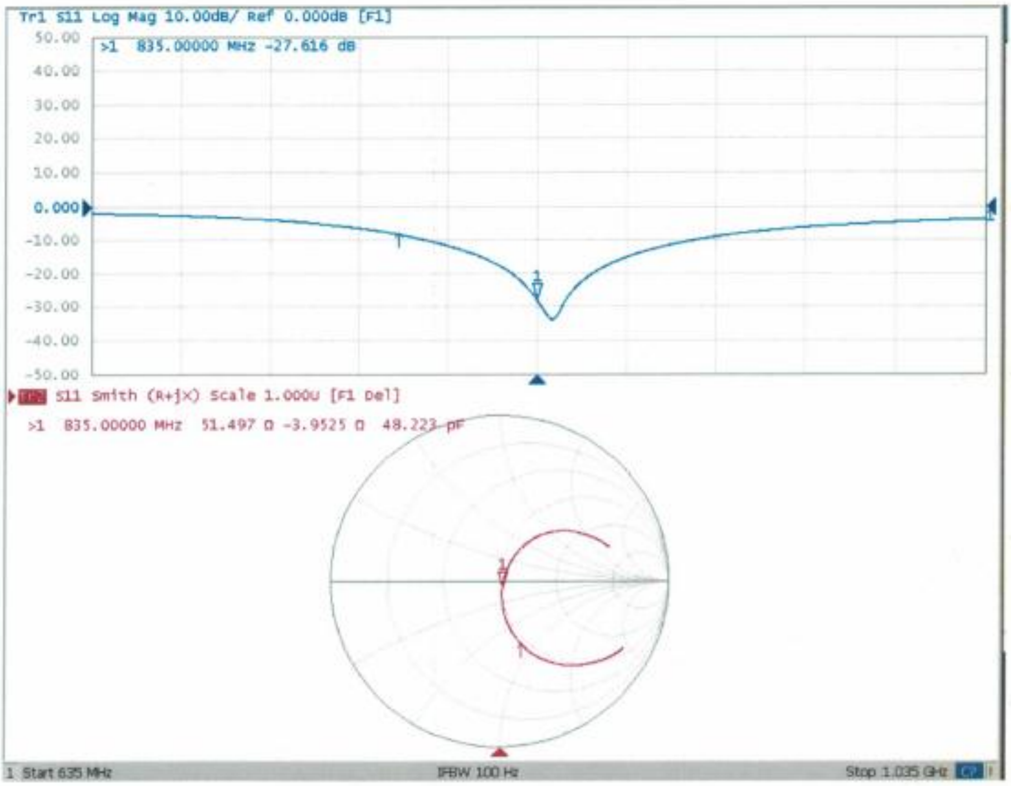
**Impedance Measurement Plot for Head TSL**



## 1.2. D1900V2 Dipole Calibration Certificate

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CNAS L0570

Client HTW

Certificate No: Z21-60019

# CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d226

Calibration Procedure(s): FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: January 22, 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)℃ 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 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| ReferenceProbe EX3DV4 | SN 7600 | 30-Nov-20(CTTL-SPEAG,No.Z20-60421) | Nov-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |

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

Issued: January 29, 2021

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**lossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| ConvF | sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
d) KDB865664, 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%.

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## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY52 | V52.10.4 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | Triple Flat Phantom 5.1C | |
| **Distance Dipole Center - TSL** | 10 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 1900 MHz ± 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 ± 0.2) °C | 40.1 ± 6 % | 1.38 mho/m ± 6 % |
| **Head TSL temperature change during test** | <1.0 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 9.85 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **39.8 W/kg ± 18.8 % (*k*=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | Condition | |
| SAR measured | 250 mW input power | 5.05 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **20.3 W/kg ± 18.7 % (*k*=2)** |

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## Appendix (Additional assessments outside the scope of CNAS L0570)

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 53.5Ω+ 7.88jΩ |
| Return Loss | - 21.6dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.102 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 |

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**DASY5 Validation Report for Head TSL** Date: 01.22.2021

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d226**

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

Medium parameters used: f = 1900 MHz; $\sigma$ = 1.38 S/m; $\varepsilon_r$ = 40.06; $\rho$ = 1000 kg/m$^3$

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7600; ConvF(8.7, 8.7, 8.7) @ 1900 MHz; Calibrated: 2020-11-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.77 V/m; Power Drift = -0.06 dB

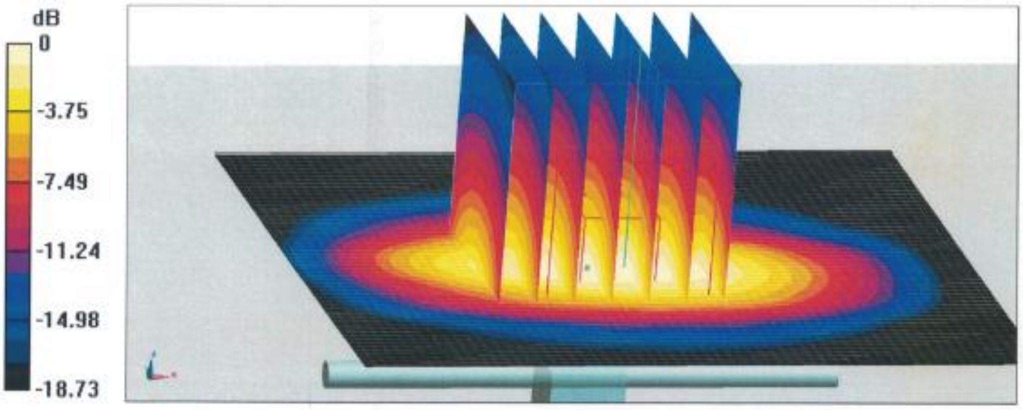
Peak SAR (extrapolated) = 19.0 W/kg

**SAR(1 g) = 9.85 W/kg; SAR(10 g) = 5.05 W/kg**

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 52.1%

Maximum value of SAR (measured) = 15.4 W/kg




**0 dB = 15.4 W/kg = 11.88 dBW/kg**

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## Impedance Measurement Plot for Head TSL