# FCC SAR Test Report

| | | |
|---|---|---|
| **APPLICANT** | : | **Planet Avvio LLC** |
| **EQUIPMENT** | : | **Mobile phone** |
| **BRAND NAME** | : | **Avvio** |
| **MODEL NAME** | : | **362** |
| **FCC ID** | : | **2ALTA362X** |
| **STANDARD** | : | **FCC 47 CFR Part 2 (2.1093)**<br>**ANSI/IEEE C95.1-1992**<br>**IEEE 1528-2013** |

**We, Sporton International (Shenzhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.**

**The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Shenzhen) Inc., the test report shall not be reproduced except in full.**

Mark Qu

**Approved by: Mark Qu / Manager**

TESTING
NVLAP LAB CODE 600156-0

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# Revision History

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FA7O1703 | Rev. 01 | Initial issue of report | Nov. 07, 2017 |
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# 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Planet Avvio LLC, Mobile phone, 362**, are as follows.

| Equipment Class | Frequency Band | | Highest SAR Summary | | Highest Simultaneous Transmission 1g SAR (W/kg) |
|---|---|---|---|---|---|
| | | | Head (Separation 0mm) | Body-worn (Separation 15mm) | |
| | | | 1g SAR (W/kg) | | |
| Licensed | GSM | GSM850 | 0.10 | 0.49 | 1.16 |
| | | GSM1900 | 0.15 | 0.52 | |
| | WCDMA | Band V | 0.13 | 0.54 | |
| | | Band II | **0.31** | **1.15** | |
| DSS | 2.4GHz Band | Bluetooth | | <0.10 | 1.16 |
| Date of Testing: | | | 2017/10/24 | | |

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. Administration Data

| Testing Laboratory | |
|---|---|
| Test Site | Sporton International (Shenzhen) Inc. |
| Test Site Location | 1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen City Guangdong Province 518055 China<br>TEL: +86-755-8637-9589<br>FAX: +86-755-8637-9595 |

| Applicant | |
|---|---|
| Company Name | Planet Avvio LLC |
| Address | 9725 NW 117th Ave., Medley, FL 33178, United States |

| Manufacturer | |
|---|---|
| Company Name | UTIME TECHNOLOGY (HK) COMPANY LIMITED |
| Address | 7/F., 5-A Building, Software IndustrialBase, No.1006 Keyuan Road, Nanshan District, Shenzhen, P. R. China |

## 3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 941225 D01 3G SAR Procedures v03r01

# 4. Equipment Under Test (EUT) Information

## 4.1 General Information

| Product Feature & Specification | |
|---|---|
| **Equipment Name** | Mobile phone |
| **Brand Name** | Avvio |
| **Model Name** | 362 |
| **FCC ID** | 2ALTA362X |
| **IMEI Code** | 356778670090017 |
| **Wireless Technology and Frequency Range** | GSM850: 824.2 MHz ~ 848.8 MHz<br>GSM1900: 1850.2 MHz ~ 1909.8 MHz<br>WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz<br>WCDMA Band V: 826.4 MHz ~ 846.6 MHz<br>Bluetooth: 2402 MHz ~ 2480 MHz |
| **Mode** | GSM/GPRS/EGPRS(Downlink Only)<br>RMC/AMR 12.2Kbps<br>HSDPA<br>HSUPA<br>Bluetooth v2.1+EDR |
| **HW Version** | V0.2 |
| **SW Version** | Avvio362_PuertoRico_Claro_V01 |
| **GSM / GPRS Transfer mode** | Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network. |
| **EUT Stage** | Identical Prototype |
| **Remark:**<br>1. This device does not support VoIP function.<br>2. This device support GRPS/EGPRS mode up to multi-slot class 12 and EGPRS downlink only. | |

# 5. RF Exposure Limits

## 5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

## 5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

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

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|---|---|---|
| 0.4 | 8.0 | 20.0 |

**Limits for General Population/Uncontrolled Exposure (W/kg)**

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|---|---|---|
| 0.08 | 1.6 | 4.0 |

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

# 6. Specific Absorption Rate (SAR)

## 6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

## 6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

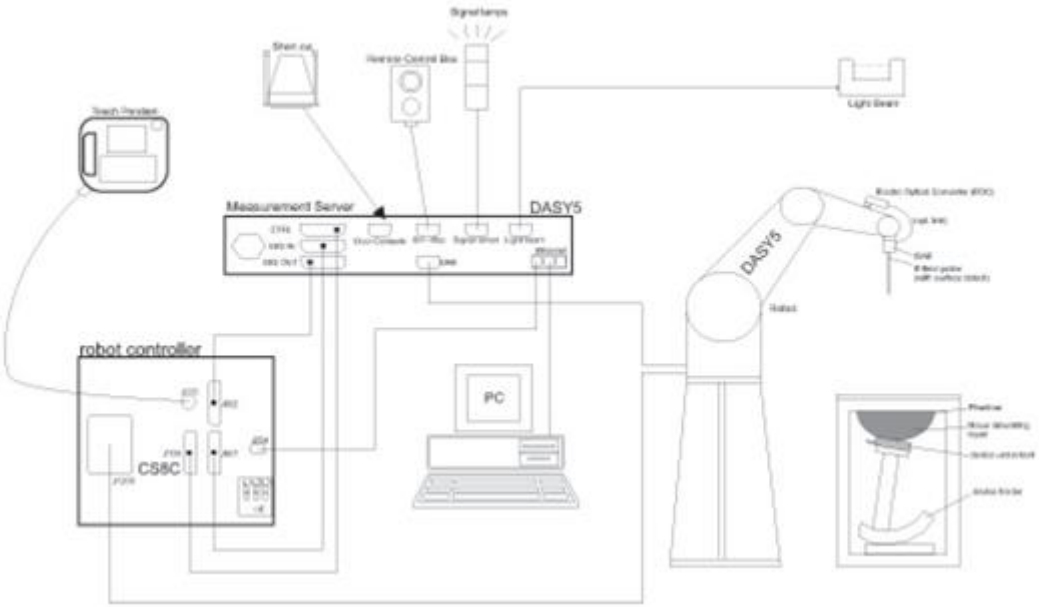
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

# 7. System Description and Setup

**The DASY system used for performing compliance tests consists of the following items:**




- A standard high precision 6-axis robot 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 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.
- 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 WinXP or Win7 and the DASY5 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.

## 7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

**<EX3DV4 Probe>**

| | |
|---|---|
| **Construction** | Symmetric design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| **Frequency** | 10 MHz – >6 GHz<br>Linearity: ±0.2 dB (30 MHz – 6 GHz) |
| **Directivity** | ±0.3 dB in TSL (rotation around probe axis)<br>±0.5 dB in TSL (rotation normal to probe axis) |
| **Dynamic Range** | 10 µW/g – >100 mW/g<br>Linearity: ±0.2 dB (noise: typically <1 µW/g) |
| **Dimensions** | Overall length: 337 mm (tip: 20 mm)<br>Tip diameter: 2.5 mm (body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm |

## 7.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists 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 and 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.

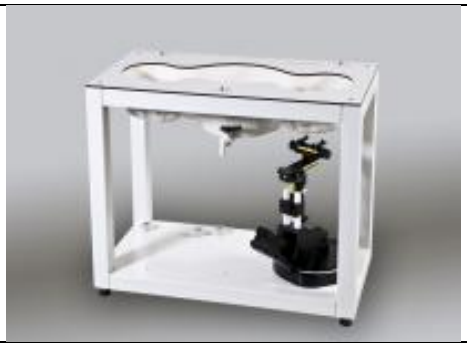
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**Fig 5.1 Photo of DAE**

## 7.3 Phantom

**<SAM Twin Phantom>**

| | |
|---|---|
| **Shell Thickness** | 2 ± 0.2 mm;<br>Center ear point: 6 ± 0.2 mm |
| **Filling Volume** | Approx. 25 liters |
| **Dimensions** | Length: 1000 mm; Width: 500 mm; Height: adjustable feet |
| **Measurement Areas** | Left Hand, Right Hand, Flat Phantom |



The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

## 7.4 Device Holder

**<Mounting Device for Hand-Held Transmitter>**

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

**<Mounting Device for Laptops and other Body-Worn Transmitters>**

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

# 8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For BT power measurement, use engineering software to configure EUT BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

## 8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

## 8.2 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. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

## 8.3 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 found in the scanned area, within a range of the global maximum. The range (in dB0 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 parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

| | ≤ 3 GHz | > 3 GHz |
|---|---|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 ± 1 mm | ½·δ·ln(2) ± 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. | |

## 8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes 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 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

| | | | ≤ 3 GHz | > 3 GHz |
|---|---|---|---|---|
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$ | | | ≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm* | 3 – 4 GHz: ≤ 5 mm*<br>4 – 6 GHz: ≤ 4 mm* |
| Maximum zoom scan spatial resolution, normal to phantom surface | uniform grid: $\Delta z_{Zoom}(n)$ | | ≤ 5 mm | 3 – 4 GHz: ≤ 4 mm<br>4 – 5 GHz: ≤ 3 mm<br>5 – 6 GHz: ≤ 2 mm |
| | graded grid | $\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface | ≤ 4 mm | 3 – 4 GHz: ≤ 3 mm<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 2 mm |
| | | $\Delta z_{Zoom}(n>1)$: between subsequent points | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ | |
| Minimum zoom scan volume | x, y, z | | ≥ 30 mm | 3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm |

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 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.

## 8.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## 8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

# 9. Test Equipment List

| Manufacturer | Name of Equipment | Type/Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Cal. | Due Date |
| SPEAG | 835MHz System Validation Kit | D835V2 | 4d162 | Nov. 22, 2016 | Nov. 21, 2017 |
| SPEAG | 1900MHz System Validation Kit | D1900V2 | 5d182 | Nov. 24, 2016 | Nov. 23, 2017 |
| SPEAG | 2450MHz System Validation Kit | D2450V2 | 924 | Mar. 21, 2017 | Mar. 20, 2018 |
| SPEAG | Data Acquisition Electronics | DAE4 | 1303 | Nov. 22, 2016 | Nov. 21, 2017 |
| SPEAG | Dosimetric E-Field Probe | EX3DV4 | 3819 | Nov. 28, 2016 | Nov. 27, 2017 |
| SPEAG | SAM Twin Phantom | QD 000 P40 CD | TP-1671 | NCR | NCR |
| Anritsu | Radio communication analyzer | MT8820C | 6201300653 | Jul. 19, 2017 | Jul. 18, 2018 |
| Agilent | Network Analyzer | E5071C | MY46523671 | Oct. 18, 2017 | Oct. 17, 2018 |
| SPEAG | Dielectric Assessment KIT | DAK-3.5 | 1071 | Nov. 23, 2016 | Nov. 22, 2017 |
| Agilent | Signal Generator | N5181A | MY50145381 | Jan. 03, 2017 | Jan. 02, 2018 |
| Anritsu | Power Senor | MA2411B | 1306099 | Aug. 21, 2017 | Aug. 20, 2018 |
| Anritsu | Power Meter | ML2495A | 1349001 | Jul. 19, 2017 | Jul. 18, 2018 |
| Anritsu | Power Senor | MA2411B | 1207253 | Jan. 03, 2017 | Jan. 02, 2018 |
| Anritsu | Power Meter | ML2495A | 1218010 | Jan. 03, 2017 | Jan. 02, 2018 |
| LKM electronic | Hygrometer | DTM3000 | 3241 | Jul. 21, 2017 | Jul. 20, 2018 |
| Anymetre | Thermo-Hygrometer | JR593 | 2015030904 | Apr. 22, 2017 | Apr. 21, 2018 |
| ARRA | Power Divider | A3200-2 | N/A | Note | |
| PASTERNACK | Dual Directional Coupler | PE2214-10 | N/A | Note | |
| Agilent | Dual Directional Coupler | 778D | 50422 | Note | |
| MCL | Attenuation1 | BW-S10W5 | N/A | Note | |
| Weinschel | Attenuation2 | 3M-20 | N/A | Note | |
| Zhongjilianhe | Attenuation3 | MVE2214-03 | N/A | Note | |
| mini-circuits | Amplifier | ZHL-42W+ | QA1341002 | Note | |
| mini-circuits | Amplifier | ZVE-3W-83+ | 599201528 | Note | |

**Note:**
Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

# 10. System Verification

## 10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

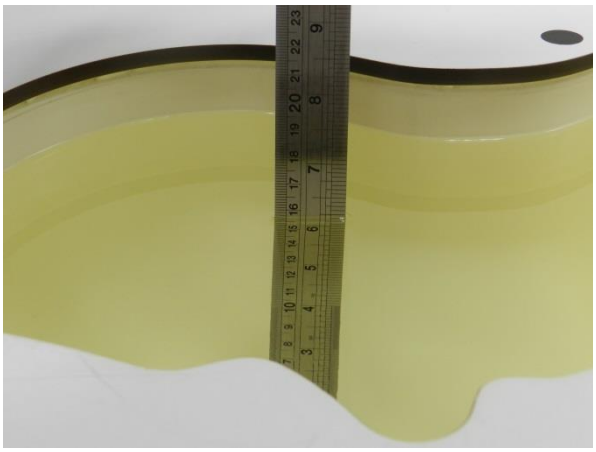


**Fig 10.1Photo of Liquid Height for Head SAR**

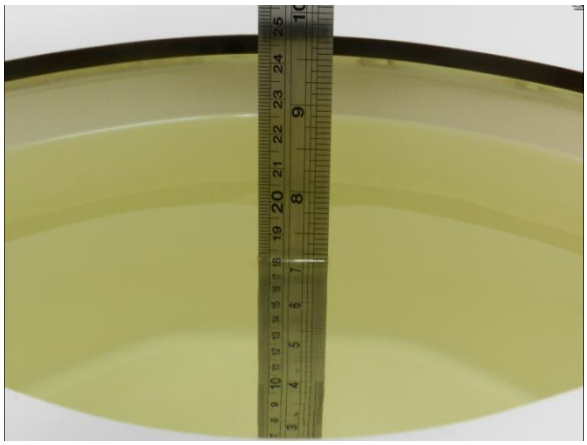


**Fig 10.2 Photo of Liquid Height for Body SAR**

## 10.2 Tissue Verification

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

| Frequency (MHz) | Water (%) | Sugar (%) | Cellulose (%) | Salt (%) | Preventol (%) | DGBE (%) | Conductivity (σ) | Permittivity (εr) |
|---|---|---|---|---|---|---|---|---|
| For Head | | | | | | | | |
| 835 | 40.3 | 57.9 | 0.2 | 1.4 | 0.2 | 0 | 0.90 | 41.5 |
| 1800, 1900, 2000 | 55.2 | 0 | 0 | 0.3 | 0 | 44.5 | 1.40 | 40.0 |
| For Body | | | | | | | | |
| 835 | 50.8 | 48.2 | 0 | 0.9 | 0.1 | 0 | 0.97 | 55.2 |
| 1800, 1900, 2000 | 70.2 | 0 | 0 | 0.4 | 0 | 29.4 | 1.52 | 53.3 |
| 2450 | 68.6 | 0 | 0 | 0 | 0 | 31.4 | 1.95 | 52.7 |

**<Tissue Dielectric Parameter Check Results>**

| Frequency (MHz) | Tissue Type | Liquid Temp. (℃) | Conductivity (σ) | Permittivity ($\varepsilon_r$) | Conductivity Target (σ) | Permittivity Target ($\varepsilon_r$) | Delta (σ) (%) | Delta ($\varepsilon_r$) (%) | Limit (%) | Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 835 | Head | 22.5 | 0.913 | 40.859 | 0.90 | 41.50 | 1.44 | -1.54 | ±5 | 2017/10/24 |
| 1900 | Head | 22.4 | 1.407 | 39.644 | 1.40 | 40.00 | 0.50 | -0.89 | ±5 | 2017/10/24 |
| 835 | Body | 22.7 | 0.994 | 55.570 | 0.97 | 55.20 | 2.47 | 0.67 | ±5 | 2017/10/24 |
| 1900 | Body | 22.6 | 1.580 | 54.631 | 1.52 | 53.30 | 3.95 | 2.50 | ±5 | 2017/10/24 |
| 2450 | Body | 22.9 | 1.991 | 52.320 | 1.95 | 52.70 | 2.10 | -0.72 | ±5 | 2017/10/24 |

## 10.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

| Date | Frequency (MHz) | Tissue Type | Input Power (mW) | Dipole S/N | Probe S/N | DAE S/N | Measured 1g SAR (W/kg) | Targeted 1g SAR (W/kg) | Normalized 1g SAR (W/kg) | Deviation (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2017/10/24 | 835 | Head | 250 | 4d162 | SN3819 | 1303 | 2.43 | 9.31 | 9.72 | 4.40 |
| 2017/10/24 | 1900 | Head | 250 | 5d182 | SN3819 | 1303 | 9.16 | 40.00 | 36.64 | -8.40 |
| 2017/10/24 | 835 | Body | 250 | 4d162 | SN3819 | 1303 | 2.54 | 9.64 | 10.16 | 5.39 |
| 2017/10/24 | 1900 | Body | 250 | 5d182 | SN3819 | 1303 | 11.00 | 40.80 | 44.00 | 7.84 |
| 2017/10/24 | 2450 | Body | 250 | 924 | SN3819 | 1303 | 13.50 | 50.50 | 54.00 | 6.93 |

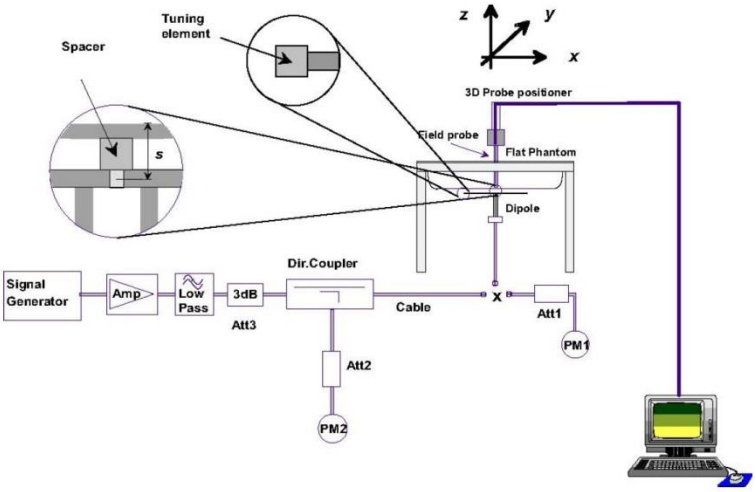



Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

# 11. RF Exposure Positions

## 11.1 Ear and handset reference point

Figure 9.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 9.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 9.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 9.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

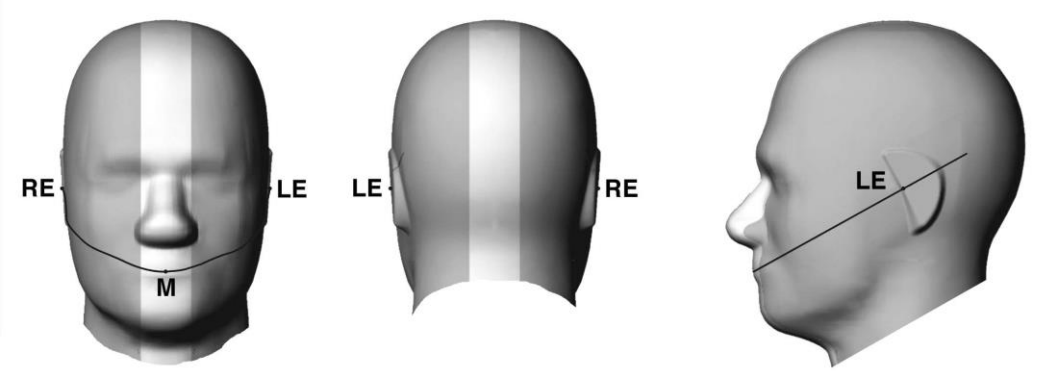



**Fig 9.1.1 Front, back, and side views of SAM twin phantom**

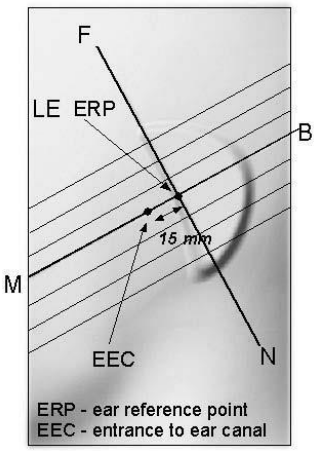



**Fig 9.1.2 Close-up side view of phantom showing the ear region.**

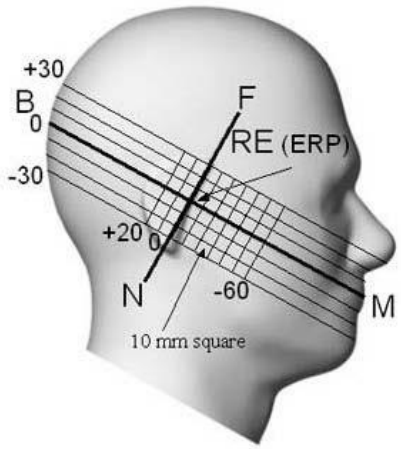



**Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations**

## 11.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 9.2.1 and Figure 9.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 9.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 9.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 9.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 9.2.3. The actual rotation angles should be documented in the test report.

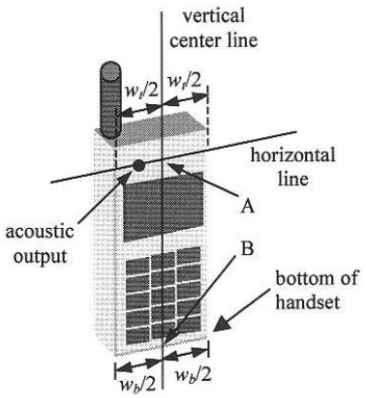



**Fig 9.2.1 Handset vertical and horizontal reference lines—"fixed case**

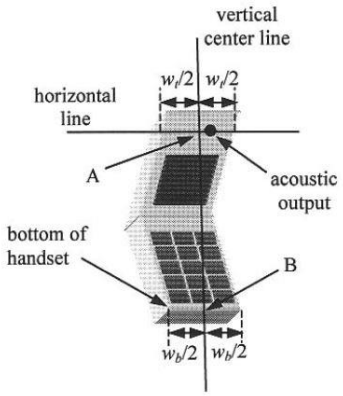



**Fig 9.2.2 Handset vertical and horizontal reference lines—"clam-shell case"**

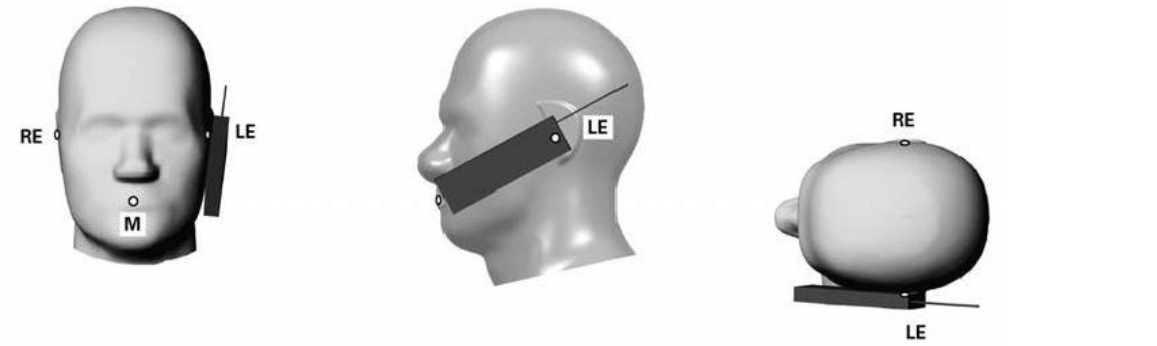



**Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.**

## 11.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 9.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

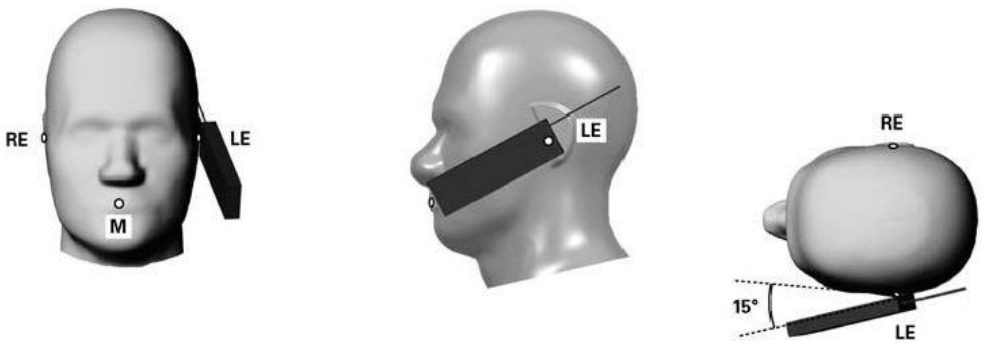



**Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.**

## 11.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. 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 handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

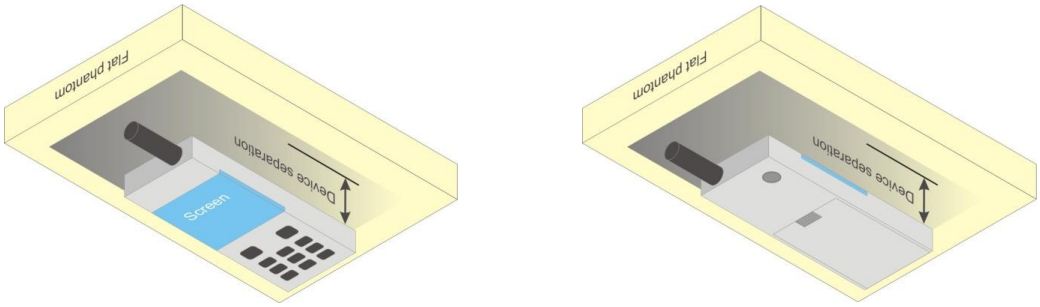



**Fig 9.4 Body Worn Position**

# 12. Conducted RF Output Power (Unit: dBm)

**<GSM Conducted Power>**

**General Note:**

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01v03r01, GSM Voice for GSM850/GSM1900 is considered to determine SAR testing.

| GSM850 | Burst Average Power (dBm) | | | Tune-up Limit (dBm) | Frame-Average Power (dBm) | | | Tune-up Limit (dBm) |
|---|---|---|---|---|---|---|---|---|
| Tx Channel | 128 | 189 | 251 | | 128 | 189 | 251 | |
| Frequency (MHz) | 824.2 | 836.4 | 848.8 | | 824.2 | 836.4 | 848.8 | |
| GSM 1 Tx slot | **32.22** | 32.05 | 32.01 | 32.50 | 23.22 | 23.05 | 23.01 | 23.50 |
| GPRS 1 Tx slot | 32.21 | 32.00 | 32.02 | 32.50 | 23.21 | 23.00 | 23.02 | 23.50 |
| GPRS 2 Tx slots | 30.58 | 30.54 | 30.52 | 31.00 | 24.58 | 24.54 | 24.52 | 25.00 |
| GPRS 3 Tx slots | 28.68 | 28.75 | 28.74 | 29.00 | 24.42 | 24.49 | 24.48 | 24.74 |
| GPRS 4 Tx slots | 26.65 | 26.66 | 26.64 | 27.00 | 23.65 | 23.66 | 23.64 | 24.00 |

**Remark:** The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.
The calculated method are shown as below:
Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB
Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB
Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB
Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

| GSM1900 | Burst Average Power (dBm) | | | Tune-up Limit (dBm) | Frame-Average Power (dBm) | | | Tune-up Limit (dBm) |
|---|---|---|---|---|---|---|---|---|
| Tx Channel | 512 | 661 | 810 | | 512 | 661 | 810 | |
| Frequency (MHz) | 1850.2 | 1880 | 1909.8 | | 1850.2 | 1880 | 1909.8 | |
| GSM 1 Tx slot | **29.24** | 29.05 | 29.15 | 29.50 | 20.24 | 20.05 | 20.15 | 20.50 |
| GPRS 1 Tx slot | 29.23 | 29.00 | 29.14 | 29.50 | 20.23 | 20.00 | 20.14 | 20.50 |
| GPRS 2 Tx slots | 27.44 | 27.23 | 27.08 | 28.00 | 21.44 | 21.23 | 21.08 | 22.00 |
| GPRS 3 Tx slots | 25.91 | 25.72 | 25.56 | 26.50 | 21.65 | 21.46 | 21.30 | 22.24 |
| GPRS 4 Tx slots | 23.82 | 23.66 | 23.50 | 24.00 | 20.82 | 20.66 | 20.50 | 21.00 |

**Remark:** The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.
The calculated method are shown as below:
Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB
Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB
Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB
Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

**<WCDMA Conducted Power>**

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.

A summary of these settings are illustrated below:

**HSDPA Setup Configuration:**

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors ($\beta_c$ and $\beta_d$) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

**Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{HS}$ (Note1, Note 2) | CM (dB) (Note 3) | MPR (dB) (Note 3) |
|---|---|---|---|---|---|---|---|
| 1 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 0.0 | 0.0 |
| 2 | 12/15 (Note 4) | 15/15 (Note 4) | 64 | 12/15 (Note 4) | 24/15 | 1.0 | 0.0 |
| 3 | 15/15 | 8/15 | 64 | 15/8 | 30/15 | 1.5 | 0.5 |
| 4 | 15/15 | 4/15 | 64 | 15/4 | 30/15 | 1.5 | 0.5 |

Note 1: $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, $\Delta_{ACK}$ and $\Delta_{NACK}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$, and $\Delta_{CQI}$ = 24/15 with $\beta_{hs}$ = 24/15 * $\beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d$ =12/15, $\beta_{hs}/\beta_c$=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the $\beta_c/\beta_d$ ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c$ = 11/15 and $\beta_d$ = 15/15.

**Setup Configuration**

**HSUPA Setup Configuration:**

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors ($\beta_c$ and $\beta_d$) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

**Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{HS}$ (Note1) | $\beta_{ec}$ | $\beta_{ed}$ (Note 4) (Note 5) | $\beta_{ed}$ (SF) | $\beta_{ed}$ (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) (Note 6) | AG Index (Note 5) | E-TFCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/225 | 1309/225 | 4 | 1 | 1.0 | 0.0 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | 4 | 1 | 3.0 | 2.0 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | $\beta_{ed}1$: 47/15<br>$\beta_{ed}2$: 47/15 | 4<br>4 | 2 | 2.0 | 1.0 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | 4 | 1 | 3.0 | 2.0 | 17 | 71 |
| 5 | 15/15 | 0 | - | - | 5/15 | 5/15 | 47/15 | 4 | 1 | 1.0 | 0.0 | 12 | 67 |

Note 1: For sub-test 1 to 4, $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$ . For sub-test 5, $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 5/15 with $\beta_{hs}$ = 5/15 * $\beta_c$ .

Note 2: CM = 1 for $\beta_c/\beta_d$ =12/15, $\beta_{hs}/\beta_c$=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the $\beta_c/\beta_d$ ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c$ = 10/15 and $\beta_d$ = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: $\beta_{ed}$ can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

**Setup Configuration**

**<WCDMA Conducted Power>**

**General Note:**

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA.

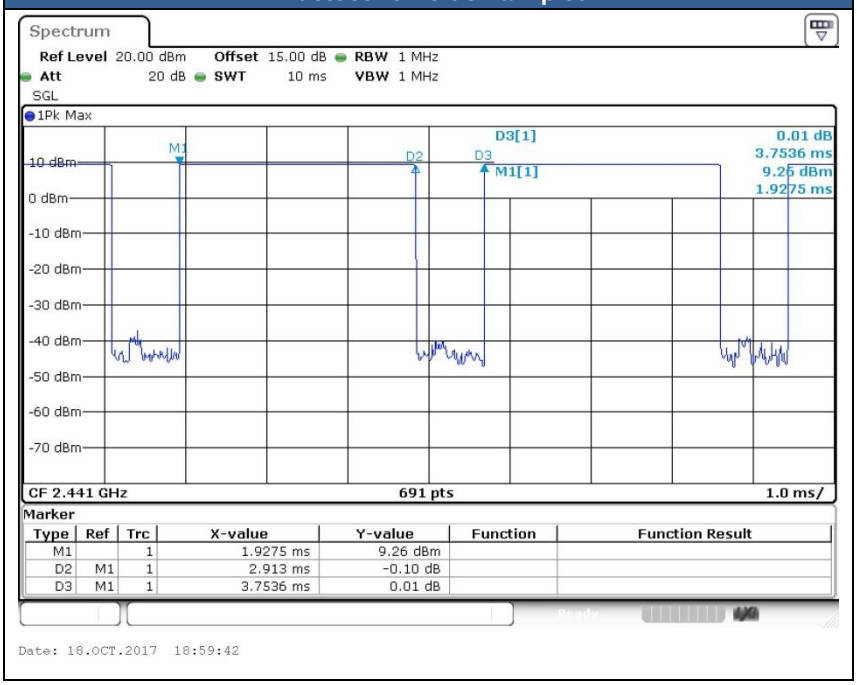
| Band | | WCDMA Band II | | | Tune-up Limit (dBm) | WCDMA Band V | | | Tune-up Limit (dBm) |
|---|---|---|---|---|---|---|---|---|---|
| Tx Channel | | 9262 | 9400 | 9538 | | 4132 | 4182 | 4233 | |
| Rx Channel | | 9662 | 9800 | 9938 | | 4357 | 4407 | 4458 | |
| Frequency (MHz) | | 1852.4 | 1880 | 1907.6 | | 826.4 | 836.4 | 846.6 | |
| 3GPP Rel 99 | AMR 12.2Kbps | 22.32 | 22.40 | 22.33 | 22.50 | 22.66 | 22.60 | 22.60 | 23.00 |
| 3GPP Rel 99 | RMC 12.2Kbps | 22.33 | **22.41** | 22.35 | 22.50 | **22.68** | 22.62 | 22.63 | 23.00 |
| 3GPP Rel 6 | HSDPA Subtest-1 | 22.25 | 22.40 | 22.34 | 22.50 | 22.62 | 22.32 | 22.54 | 23.00 |
| 3GPP Rel 6 | HSDPA Subtest-2 | 22.18 | 22.36 | 22.37 | 22.50 | 22.63 | 22.27 | 22.54 | 23.00 |
| 3GPP Rel 6 | HSDPA Subtest-3 | 22.18 | 22.34 | 22.32 | 22.50 | 22.62 | 22.27 | 22.55 | 23.00 |
| 3GPP Rel 6 | HSDPA Subtest-4 | 22.12 | 22.29 | 22.38 | 22.50 | 22.58 | 22.23 | 22.47 | 23.00 |
| 3GPP Rel 6 | HSUPA Subtest-1 | 21.47 | 20.98 | 21.25 | 21.50 | 21.24 | 20.89 | 21.13 | 21.50 |
| 3GPP Rel 6 | HSUPA Subtest-2 | 21.36 | 21.74 | 21.78 | 22.50 | 22.01 | 21.79 | 21.86 | 22.50 |
| 3GPP Rel 6 | HSUPA Subtest-3 | 21.63 | 21.82 | 21.95 | 22.50 | 22.10 | 21.77 | 22.01 | 22.50 |
| 3GPP Rel 6 | HSUPA Subtest-4 | 21.78 | 21.85 | 22.14 | 22.50 | 22.29 | 21.91 | 22.22 | 22.50 |
| 3GPP Rel 6 | HSUPA Subtest-5 | 22.10 | 22.00 | 22.10 | 22.50 | 22.30 | 22.00 | 22.20 | 22.50 |

**<2.4GHz Bluetooth>**

**General Note:**

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 77.61 % as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation

**Bluetooth time-domain plot**

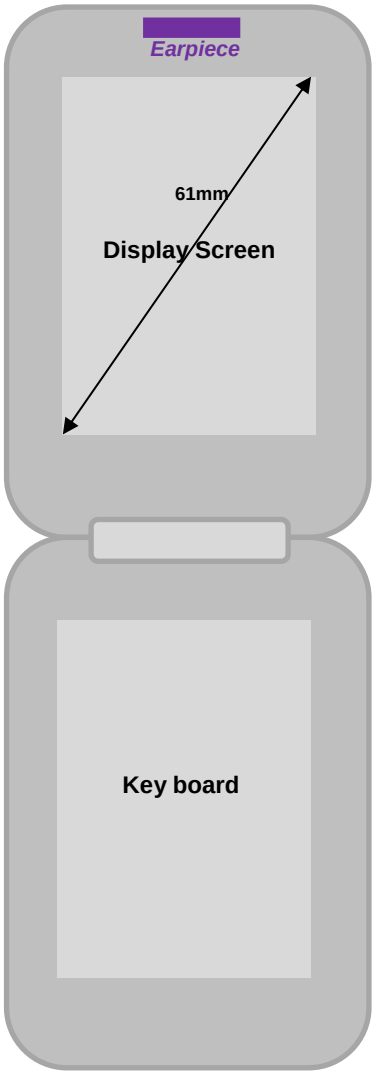



| Mode | Channel | Frequency (MHz) | Average power (dBm) |
|---|---|---|---|
| | | | 1Mbps |
| v2.1+EDR | CH 00 | 2402 | 9.28 |
| | CH 39 | 2441 | **9.46** |
| | CH 78 | 2480 | 9.38 |
| Tune-up limit (dBm) | | | 10.00 |

# 13. Antenna Location

**<Flip-Open Mode>**

**Top Side**




**Left Side**

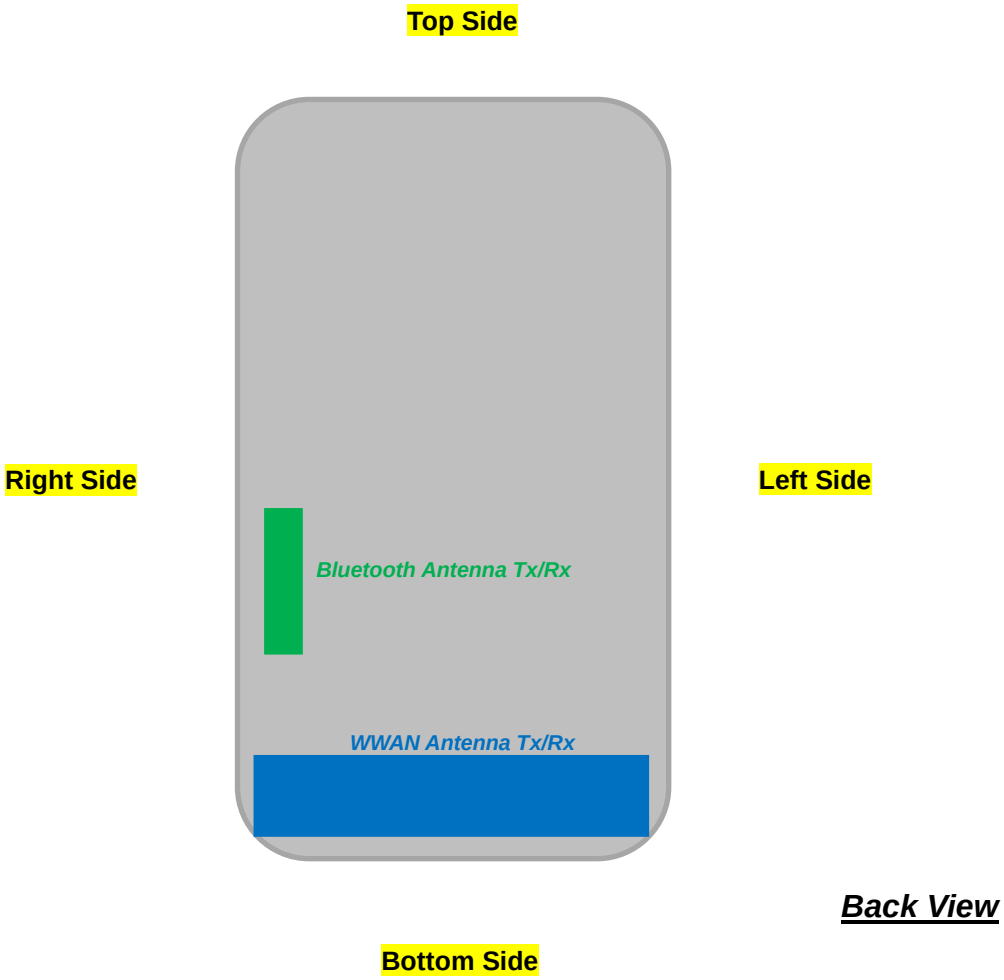
**Right Side**

Length: 101 mm
Width: 52 mm

***Front View***

**Bottom Side**

**<Flip-Close Mode>**



# 14. SAR Test Results

**General Note:**

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of Bluetooth signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, 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
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

**GSM Note:**

Per KDB 941225 D01v03r01, GSM Voice for GSM850/GSM1900 is considered.

**UMTS Note:**

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”.
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA.

## 14.1 Head SAR

**<GSM SAR>**

| Plot No. | Band | Mode | Flip Configuration | Test Position | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GSM850 | GSM Voice | Open | Right Cheek | 128 | 824.2 | 32.22 | 32.50 | 1.067 | 0.01 | 0.084 | 0.090 |
| | GSM850 | GSM Voice | Open | Right Tilted | 128 | 824.2 | 32.22 | 32.50 | 1.067 | 0.07 | 0.020 | 0.021 |
| 01 | GSM850 | GSM Voice | Open | Left Cheek | 128 | 824.2 | 32.22 | 32.50 | 1.067 | -0.03 | 0.093 | **0.099** |
| | GSM850 | GSM Voice | Open | Left Tilted | 128 | 824.2 | 32.22 | 32.50 | 1.067 | -0.01 | 0.018 | 0.019 |
| 02 | GSM1900 | GSM Voice | Open | Right Cheek | 512 | 1850.2 | 29.24 | 29.50 | 1.062 | 0.06 | 0.142 | **0.151** |
| | GSM1900 | GSM Voice | Open | Right Tilted | 512 | 1850.2 | 29.24 | 29.50 | 1.062 | 0.08 | 0.077 | 0.082 |
| | GSM1900 | GSM Voice | Open | Left Cheek | 512 | 1850.2 | 29.24 | 29.50 | 1.062 | 0.07 | 0.061 | 0.065 |
| | GSM1900 | GSM Voice | Open | Left Tilted | 512 | 1850.2 | 29.24 | 29.50 | 1.062 | 0.04 | 0.047 | 0.050 |

**<WCDMA SAR>**

| Plot No. | Band | Mode | Flip Configuration | Test Position | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WCDMA Band V | RMC 12.2Kbps | Open | Right Cheek | 4132 | 826.4 | 22.68 | 23.00 | 1.076 | 0.01 | 0.087 | 0.094 |
| | WCDMA Band V | RMC 12.2Kbps | Open | Right Tilted | 4132 | 826.4 | 22.68 | 23.00 | 1.076 | 0.04 | 0.019 | 0.020 |
| 03 | WCDMA Band V | RMC 12.2Kbps | Open | Left Cheek | 4132 | 826.4 | 22.68 | 23.00 | 1.076 | -0.05 | 0.120 | **0.129** |
| | WCDMA Band V | RMC 12.2Kbps | Open | Left Tilted | 4132 | 826.4 | 22.68 | 23.00 | 1.076 | 0.02 | 0.023 | 0.025 |
| 04 | WCDMA Band II | RMC 12.2Kbps | Open | Right Cheek | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.04 | 0.299 | **0.305** |
| | WCDMA Band II | RMC 12.2Kbps | Open | Right Tilted | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.04 | 0.146 | 0.149 |
| | WCDMA Band II | RMC 12.2Kbps | Open | Left Cheek | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.17 | 0.217 | 0.221 |
| | WCDMA Band II | RMC 12.2Kbps | Open | Left Tilted | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.01 | 0.138 | 0.141 |

## 14.2 Body Worn Accessory SAR

### <GSM SAR>

| Plot No. | Band | Mode | Flip Configuration | Test Position | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GSM850 | GSM Voice | Close | Front | 15 | 128 | 824.2 | 32.22 | 32.50 | 1.067 | 0.04 | 0.149 | 0.159 |
| 05 | GSM850 | GSM Voice | Close | Back | 15 | 128 | 824.2 | 32.22 | 32.50 | 1.067 | 0.04 | 0.456 | **0.486** |
| | GSM1900 | GSM Voice | Close | Front | 15 | 512 | 1850.2 | 29.24 | 29.50 | 1.062 | 0.1 | 0.091 | 0.097 |
| 06 | GSM1900 | GSM Voice | Close | Back | 15 | 512 | 1850.2 | 29.24 | 29.50 | 1.062 | 0.07 | 0.490 | **0.520** |

### <WCDMA SAR>

| Plot No. | Band | Mode | Flip Configuration | Test Position | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WCDMA Band V | RMC 12.2Kbps | Close | Front | 15 | 4132 | 826.4 | 22.68 | 23.00 | 1.076 | 0.05 | 0.164 | 0.177 |
| 07 | WCDMA Band V | RMC 12.2Kbps | Close | Back | 15 | 4132 | 826.4 | 22.68 | 23.00 | 1.076 | 0.01 | 0.505 | **0.544** |
| | WCDMA Band II | RMC 12.2Kbps | Close | Front | 15 | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.02 | 0.210 | 0.214 |
| 08 | WCDMA Band II | RMC 12.2Kbps | Close | Back | 15 | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.04 | 1.130 | **1.153** |
| | WCDMA Band II | RMC 12.2Kbps | Close | Back | 15 | 9262 | 1852.4 | 22.33 | 22.50 | 1.040 | 0.16 | 1.100 | 1.144 |
| | WCDMA Band II | RMC 12.2Kbps | Close | Back | 15 | 9538 | 1907.6 | 22.35 | 22.50 | 1.035 | 0.19 | 0.998 | 1.033 |

### <Bluetooth SAR>

| Plot No. | Band | Mode | Flip Configuration | Test Position | Gap (mm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 09 | Bluetooth | 1Mbps | Close | Front | 15 | 39 | 2441 | 9.46 | 10.00 | 1.132 | 77.61 | 1.073 | 0.05 | 0.005 | **0.006** |
| | Bluetooth | 1Mbps | Close | Back | 15 | 39 | 2441 | 9.46 | 10.00 | 1.132 | 77.61 | 1.073 | 0.01 | 0.003 | 0.004 |

## 14.3 Repeated SAR Measurement

| No. | Band | Mode | Flip Configuration | Test Position | Gap (cm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Power Drift (dB) | Measured 1g SAR (W/kg) | Ratio | Reported 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st | WCDMA Band II | RMC 12.2Kbps | Close | Back | 15 | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.04 | 1.130 | 1 | 1.153 |
| 2nd | WCDMA Band II | RMC 12.2Kbps | Close | Back | 15 | 9400 | 1880 | 22.41 | 22.50 | 1.020 | 0.06 | 1.120 | 1.009 | 1.143 |

**General Note:**

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

# 15. Simultaneous Transmission Analysis

| NO. | Simultaneous Transmission Configurations | Mobile phone | |
|---|---|---|---|
| | | Head | Body-worn |
| 1. | GSM Voice + Bluetooth | | Yes |
| 2. | WCDMA + Bluetooth | | Yes |

**General Note:**

1. This device does not support VoIP function.
2. EUT will choose either GSM or WCDMA 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. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.

## 15.1 Body-Worn Accessory Exposure Conditions

| WWAN Band | | Exposure Position | 1 | 2 | 1+2 Summed 1g SAR (W/kg) |
|---|---|---|---|---|---|
| | | | WWAN | Bluetooth | |
| | | | 1g SAR (W/kg) | Reported 1g SAR (W/kg) | |
| GSM | GSM850 | Front | 0.159 | 0.006 | 0.17 |
| | | Back | 0.486 | 0.004 | 0.49 |
| | GSM1900 | Front | 0.097 | 0.006 | 0.10 |
| | | Back | 0.520 | 0.004 | 0.52 |
| WCDMA | Band V | Front | 0.177 | 0.006 | 0.18 |
| | | Back | 0.544 | 0.004 | 0.55 |
| | Band II | Front | 0.214 | 0.006 | 0.22 |
| | | Back | 1.153 | 0.004 | **1.16** |

**Test Engineer：** Weilong Chen

# 16. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

| Uncertainty Distributions | Normal | Rectangular | Triangular | U-Shape |
|---|---|---|---|---|
| Multi-plying Factor[(a)] | 1/k[(b)] | $1/\sqrt{3}$ | $1/\sqrt{6}$ | $1/\sqrt{2}$ |

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) $\kappa$ is the coverage factor

**Table 16.1. Standard Uncertainty for Assumed Distribution**

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

| Error Description | Uncertainty Value (±%) | Probability | Divisor | (Ci) 1g | (Ci) 10g | Standard Uncertainty (1g) (±%) | Standard Uncertainty (10g) (±%) |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe Calibration | 6.00 | N | 1 | 1 | 1 | 6.0 | 6.0 |
| Axial Isotropy | 4.70 | R | 1.732 | 0.7 | 0.7 | 1.9 | 1.9 |
| Hemispherical Isotropy | 9.60 | R | 1.732 | 0.7 | 0.7 | 3.9 | 3.9 |
| Boundary Effects | 1.00 | R | 1.732 | 1 | 1 | 0.6 | 0.6 |
| Linearity | 4.70 | R | 1.732 | 1 | 1 | 2.7 | 2.7 |
| System Detection Limits | 1.00 | R | 1.732 | 1 | 1 | 0.6 | 0.6 |
| Modulation Response | 4.68 | R | 1.732 | 1 | 1 | 2.7 | 2.7 |
| Readout Electronics | 0.30 | N | 1 | 1 | 1 | 0.3 | 0.3 |
| Response Time | 0.00 | R | 1.732 | 1 | 1 | 0.0 | 0.0 |
| Integration Time | 2.60 | R | 1.732 | 1 | 1 | 1.5 | 1.5 |
| RF Ambient Noise | 3.00 | R | 1.732 | 1 | 1 | 1.7 | 1.7 |
| RF Ambient Reflections | 3.00 | R | 1.732 | 1 | 1 | 1.7 | 1.7 |
| Probe Positioner | 0.40 | R | 1.732 | 1 | 1 | 0.2 | 0.2 |
| Probe Positioning | 2.90 | R | 1.732 | 1 | 1 | 1.7 | 1.7 |
| Max. SAR Eval. | 2.00 | R | 1.732 | 1 | 1 | 1.2 | 1.2 |
| **Test Sample Related** | | | | | | | |
| Device Positioning | 3.03 | N | 1 | 1 | 1 | 3.0 | 3.0 |
| Device Holder | 3.60 | N | 1 | 1 | 1 | 3.6 | 3.6 |
| Power Drift | 5.00 | R | 1.732 | 1 | 1 | 2.9 | 2.9 |
| Power Scaling | 0.00 | R | 1.732 | 1 | 1 | 0.0 | 0.0 |
| **Phantom and Setup** | | | | | | | |
| Phantom Uncertainty | 6.10 | R | 1.732 | 1 | 1 | 3.5 | 3.5 |
| SAR correction | 0.00 | R | 1.732 | 1 | 0.84 | 0.0 | 0.0 |
| Liquid Conductivity Repeatability | 0.03 | N | 1 | 0.78 | 0.71 | 0.0 | 0.0 |
| Liquid Conductivity (target) | 5.00 | R | 1.732 | 0.78 | 0.71 | 2.3 | 2.0 |
| Liquid Conductivity (mea.) | 2.50 | R | 1.732 | 0.78 | 0.71 | 1.1 | 1.0 |
| Temp. unc. - Conductivity | 3.68 | R | 1.732 | 0.78 | 0.71 | 1.7 | 1.5 |
| Liquid Permittivity Repeatability | 0.02 | N | 1 | 0.23 | 0.26 | 0.0 | 0.0 |
| Liquid Permittivity (target) | 5.00 | R | 1.732 | 0.23 | 0.26 | 0.7 | 0.8 |
| Liquid Permittivity (mea.) | 2.50 | R | 1.732 | 0.23 | 0.26 | 0.3 | 0.4 |
| Temp. unc. - Permittivity | 0.84 | R | 1.732 | 0.23 | 0.26 | 0.1 | 0.1 |
| **Combined Std. Uncertainty** | | | | | | 11.6% | 11.6% |
| **Coverage Factor for 95 %** | | | | | | K=2 | K=2 |
| **Expanded STD Uncertainty** | | | | | | 23.2% | 23.1% |

**Table 16.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz**

# 17. References


[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] 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”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[6] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.

[7] FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, Oct 2015

[8] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[9] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.

# Appendix A. Plots of System Performance Check

The plots are shown as follows.

## System Check_Head_835MHz_171024

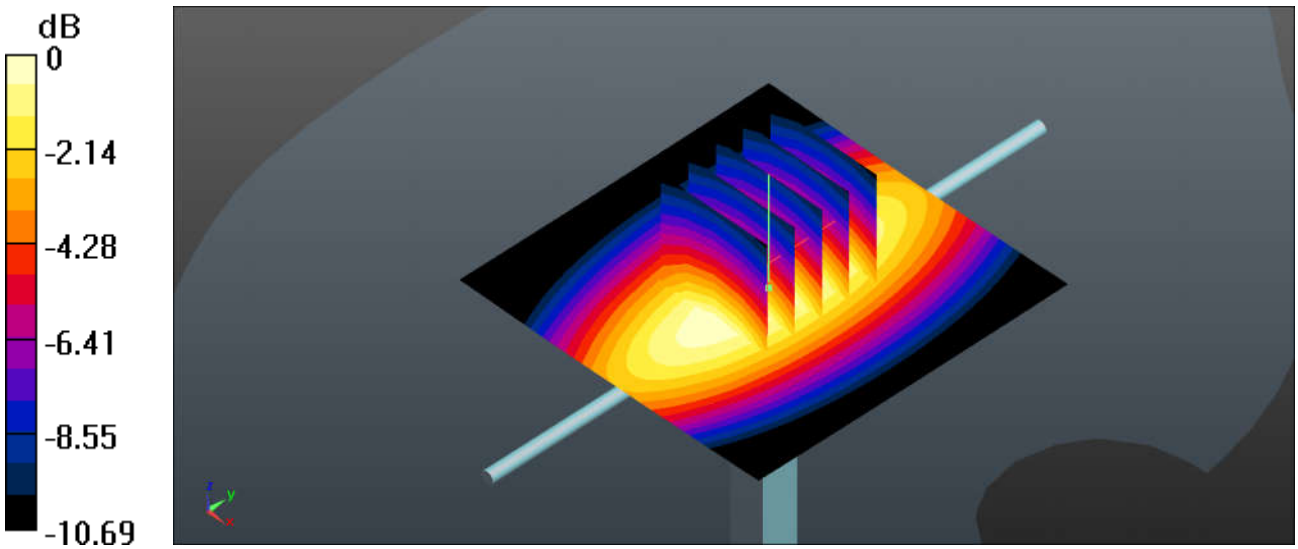
**DUT: D835V2-SN:4d162**

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_171024 Medium parameters used: f = 835 MHz; $\sigma$ = 0.913 S/m; $\varepsilon_r$ = 40.859; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.3 ℃； Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.19 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 60.82 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.60 W/kg
**SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.6 W/kg**
Maximum value of SAR (measured) = 3.07 W/kg




0 dB = 3.07 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017.10.24

## System Check_Head_1900MHz_171024

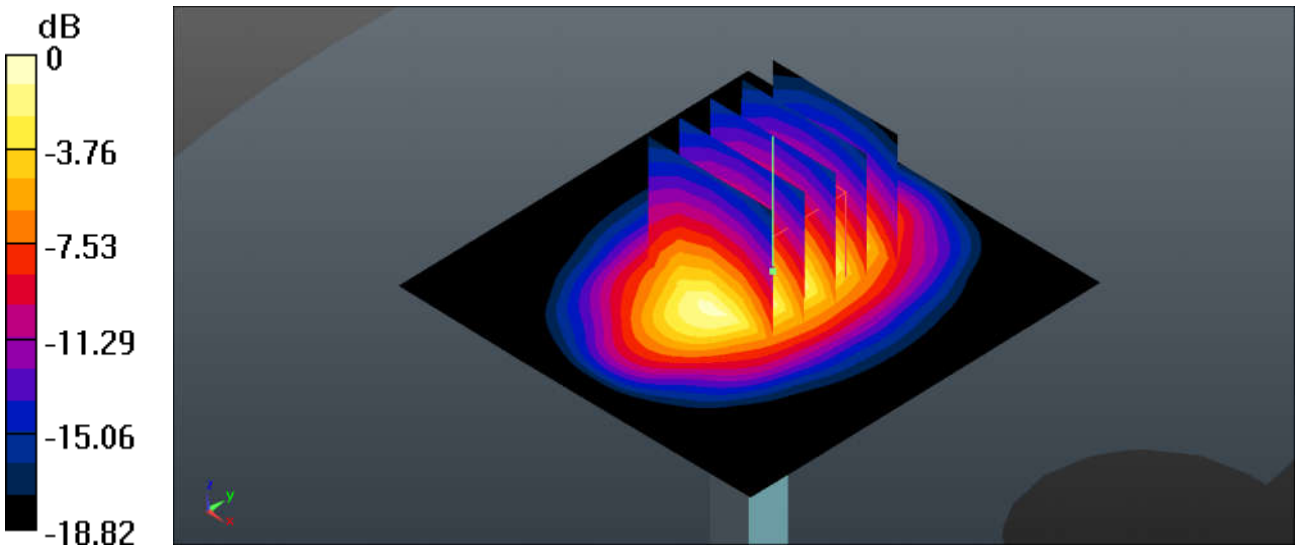
**DUT: D1900V2-SN:5d182**

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_171024 Medium parameters used: f = 1900 MHz; $\sigma$ = 1.407 S/m; $\varepsilon_r$ = 39.644; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.4 ℃； Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 13.6 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.00 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 16.9 W/kg
**SAR(1 g) = 9.16 W/kg; SAR(10 g) = 4.74 W/kg**
Maximum value of SAR (measured) = 13.0 W/kg




0 dB = 13.0 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017.10.24

## System Check_Body_835MHz_171024

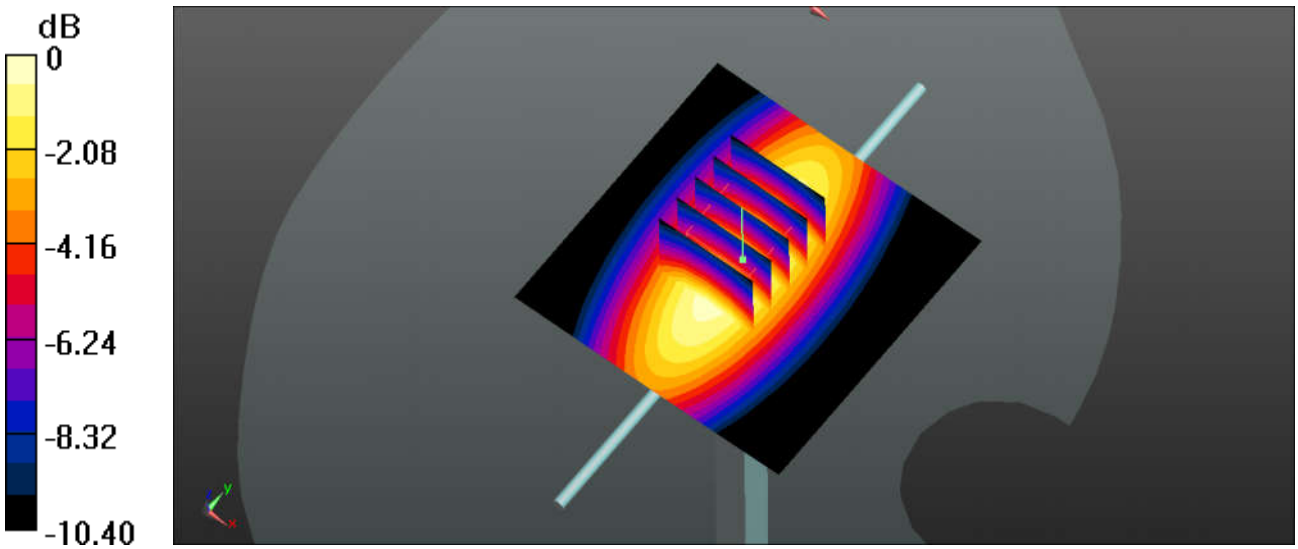
**DUT: D835V2-SN:4d162**

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL_835_170104 Medium parameters used: f = 835 MHz; $\sigma$ = 0.994 S/m; $\varepsilon_r$ = 55.57; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.4 ℃； Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.53, 9.53, 9.53); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.19 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 51.98 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 3.71 W/kg
**SAR(1 g) = 2.54 W/kg; SAR(10 g) = 1.68 W/kg**
Maximum value of SAR (measured) = 3.20 W/kg




0 dB = 3.19 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017.10.24

## System Check_Body_1900MHz_171024

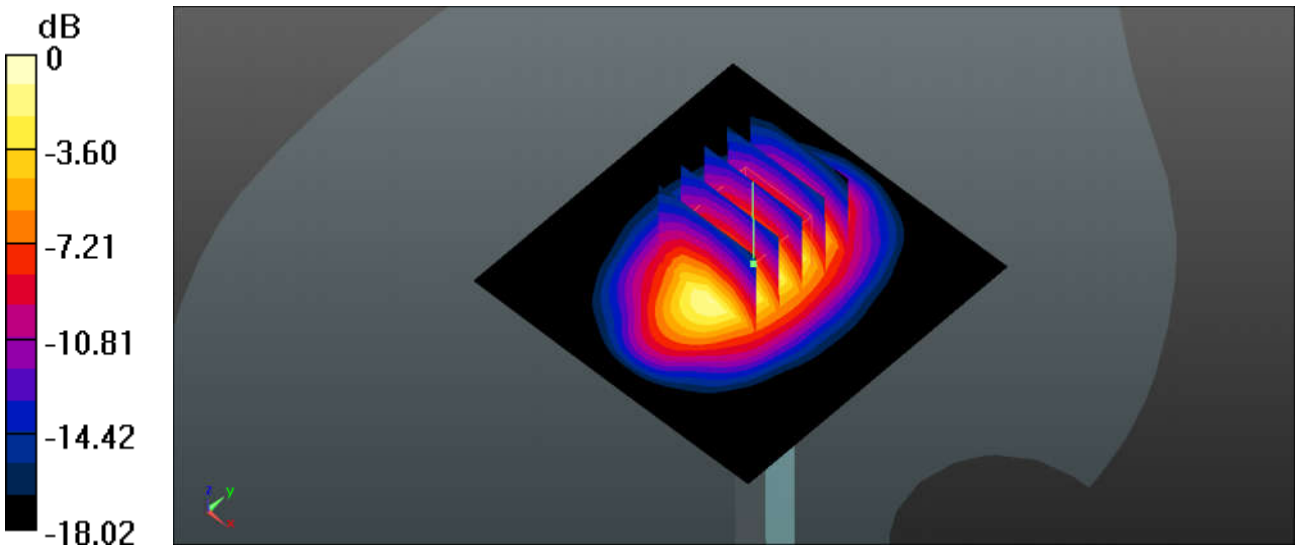
**DUT: D1900V2-SN:5d182**

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_171024 Medium parameters used: f = 1900 MHz; $\sigma$ = 1.58 S/m; $\varepsilon_r$ = 54.631; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.3 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.77, 7.77, 7.77); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (61x61x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 15.5 W/kg

**Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 87.48 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 19.6 W/kg
**SAR(1 g) = 11 W/kg; SAR(10 g) = 5.75 W/kg**
Maximum value of SAR (measured) = 15.4 W/kg




0 dB = 15.5 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017.10.24

## System Check_Body_2450MHz_171024

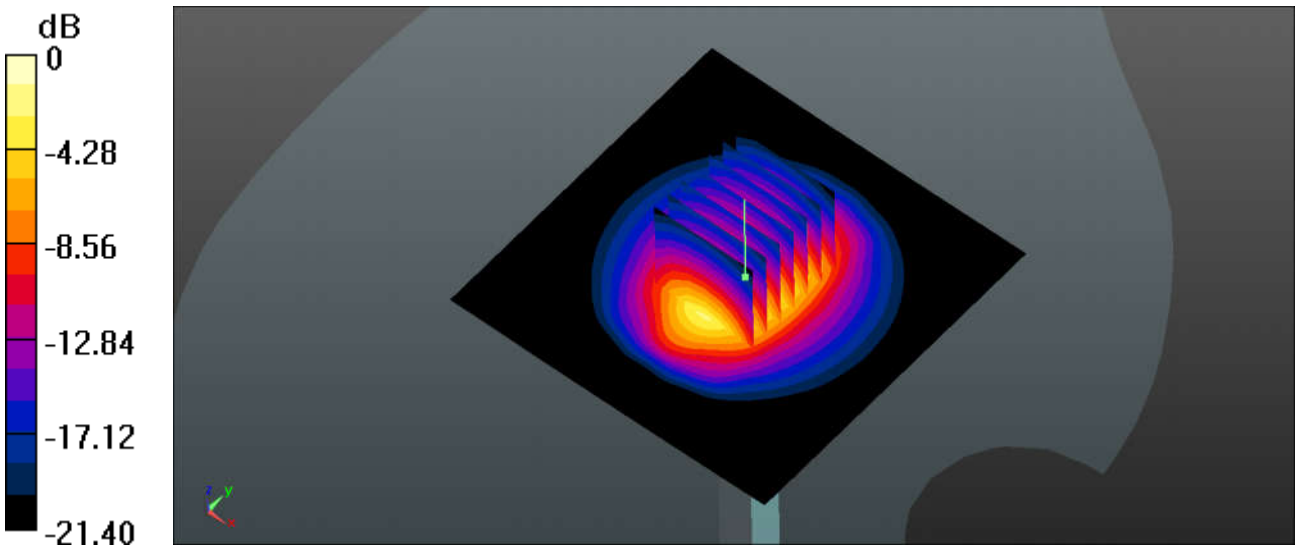
**DUT: D2450V2-SN:924**

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_171024 Medium parameters used: f = 2450 MHz; $\sigma$ = 1.991 S/m; $\varepsilon_r$ = 52.32; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.4 ℃； Liquid Temperature：22.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.34, 7.34, 7.34); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Pin=250mW/Area Scan (81x81x1):** Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 20.9 W/kg

**Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.51 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 28.1 W/kg
**SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.3 W/kg**
Maximum value of SAR (measured) = 21.0 W/kg




0 dB = 20.9 W/kg

# Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

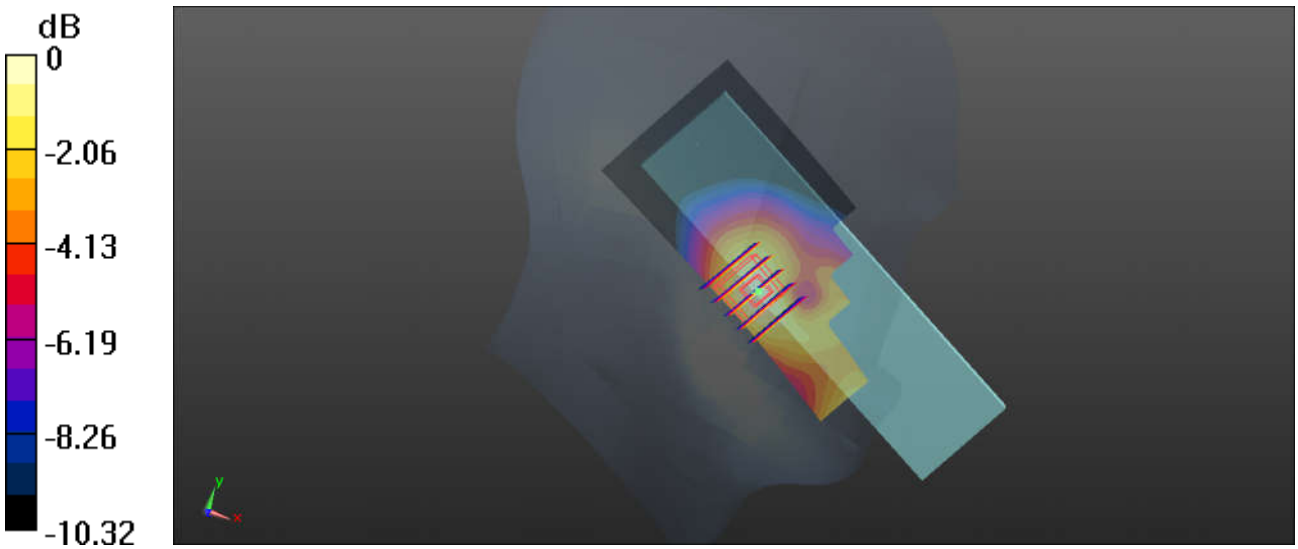
## 01_GSM850_GSM Voice_Left Cheek_Ch128

Communication System: UID 0, Generic GSM (0); Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium: HSL_835_171024 Medium parameters used: f = 824.2 MHz; $\sigma$ = 0.903 S/m; $\varepsilon_r$ = 40.977; $\rho$= 1000 kg/m$^3$
Ambient Temperature：23.3 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch128/Area Scan (51x151x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.123 W/kg

**Ch128/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.708 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.140 W/kg
**SAR(1 g) = 0.093 W/kg; SAR(10 g) = 0.059 W/kg**
Maximum value of SAR (measured) = 0.121 W/kg




0 dB = 0.121 W/kg

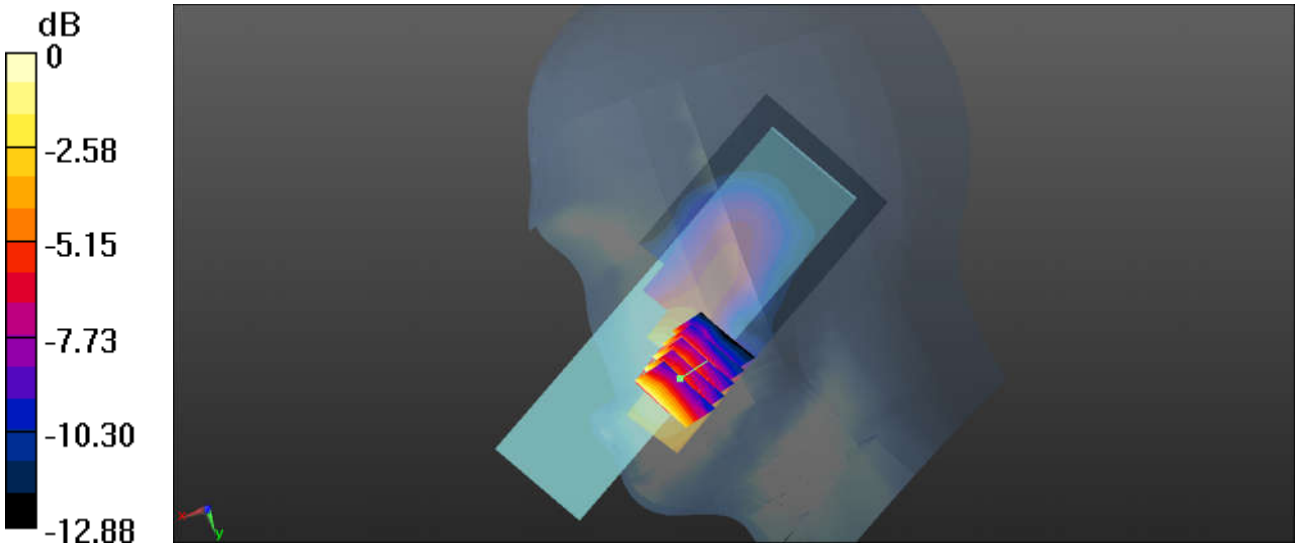
## 02_GSM1900_GSM Voice_Right Cheek_Ch512

Communication System: UID 0, Generic GSM (0); Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: HSL_1900_171024 Medium parameters used: f = 1850.2 MHz; $\sigma$ = 1.361 S/m; $\varepsilon_r$ = 39.822; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch512/Area Scan (51x151x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.174 W/kg

**Ch512/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.510 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.202 W/kg
**SAR(1 g) = 0.142 W/kg; SAR(10 g) = 0.095 W/kg**
Maximum value of SAR (measured) = 0.172 W/kg




0 dB = 0.174 W/kg

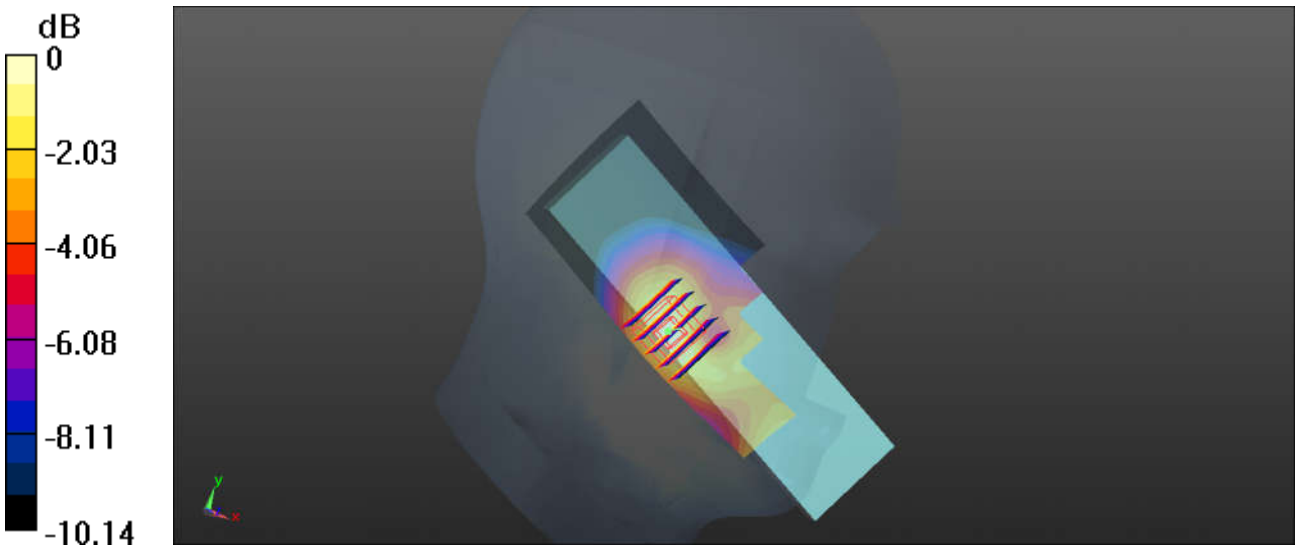
## 03_WCDMA Band V_RMC 12.2Kbps_Left Cheek_Ch4132

Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_171024 Medium parameters used: f = 826.4 MHz; $\sigma$ = 0.905 S/m; $\varepsilon_r$ = 40.951; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.3 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4132/Area Scan (51x151x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.154 W/kg

**Ch4132/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.019 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.199 W/kg
**SAR(1 g) = 0.120 W/kg; SAR(10 g) = 0.074 W/kg**
Maximum value of SAR (measured) = 0.156 W/kg




0 dB = 0.154 W/kg

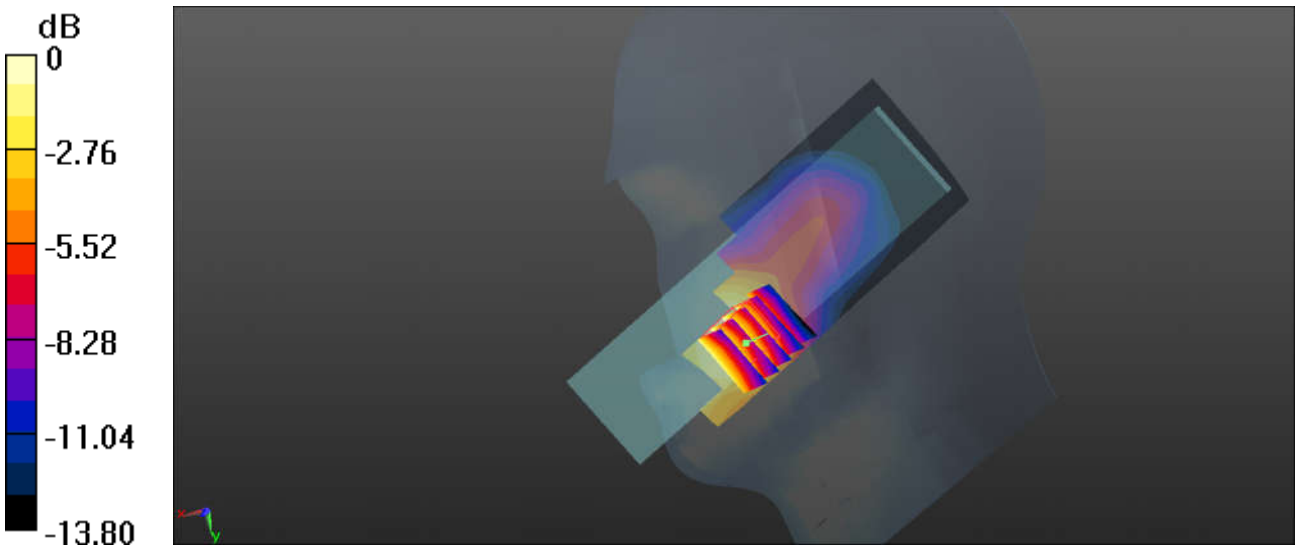
## 04_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_171024 Medium parameters used: f = 1880 MHz; $\sigma$ = 1.388 S/m; $\varepsilon_r$ = 39.717; $\rho$= 1000 kg/m$^3$
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9400/Area Scan (61x181x1):** Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.360 W/kg

**Ch9400/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.38 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.429 W/kg
**SAR(1 g) = 0.299 W/kg; SAR(10 g) = 0.200 W/kg**
Maximum value of SAR (measured) = 0.366 W/kg




0 dB = 0.360 W/kg

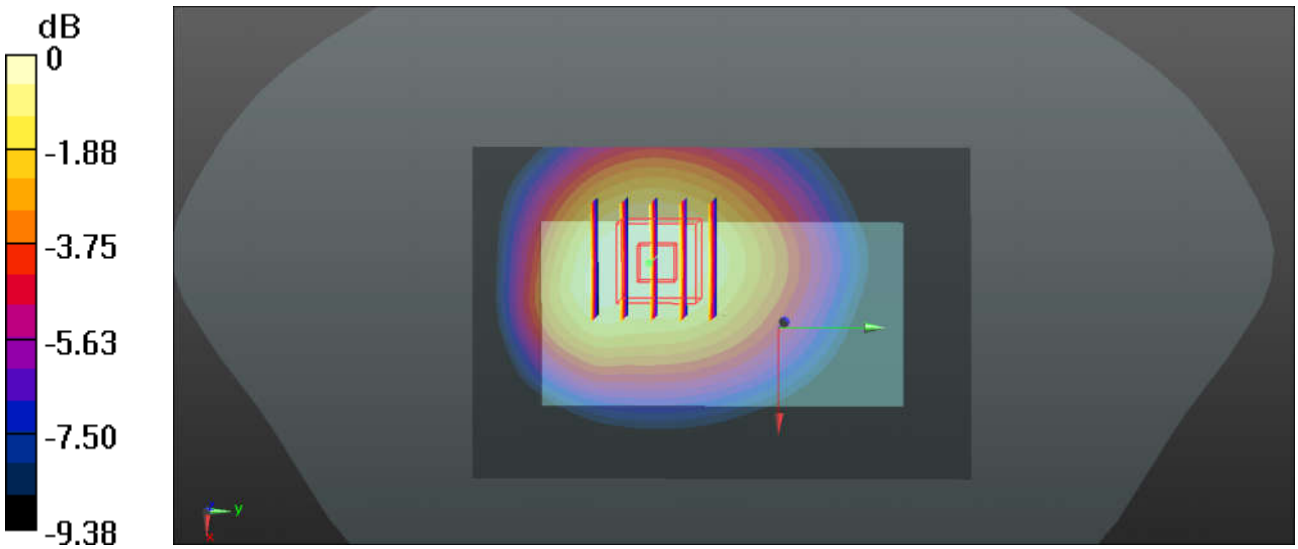
## 05_GSM850_GSM Voice_Back_15mm_Ch128

Communication System: UID 0, Generic GSM (0); Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium: MSL_835_171024 Medium parameters used: f = 824.2 MHz; $\sigma$ = 0.984 S/m; $\varepsilon_r$ = 55.661; $\rho$= 1000 kg/m$^3$
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.53, 9.53, 9.53); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch128/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.538 W/kg

**Ch128/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.316 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.604 W/kg
**SAR(1 g) = 0.456 W/kg; SAR(10 g) = 0.328 W/kg**
Maximum value of SAR (measured) = 0.542 W/kg




0 dB = 0.538 W/kg

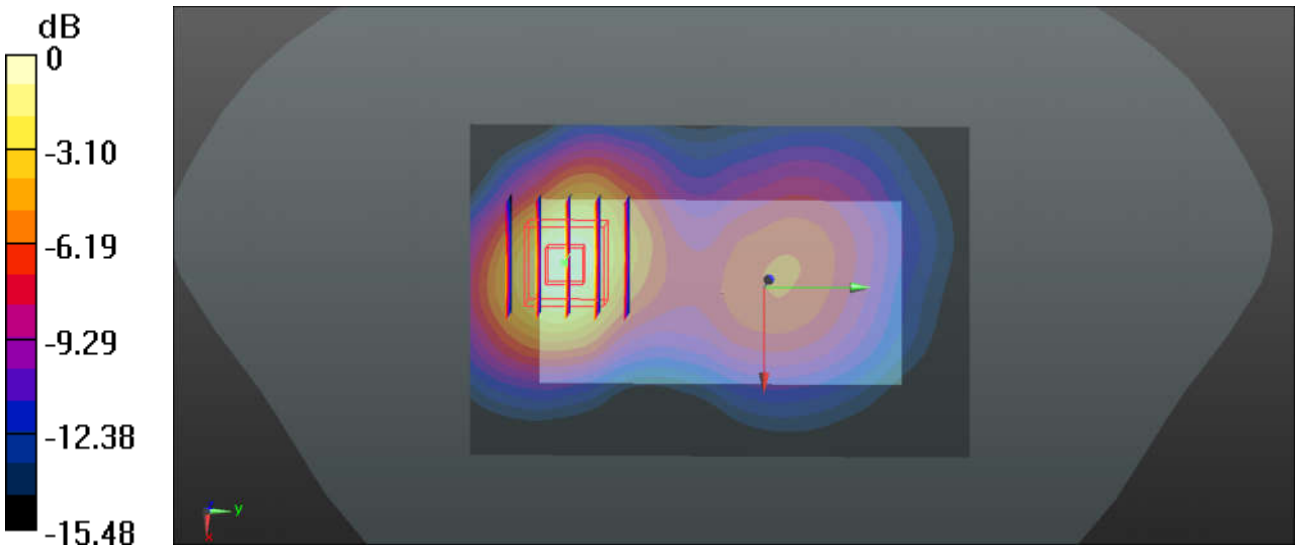
## 06_GSM1900_GSM Voice_Back_15mm_Ch512

Communication System: UID 0, Generic GSM (0); Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: MSL_1900_171024 Medium parameters used: f = 1850.2 MHz; $\sigma$ = 1.515 S/m; $\varepsilon_r$ = 54.748; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.3 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.77, 7.77, 7.77); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch512/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.696 W/kg

**Ch512/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.072 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.814 W/kg
**SAR(1 g) = 0.490 W/kg; SAR(10 g) = 0.276 W/kg**
Maximum value of SAR (measured) = 0.666 W/kg




0 dB = 0.696 W/kg

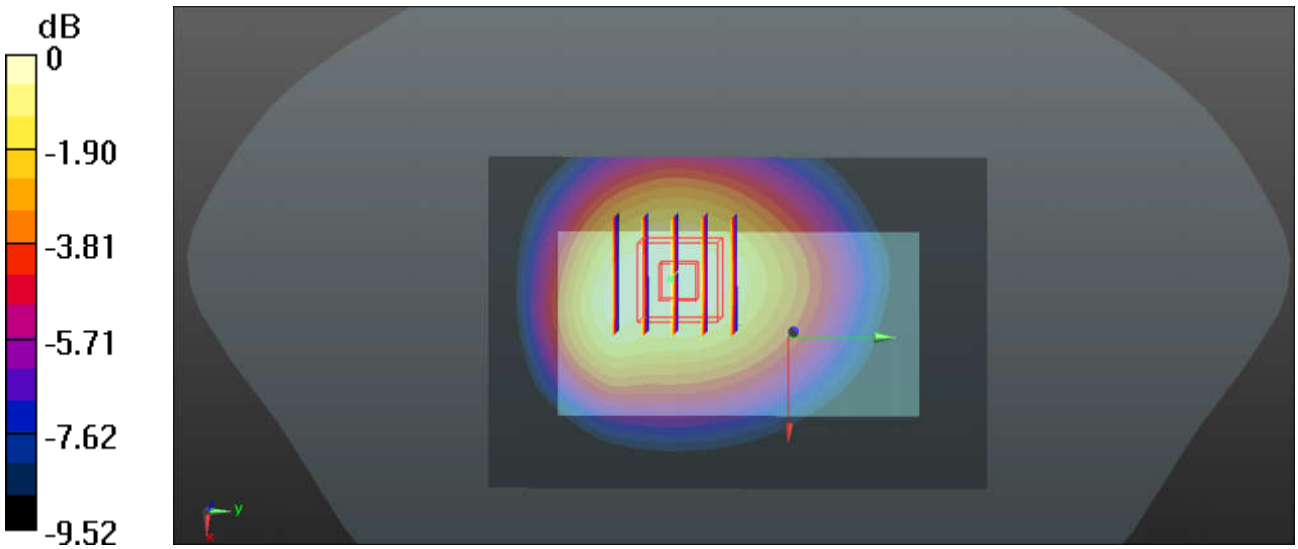
## 07_WCDMA Band V_RMC 12.2Kbps_Back_15mm_Ch4132

Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz;Duty Cycle: 1:1
Medium: MSL_835_171024 Medium parameters used: f = 826.4 MHz; $\sigma$ = 0.986 S/m; $\varepsilon_r$ = 55.641; $\rho$ = 1000 kg/m$^3$
Ambient Temperature：23.4 ℃； Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.53, 9.53, 9.53); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4132/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.611 W/kg

**Ch4132/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.461 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.673 W/kg
**SAR(1 g) = 0.505 W/kg; SAR(10 g) = 0.365 W/kg**
Maximum value of SAR (measured) = 0.599 W/kg




0 dB = 0.611 W/kg

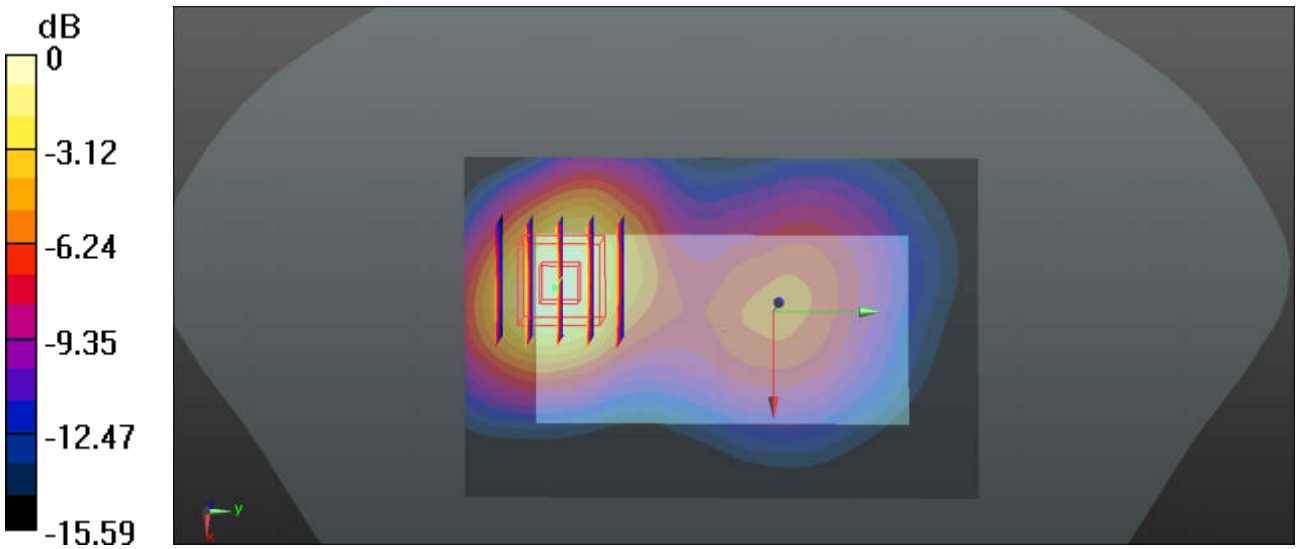
## 08_WCDMA Band II_RMC 12.2Kbps_Back_15mm_Ch9400

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: MSL_1900_171024 Medium parameters used: f = 1880 MHz; $\sigma$ = 1.557 S/m; $\varepsilon_r$ = 54.666; $\rho$= 1000 kg/m$^3$
Ambient Temperature：23.3 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.77, 7.77, 7.77); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9400/Area Scan (61x91x1):** Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.55 W/kg

**Ch9400/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.293 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.89 W/kg
**SAR(1 g) = 1.13 W/kg; SAR(10 g) = 0.641 W/kg**
Maximum value of SAR (measured) = 1.54 W/kg




0 dB = 1.55 W/kg

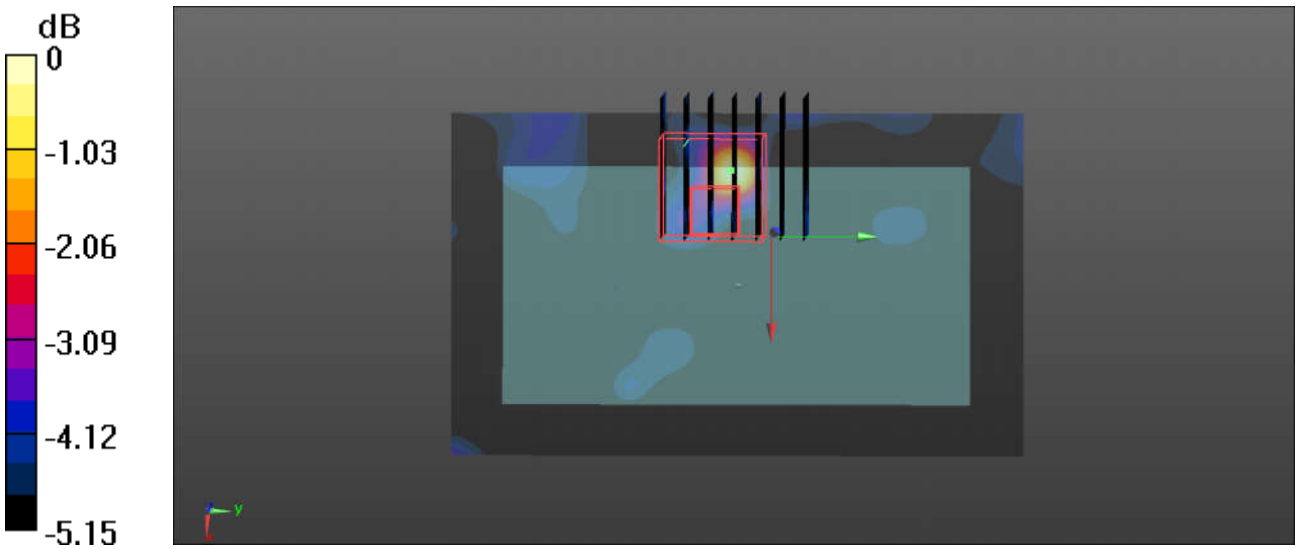
## 09_Bluetooth_1Mbps_Front_15mm_Ch39

Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz;Duty Cycle: 1:1.288
Medium: MSL_2450_171024 Medium parameters used: f = 2441 MHz; $\sigma$ = 1.978 S/m; $\varepsilon_r$ = 52.377; $\rho$= 1000 kg/m$^3$
Ambient Temperature：23.4 ℃; Liquid Temperature：22.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.34, 7.34, 7.34); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch39/Area Scan (61x101x1):** Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.0153 W/kg

**Ch39/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.488 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.00685 W/kg
**SAR(1 g) = 0.005 W/kg; SAR(10 g) = 0.00446 W/kg**
Maximum value of SAR (measured) = 0.00680 W/kg




0 dB = 0.0153 W/kg

# Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client **Sporton-CN** **Certificate No: Z16-97224**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D835V2 - SN: 4d162 |
| Calibration Procedure(s) | FD-Z11-003-01<br>Calibration Procedures for dipole validation kits |
| Calibration date: | November 22, 2016 |

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 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Power sensor NRP-Z91 | 101547 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Reference Probe EX3DV4 | SN 7433 | 26-Sep-16(SPEAG,No.EX3-7433_Sep16) | Sep-17 |
| DAE4 | SN 771 | 02-Feb-16(CTTL-SPEAG,No.Z16-97011) | Feb-17 |
| **Secondary Standards** | **ID #** | **Cal Date(Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| Signal Generator E4438C | MY49071430 | 01-Feb-16 (CTTL, No.J16X00893) | Jan-17 |
| Network Analyzer E5071C | MY46110673 | 26-Jan-16 (CTTL, No.J16X00894) | Jan-17 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Zhao Jing | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: November 26, 2016

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

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

**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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
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%.

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY52 | 52.8.8.1258 |
| **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 | 41.4 ± 6 % | 0.92 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 | 2.36 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **9.31 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | Condition | |
| SAR measured | 250 mW input power | 1.55 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **6.13 mW /g ± 20.4 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 55.2 | 0.97 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 54.2 ± 6 % | 0.95 mho/m ± 6 % |
| **Body TSL temperature change during test** | <1.0 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 2.39 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **9.64 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | Condition | |
| SAR measured | 250 mW input power | 1.59 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **6.41 mW /g ± 20.4 % (k=2)** |

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## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 51.0Ω- 2.13jΩ |
| Return Loss | - 32.6dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 48.0Ω- 3.53jΩ |
| Return Loss | - 27.7dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.326 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: 11.22.2016

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162**

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

Medium parameters used: f = 835 MHz; $\sigma$ = 0.916 S/m; $\varepsilon_r$ = 41.41; $\rho$ = 1000 kg/m$^3$

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.82, 9.82, 9.82); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

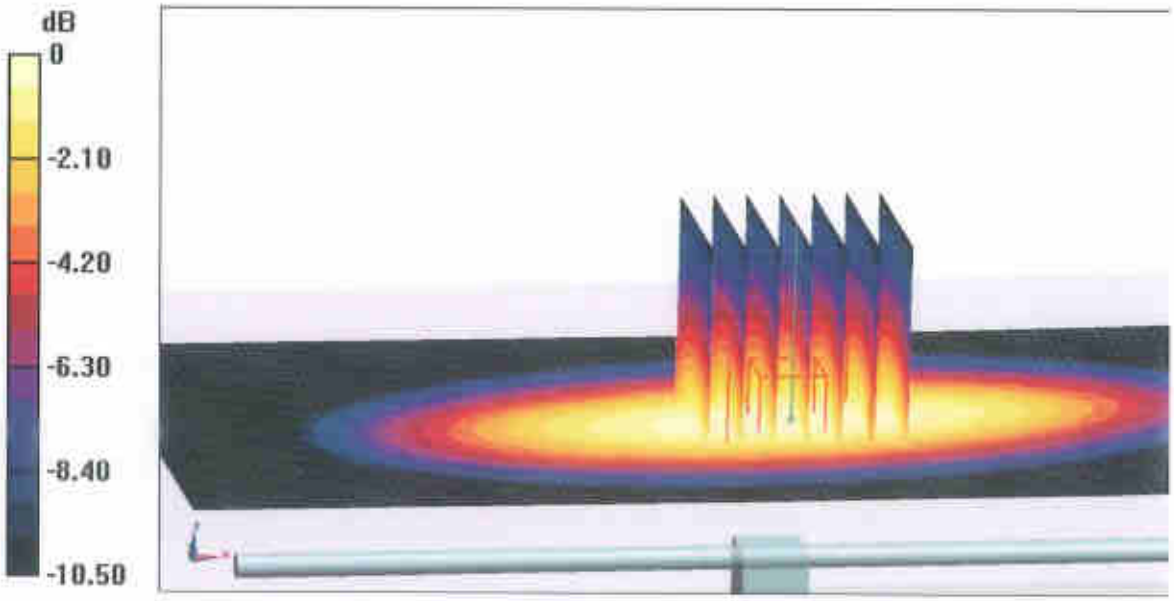
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.15V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.53 W/kg

**SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.55 W/kg**

Maximum value of SAR (measured) = 3.00 W/kg




**0 dB = 3.00 W/kg = 4.77 dBW/kg**

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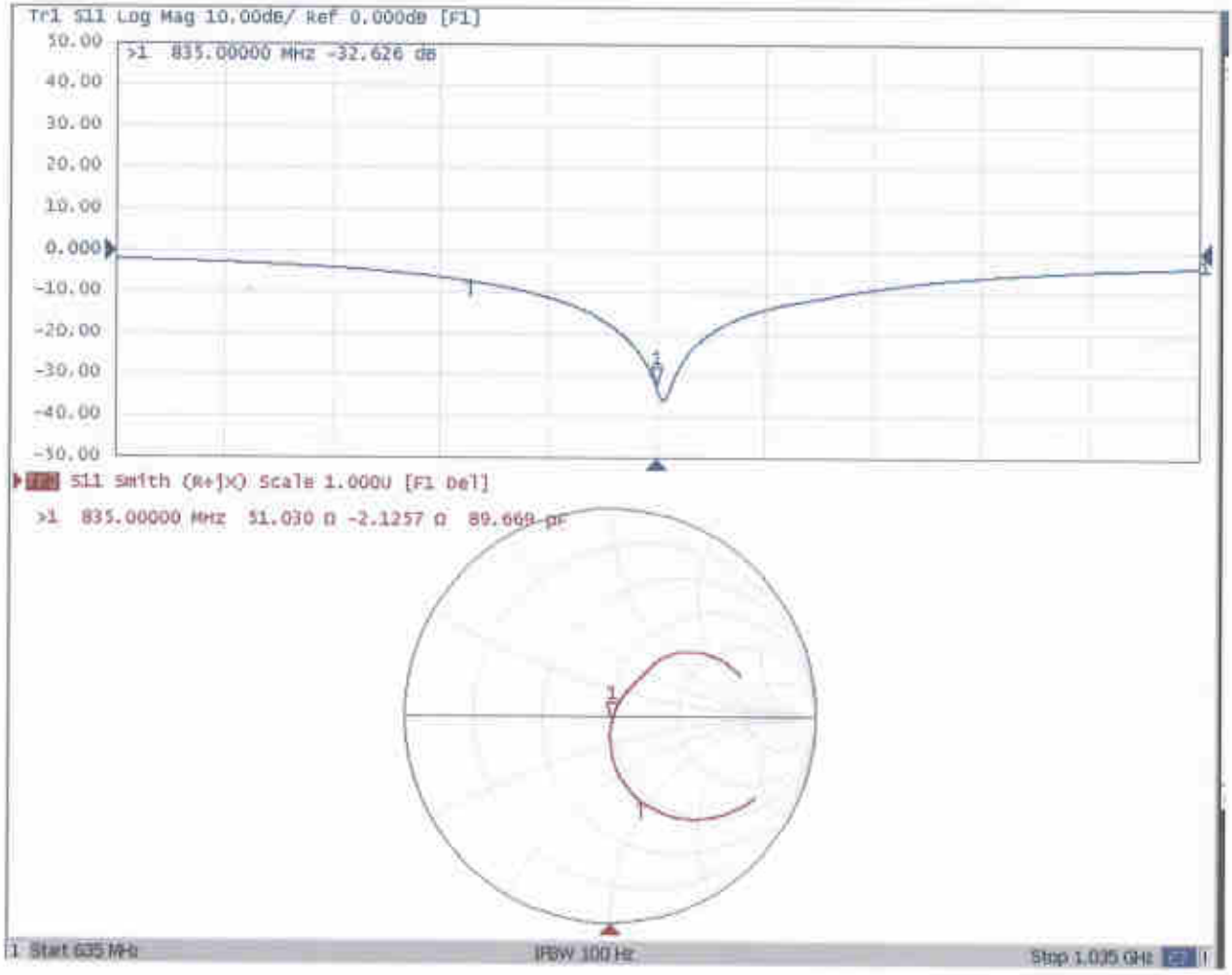
## Impedance Measurement Plot for Head TSL



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**DASY5 Validation Report for Body TSL** Date: 11.22.2016

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162**

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

Medium parameters used: f = 835 MHz; $\sigma$ = 0.954 S/m; $\varepsilon_r$ = 54.22; $\rho$ = 1000 kg/m$^3$

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.5,9.5, 9.5); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

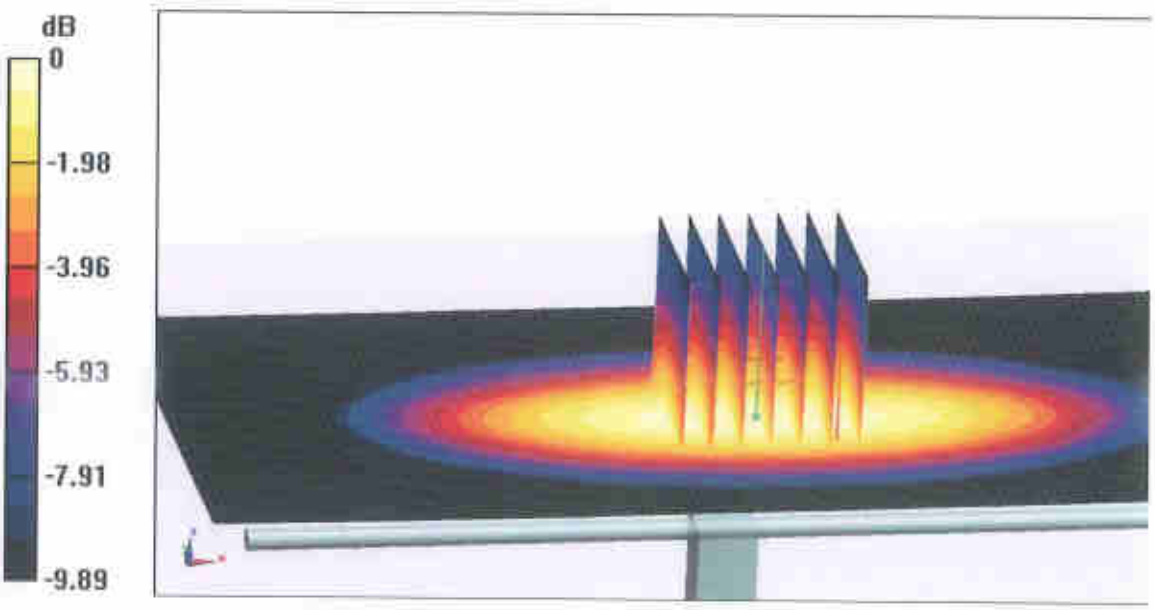
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.01 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.48 W/kg

**SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.59 W/kg**

Maximum value of SAR (measured) = 2.99 W/kg




**0 dB = 2.99 W/kg = 4.76 dBW/kg**

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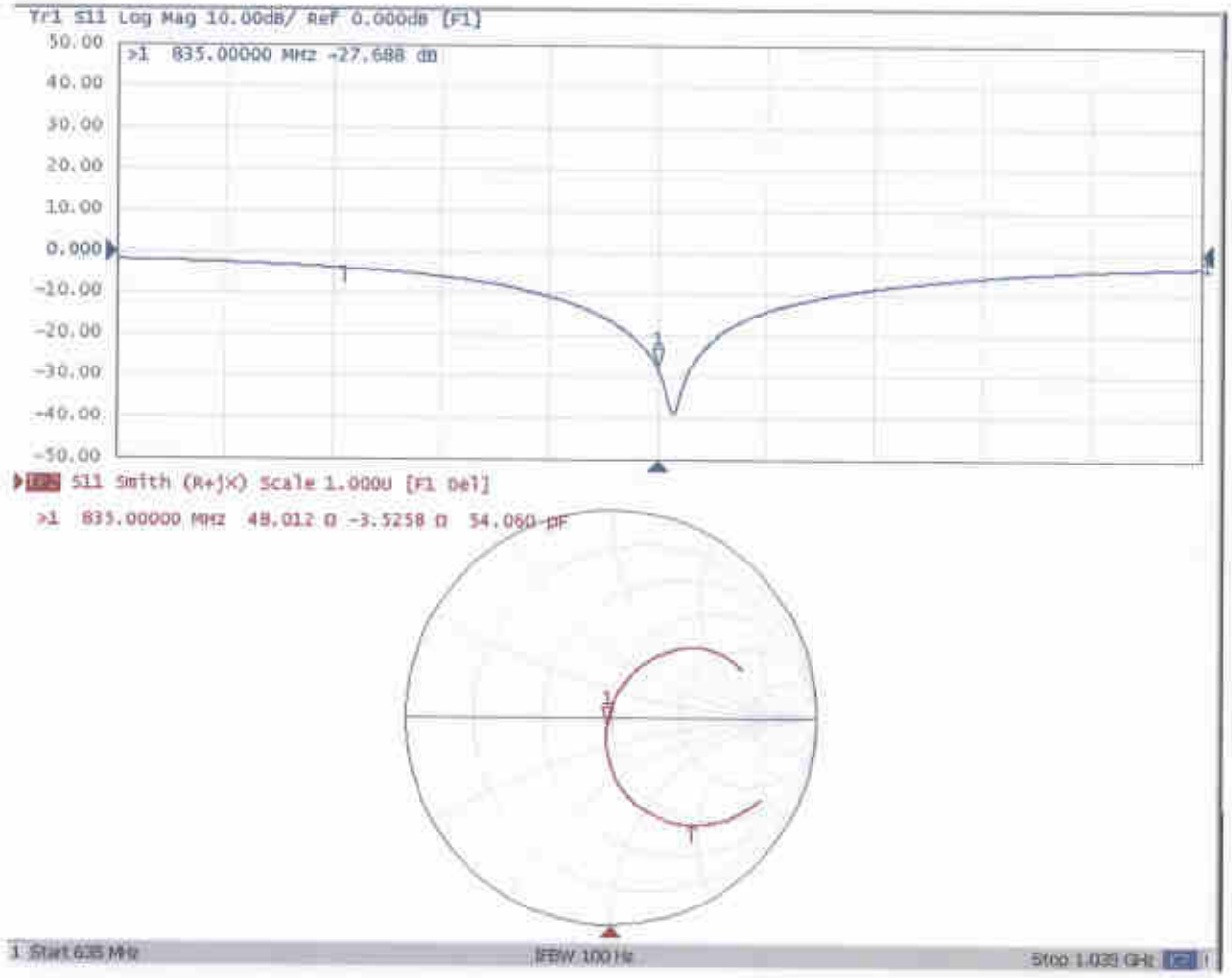
## Impedance Measurement Plot for Body TSL



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Client **Sporton-CN** **Certificate No: Z16-97230**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D1900V2 - SN: 5d182 |
| Calibration Procedure(s) | FD-Z11-003-01<br>Calibration Procedures for dipole validation kits |
| Calibration date: | November 24, 2016 |

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 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Power sensor NRP-Z91 | 101547 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Reference Probe EX3DV4 | SN 7433 | 26-Sep-16(SPEAG,No.EX3-7433_Sep16) | Sep-17 |
| DAE4 | SN 771 | 02-Feb-16(CTTL-SPEAG,No.Z16-97011) | Feb-17 |
| **Secondary Standards** | **ID #** | **Cal Date(Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| Signal Generator E4438C | MY49071430 | 01-Feb-16 (CTTL, No.J16X00893) | Jan-17 |
| Network Analyzer E5071C | MY46110673 | 26-Jan-16 (CTTL, No.J16X00894) | Jan-17 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Zhao Jing | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: November 27, 2016

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

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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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
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 | 52.8.8.1258 |
| **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 | 40.4 ± 6 % | 1.43 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 | 10.1 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **40.0 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | Condition | |
| SAR measured | 250 mW input power | 5.23 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **20.8 mW /g ± 20.4 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 53.3 | 1.52 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 54.6 ± 6 % | 1.53 mho/m ± 6 % |
| **Body TSL temperature change during test** | <1.0 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 10.2 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **40.8 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | Condition | |
| SAR measured | 250 mW input power | 5.32 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **21.3 mW /g ± 20.4 % (k=2)** |

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# Appendix

## Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 52.6Ω+ 5.15jΩ |
| Return Loss | - 25.0dB |

## Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 48.2Ω+ 6.18jΩ |
| Return Loss | - 23.7dB |

## General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.086 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: 11.24.2016

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182**

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

Medium parameters used: f = 1900 MHz; $\sigma$ = 1.426 S/m; $\varepsilon r$ = 40.35; $\rho$ = 1000 kg/m3

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.98, 7.98, 7.98); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

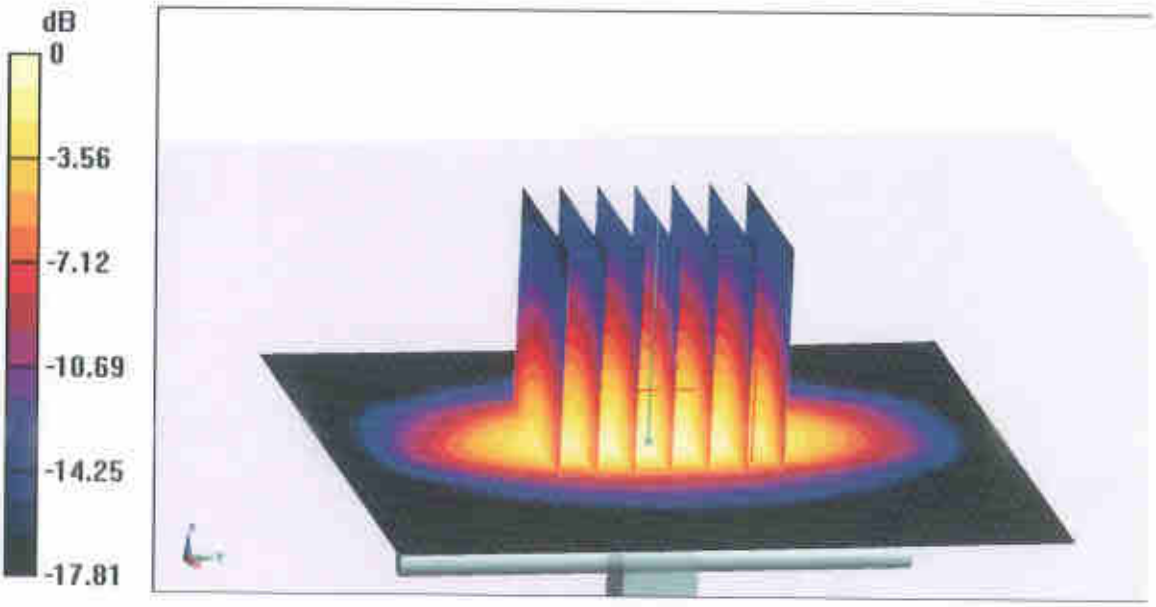
**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.8 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 18.7 W/kg

**SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.23 W/kg**

Maximum value of SAR (measured) = 14.5 W/kg




**0 dB = 14.5 W/kg = 11.61 dBW/kg**

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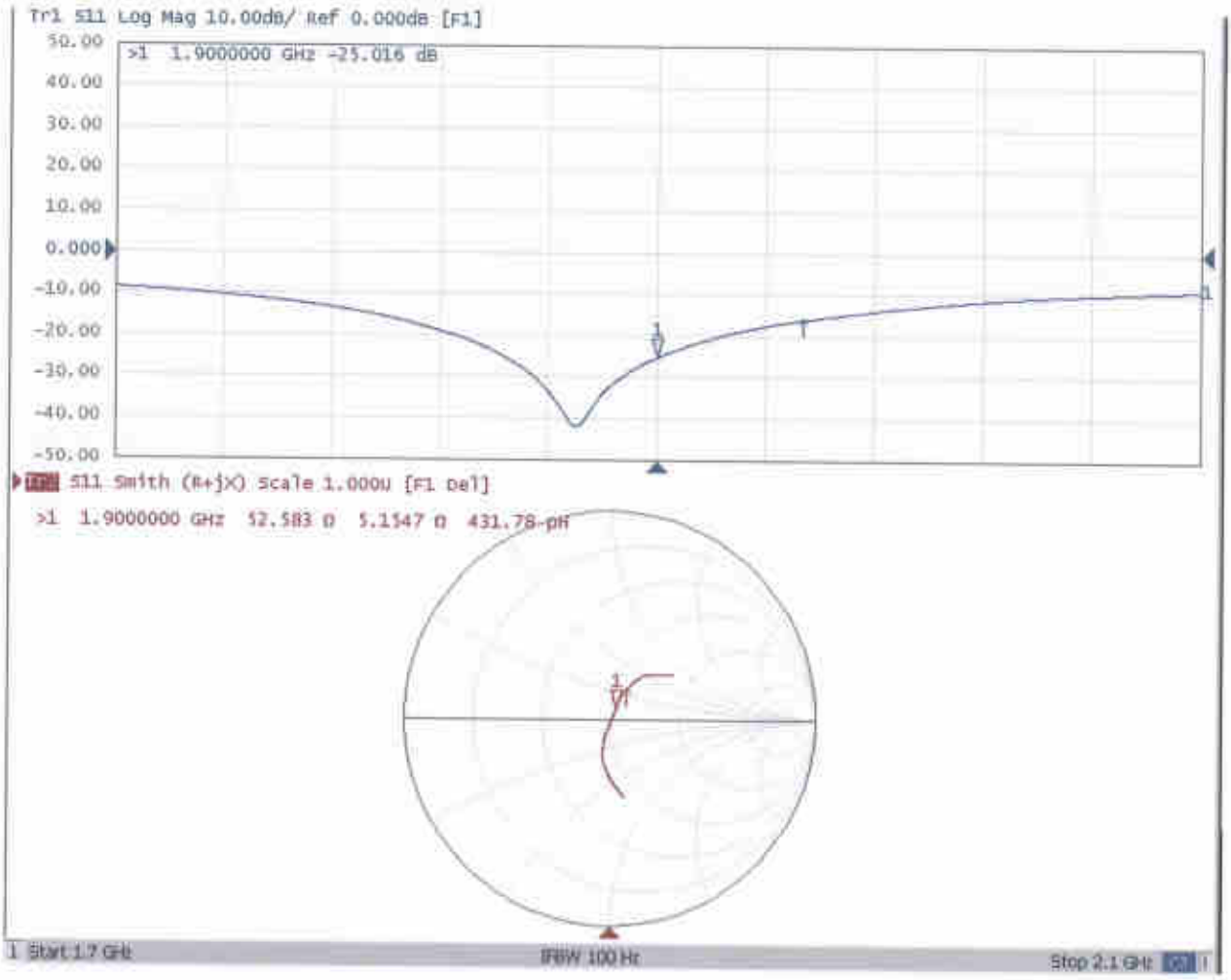
## Impedance Measurement Plot for Head TSL



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**DASY5 Validation Report for Body TSL** Date: 11.23.2016

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182**

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

Medium parameters used: f = 1900 MHz; $\sigma$ = 1.531 S/m; $\varepsilon_r$ = 54.57; $\rho$ = 1000 kg/m$^3$

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.7, 7.7, 7.7); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

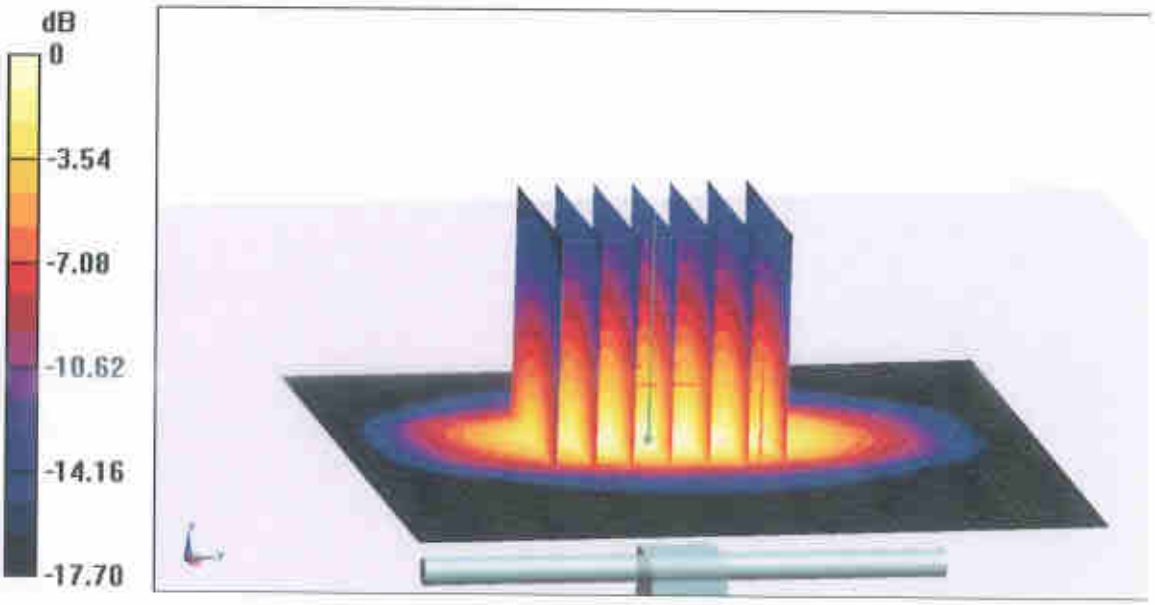
**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.33 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.6 W/kg

**SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.32 W/kg**

Maximum value of SAR (measured) = 14.6 W/kg




**0 dB = 14.6 W/kg = 11.64 dBW/kg**

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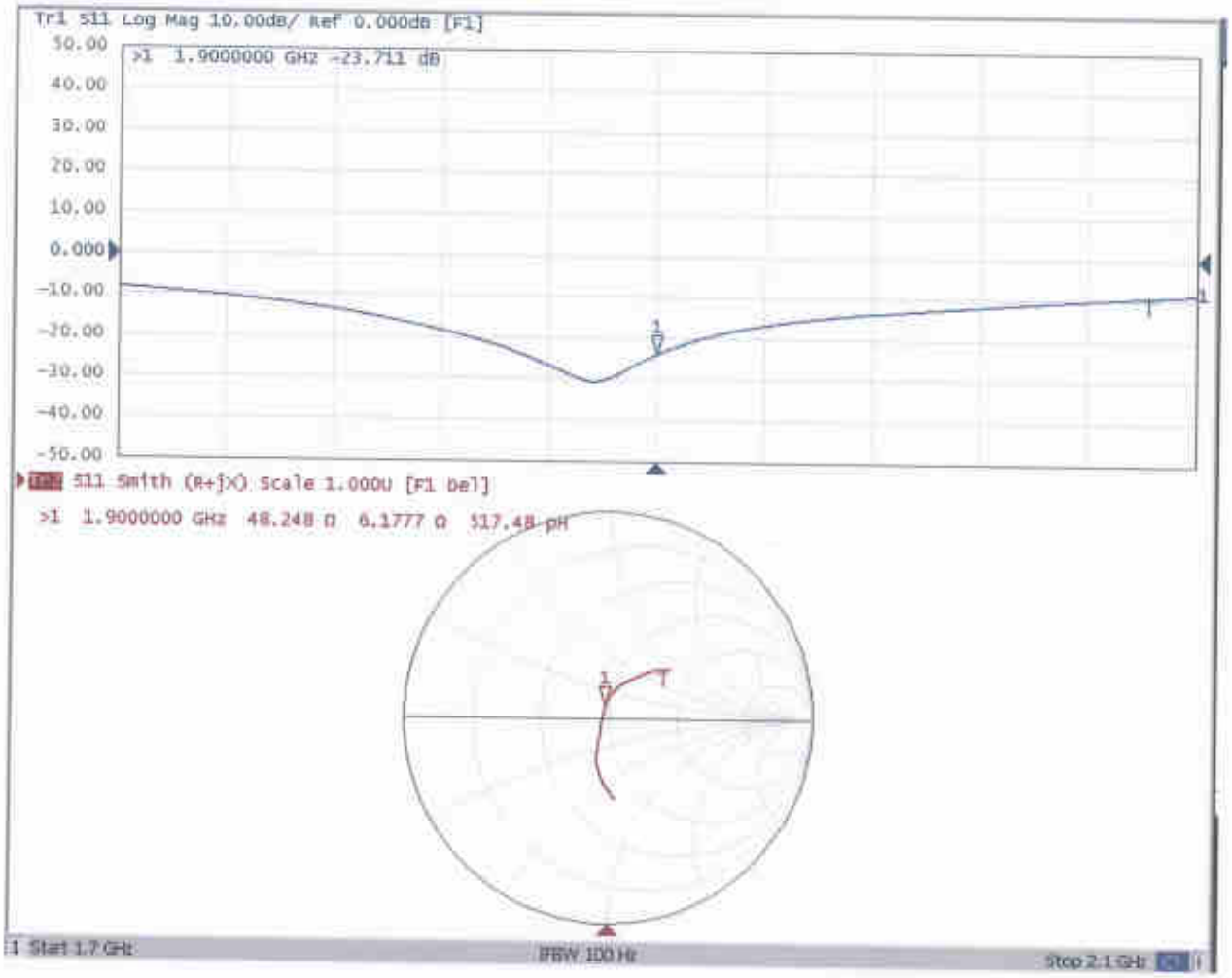
## Impedance Measurement Plot for Body TSL



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Client Sporton_SZ Certificate No: Z17-97044

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN: 924 |
| Calibration Procedure(s) | FD-Z11-003-01<br>Calibration Procedures for dipole validation kits |
| Calibration date: | March 21, 2017 |

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 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Power sensor NRP-Z91 | 101547 | 27-Jun-16 (CTTL, No.J16X04777) | Jun-17 |
| Reference Probe EX3DV4 | SN 3617 | 23-Jan-17(SPEAG,No.EX3-3617_Jan17) | Jan-18 |
| DAE4 | SN 777 | 22-Aug-16(CTTL-SPEAG,No.Z16-97138) | Aug-17 |
| **Secondary Standards** | **ID #** | **Cal Date(Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| Signal Generator E4438C | MY49071430 | 13-Jan-17 (CTTL, No.J17X00286) | Jan-18 |
| Network Analyzer E5071C | MY46110673 | 13-Jan-17 (CTTL, No.J17X00285) | Jan-18 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Zhao Jing | SAR Test Engineer | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory | |

Issued: March 25, 2017

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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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
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 | 52.8.8.1258 |
| **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** | 2450 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 39.2 | 1.80 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 39.0 ± 6 % | 1.77 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 | 13.0 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **52.4 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | Condition | |
| SAR measured | 250 mW input power | 6.04 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **24.3 mW /g ± 20.4 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 52.7 | 1.95 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 52.3 ± 6 % | 1.93 mho/m ± 6 % |
| **Body TSL temperature change during test** | <1.0 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 12.6 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **50.5 mW /g ± 20.8 % (k=2)** |
| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | Condition | |
| SAR measured | 250 mW input power | 5.86 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **23.5 mW /g ± 20.4 % (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 | 50.9Ω+ 3.77jΩ |
| Return Loss | - 28.3dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 48.3Ω+ 4.18jΩ |
| Return Loss | - 26.8dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.260 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 |