



# SAR TEST REPORT

|                      |                                                        |
|----------------------|--------------------------------------------------------|
| <b>Product Name</b>  | HSUPA/HSDPA/UMTS dual-band / GSM quadband mobile phone |
| <b>Model Name</b>    | 4019A                                                  |
| <b>FCC ID</b>        | RAD442                                                 |
| <b>Client</b>        | TCT Mobile Limited                                     |
| <b>Manufacturer</b>  | TCT Mobile Limited                                     |
| <b>Date of issue</b> | May 8, 2014                                            |

**TA Technology (Shanghai) Co., Ltd.**

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### GENERAL SUMMARY

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Standard(s)</b> | <p><b>FCC 47CFR §2.1093</b> Radiofrequency Radiation Exposure Evaluation: Portable Devices</p> <p><b>ANSI C95.1, 1992:</b> Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1991)</p> <p><b>IEEE Std 1528™-2003:</b> IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.</p> <p><b>KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03:</b> SAR Measurement Requirements for 100 MHz to 6 GHz</p> <p><b>KDB 447498 D01 Mobile Portable RF Exposure v05r02:</b> Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies</p> <p><b>KDB 648474 D04 Handset SAR v01r02:</b> SAR Evaluation Considerations for Wireless Handsets.</p> <p><b>KDB 941225 D01 SAR test for 3G devices v02:</b> SAR Measurement Procedures CDMA 20001x RTT, 1x Ev-Do, WCDMA, HSDPA/HSPA</p> <p><b>KDB 941225 D02 HSPA and 1x Advanced v02r02</b> SAR Guidance for HSPA, HSPA+, DC-HSDPA and 1x-Advanced</p> <p><b>KDB 941225 D03 Test Reduction GSM_GPRS_EDGE v01:</b>Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE</p> <p><b>KDB 248227 D01 SAR meas for 802 11 a b g v01r02:</b> SAR Measurement Procedures for 802.11a/b/g Transmitters.</p> |
| <b>Conclusion</b>            | <p>This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 7 of this test report are below limits specified in the relevant standards for the tested bands only.</p> <p>General Judgment: <b>Pass</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Comment</b>               | <p>The test result only responds to the measured sample.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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## 1. General Information

### 1.1. Notes of the Test Report

**TA Technology (Shanghai) Co., Ltd.** has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L2264.

**TA Technology (Shanghai) Co., Ltd.** guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at TA Technology (Shanghai) Co., Ltd. at the time of execution of the test.

**TA Technology (Shanghai) Co., Ltd.** is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the items under test and the results of the test. The sample under test was selected by the Client. This report only refers to the item that has undergone the test.

This report alone does not constitute or imply by its own an approval of the product by the certification Bodies or competent Authorities. This report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of **TA Technology (Shanghai) Co., Ltd.** and the Accreditation Bodies, if it applies.

If the electronic report is inconsistent with the printed one, it should be subject to the latter.

### 1.2. Testing Laboratory

|            |                                                                                |
|------------|--------------------------------------------------------------------------------|
| Company:   | TA Technology (Shanghai) Co., Ltd.                                             |
| Address:   | No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China             |
| City:      | Shanghai                                                                       |
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### 1.3. Applicant Information

Company: TCT Mobile Limited  
Address: 5F, C building, No. 232, Liang Jing Road ZhangJiang High-Tech Park,  
Pudong Area Shanghai  
P.R. China  
201203

### 1.4. Manufacturer Information

Company: TCT Mobile Limited  
Address: 5F, C building, No. 232, Liang Jing Road ZhangJiang High-Tech Park,  
Pudong Area Shanghai  
P.R. China  
201203

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### 1.5. Information of EUT

#### General Information

|                                   |                                                                                   |                 |                 |
|-----------------------------------|-----------------------------------------------------------------------------------|-----------------|-----------------|
| Device Type:                      | Portable Device                                                                   |                 |                 |
| Exposure Category:                | Uncontrolled Environment / General Population                                     |                 |                 |
| State of Sample:                  | Prototype Unit                                                                    |                 |                 |
| Product IMEI:                     | 014008000100385                                                                   |                 |                 |
| Hardware Version:                 | PIO                                                                               |                 |                 |
| Software Version:                 | v126                                                                              |                 |                 |
| Antenna Type:                     | Internal Antenna                                                                  |                 |                 |
| Device Operating Configurations : |                                                                                   |                 |                 |
| Test Mode(s):                     | GSM 850/GSM 1900;<br>UMTS Band II/UMTS Band V;<br>802.11b/g/n HT20;<br>Bluetooth; |                 |                 |
| Test Modulation:                  | (GSM)GMSK; (UMTS)QPSK,                                                            |                 |                 |
| Device Class:                     | B                                                                                 |                 |                 |
| HSUPA UE Category:                | 6                                                                                 |                 |                 |
| HSPA+ UE Downlink Category:       | 14                                                                                |                 |                 |
| GPRS Multislot Class(12):         | Max Number of Timeslots in Uplink                                                 | 4               |                 |
|                                   | Max Number of Timeslots in Downlink                                               | 4               |                 |
|                                   | Max Total Timeslot                                                                | 5               |                 |
| EGPRS:                            | Downlink Only                                                                     |                 |                 |
| Operating Frequency Range(s):     | Mode                                                                              | Tx (MHz)        | Rx (MHz)        |
|                                   | GSM 850                                                                           | 824.2 ~ 848.8   | 869.2 ~ 893.8   |
|                                   | GSM 1900                                                                          | 1850.2 ~ 1909.8 | 1930.2 ~ 1989.8 |
|                                   | UMTS Band II                                                                      | 1852.4 ~ 1907.6 | 1932.4 ~ 1987.6 |
|                                   | UMTS Band V                                                                       | 826.4 ~ 846.6   | 871.4 ~ 891.6   |
|                                   | Bluetooth                                                                         | 2402 ~2480      | 2402 ~2480      |
|                                   | WIFI                                                                              | 2412 ~2462      | 2412 ~2462      |
| Power Class:                      | GSM 850: 4                                                                        |                 |                 |
|                                   | GSM 1900: 1                                                                       |                 |                 |
|                                   | UMTS Band II/V: 3                                                                 |                 |                 |
| Power Level                       | GSM 850: level 5                                                                  |                 |                 |
|                                   | GSM 1900: level 0                                                                 |                 |                 |
|                                   | UMTS Band II/V: all up bits                                                       |                 |                 |
| Operating Channel/                | 128/824.4 – 190/836.6 – 251/848.8 (GSM 850)                                       |                 |                 |

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|                                          |                                                                                                                                                                                |                                                                                    |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Frequency(MHz):<br>(Low - Middle - High) | 512/1850.2 – 661/1880 – 810/1909.8<br>9262/1852.4 – 9400/1880 – 9538/1907.6<br>4132/826.4 – 4183/836.6 – 4233/846.6<br>1/2412 – 6/2437 – 11/2462<br>0/2402 – 39/2441 – 78/2480 | (GSM 1900)<br>(UMTS Band II)<br>(UMTS Band V)<br>(802.11b/g/n HT20)<br>(Bluetooth) |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|

**Auxiliary Equipment Details**

| Name                                                                                                    | Model        | S/N | Manufacturer |
|---------------------------------------------------------------------------------------------------------|--------------|-----|--------------|
| Battery                                                                                                 | CAB31P0000C1 | /   | BYD          |
| Earphone 1                                                                                              | CCB3160A15C6 | /   | Shenghua     |
| Earphone 2                                                                                              | CCB3160A15C4 | /   | Meihao       |
| Earphone 3                                                                                              | CCB3160A11C6 | /   | Shenghua     |
| Earphone 4                                                                                              | CCB3160A11C4 | /   | Meihao       |
| Note: Earphone 1 and Earphone 2 REACH, no need test.<br>Earphone 3 and Earphone 4 non-REACH, need test. |              |     |              |

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### 1.6. The Maximum Reported SAR<sub>1g</sub>

#### Head SAR Configuration

| Mode          | Test Position | Channel<br>/Frequency(MHz) | Limit SAR <sub>1g</sub> 1.6 W/kg     |                                      |
|---------------|---------------|----------------------------|--------------------------------------|--------------------------------------|
|               |               |                            | Measured SAR <sub>1g</sub><br>(W/kg) | Reported SAR <sub>1g</sub><br>(W/kg) |
| GSM 850       | Left/Cheek    | 190/836.6                  | 0.653                                | 0.922                                |
| GSM 1900      | Right/Cheek   | 512/1850.2                 | 0.682                                | 0.859                                |
| UMTS Band II  | Right/Cheek   | 9538/1907.6                | 0.980                                | 1.197                                |
| UMTS Band V   | Left/Cheek    | 4132/826.4                 | 0.889                                | 1.135                                |
| WiFi(802.11b) | Left/Cheek    | 11/2462                    | 0.144                                | 0.149                                |

#### Body Worn Configuration

| Mode          | Test Position | Channel<br>/Frequency(MHz) | Limit SAR <sub>1g</sub> 1.6 W/kg     |                                      |
|---------------|---------------|----------------------------|--------------------------------------|--------------------------------------|
|               |               |                            | Measured SAR <sub>1g</sub><br>(W/kg) | Reported SAR <sub>1g</sub><br>(W/kg) |
| GSM 850       | Back Side     | 128/824.4                  | 0.695                                | 0.929                                |
| GSM 1900      | Back Side     | 512/1850.2                 | 0.609                                | 0.852                                |
| UMTS Band II  | Back Side     | 9538/1907.6                | 0.728                                | 0.889                                |
| UMTS Band V   | Back Side     | 4132/826.4                 | 0.928                                | 1.185                                |
| WiFi(802.11b) | Back Side     | 11/2462                    | 0.144                                | 0.149                                |

### 1.7. Test Date

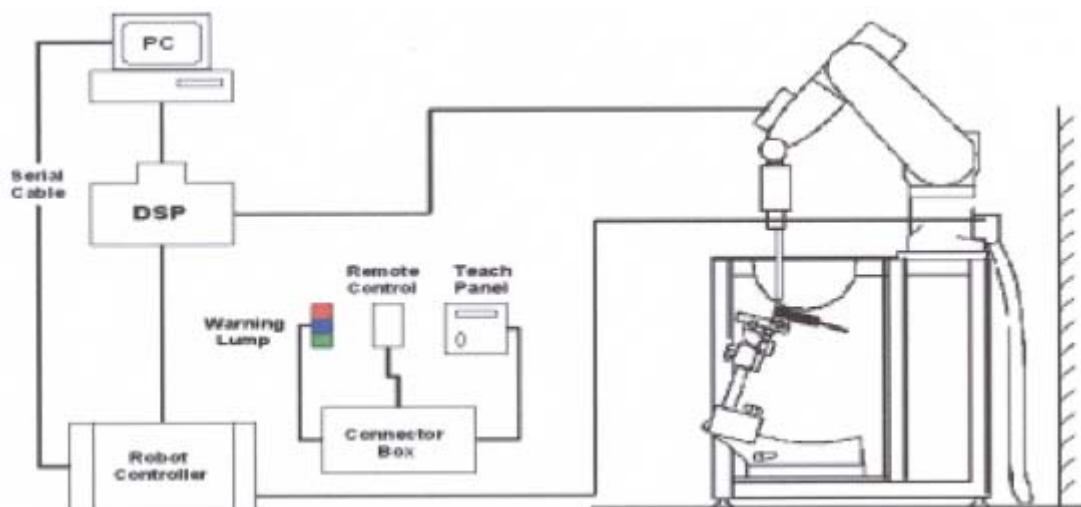
The test performed from March 29, 2014 to March 31, 2014.

## 2. SAR Measurements System Configuration

### 2.1. SAR Measurement Set-up

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

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
- The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003
- DASY5 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.



**Figure 1 SAR Lab Test Measurement Set-up**

## 2.2. DASY5 E-field Probe System

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

### 2.2.1. EX3DV4 Probe Specification

|               |                                                                                                                                                                                                               |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction  | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE)                                                   |
| Calibration   | ISO/IEC 17025 calibration service available                                                                                                                                                                   |
| Frequency     | 10 MHz to > 6 GHz<br>Linearity: $\pm 0.2$ dB<br>(30 MHz to 6 GHz)                                                                                                                                             |
| Directivity   | $\pm 0.3$ dB in HSL (rotation around probe axis)<br>$\pm 0.5$ dB in tissue material (rotation normal to probe axis)                                                                                           |
| Dynamic Range | 10 $\mu$ W/g to > 100 mW/g Linearity:<br><br>$\pm 0.2$ dB (noise: typically < 1 $\mu$ W/g)                                                                                                                    |
| Dimensions    | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm                                                                          |
| Application   | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields).<br>Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |



**Figure 2.EX3DV4 E-field Probe**



**Figure 3. EX3DV4 E-field probe**

### 2.2.2. E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated and found to be better than  $\pm 0.25\text{dB}$ . The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C \frac{\Delta T}{\Delta t}$$

Where:  $\Delta t$  = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

Or

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

Where:

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density ( $\text{kg/m}^3$ ).

## 2.3. Other Test Equipment

### 2.3.1. Device Holder for Transmitters

The DASY device holder is designed to cope with the different positions given in the standard.

It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.



**Figure 4 Device Holder**

### 2.3.2. Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden Figure. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

|                 |                                                   |
|-----------------|---------------------------------------------------|
| Shell Thickness | 2±0.1 mm                                          |
| Filling Volume  | Approx. 20 liters                                 |
| Dimensions      | 810 x 1000 x 500 mm (H x L x W) Available Special |



**Figure 5 Generic Twin Phantom**

### 2.4. Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max.  $\pm 5\%$ .
- The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)
- Area Scan  
The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid

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spacing is set according to FCC KDB Publication 865664. During scan the distance of the probe to the phantom remains unchanged.

After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

- **Zoom Scan**

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

- **Spatial Peak Detection**

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation.

- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

**Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01**

| Frequency    | Maximum Area Scan Resolution (mm)<br>( $\Delta x_{\text{area}}, \Delta y_{\text{area}}$ ) | Maximum Zoom Scan Resolution (mm)<br>( $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}}$ ) | Maximum Zoom Scan Spatial Resolution (mm)<br>$\Delta z_{\text{zoom}}(n)$ | Minimum Zoom Scan Volume (mm)<br>(x,y,z) |
|--------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------|
| $\leq 2$ GHz | $\leq 15$                                                                                 | $\leq 8$                                                                                  | $\leq 5$                                                                 | $\geq 30$                                |
| 2-3 GHz      | $\leq 12$                                                                                 | $\leq 5$                                                                                  | $\leq 5$                                                                 | $\geq 30$                                |
| 3-4 GHz      | $\leq 12$                                                                                 | $\leq 5$                                                                                  | $\leq 4$                                                                 | $\geq 28$                                |
| 4-5 GHz      | $\leq 10$                                                                                 | $\leq 4$                                                                                  | $\leq 3$                                                                 | $\geq 25$                                |
| 5-6 GHz      | $\leq 10$                                                                                 | $\leq 4$                                                                                  | $\leq 2$                                                                 | $\geq 22$                                |

## **2.5. Data Storage and Evaluation**

### **2.5.1. Data Storage**

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DAE4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

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

### **2.5.2. Data Evaluation by SEMCAD**

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

|                    |                           |                                       |
|--------------------|---------------------------|---------------------------------------|
| Probe parameters:  | - Sensitivity             | Normi, $a_{i0}$ , $a_{i1}$ , $a_{i2}$ |
|                    | - Conversion factor       | ConvF <sub>i</sub>                    |
|                    | - Diode compression point | Dcp <sub>i</sub>                      |
| Device parameters: | - Frequency               | f                                     |
|                    | - Crest factor            | cf                                    |
| Media parameters:  | - Conductivity            |                                       |
|                    | - Density                 |                                       |

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

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

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If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot c f / d c p_i$$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$U_i$  = input signal of channel i (i = x, y, z)

$cf$  = crest factor of exciting field (DASY parameter)

$dcp_i$  = diode compression point (DASY parameter)

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

E-field probes:  $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes:  $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2) / f$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$Norm_i$  = sensor sensitivity of channel i (i = x, y, z)  
[mV/(V/m)<sup>2</sup>] for E-field Probes

$ConvF$  = sensitivity enhancement in solution

$a_{ij}$  = sensor sensitivity factors for H-field probes

$f$  = carrier frequency [GHz]

$E_i$  = electric field strength of channel i in V/m

$H_i$  = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$SAR = (E_{tot})^2 \cdot \sigma / (\rho \cdot 1000)$$

with **SAR** = local specific absorption rate in mW/g

**$E_{tot}$**  = total field strength in V/m

**$\sigma$**  = conductivity in [mho/m] or [Siemens/m]

**$\rho$**  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with  **$P_{pwe}$**  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

**$E_{tot}$**  = total electric field strength in V/m

**$H_{tot}$**  = total magnetic field strength in A/m

### 3. Laboratory Environment

**Table 2: The Requirements of the Ambient Conditions**

|                                                                                                 |                           |
|-------------------------------------------------------------------------------------------------|---------------------------|
| Temperature                                                                                     | Min. = 18°C, Max. = 25 °C |
| Relative humidity                                                                               | Min. = 30%, Max. = 70%    |
| Ground system resistance                                                                        | < 0.5 $\Omega$            |
| Ambient noise is checked and found very low and in compliance with requirement of standards.    |                           |
| Reflection of surrounding objects is minimized and in compliance with requirement of standards. |                           |

## 4. Tissue-equivalent Liquid

### 4.1. Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, salt, Glycol, Sugar, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The table 3 and table 4 show the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB 865664 D01.

**Table 3: Composition of the Head Tissue Equivalent Matter**

| MIXTURE%                              | FREQUENCY(Brain) 835MHz               |
|---------------------------------------|---------------------------------------|
| Water                                 | 41.45                                 |
| Sugar                                 | 56                                    |
| Salt                                  | 1.45                                  |
| Preventol                             | 0.1                                   |
| Cellulose                             | 1.0                                   |
| Dielectric Parameters<br>Target Value | f=835MHz $\epsilon=41.5$ $\sigma=0.9$ |

| MIXTURE%                              | FREQUENCY(Brain) 1900MHz                |
|---------------------------------------|-----------------------------------------|
| Water                                 | 55.242                                  |
| Glycol monobutyl                      | 44.452                                  |
| Salt                                  | 0.306                                   |
| Dielectric Parameters<br>Target Value | f=1900MHz $\epsilon=40.0$ $\sigma=1.40$ |

| MIXTURE%                              | FREQUENCY(Brain) 2450MHz                 |
|---------------------------------------|------------------------------------------|
| Water                                 | 62.7                                     |
| Glycol                                | 36.8                                     |
| Salt                                  | 0.5                                      |
| Dielectric Parameters<br>Target Value | f=2450MHz $\epsilon=39.20$ $\sigma=1.80$ |

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**Table 4: Composition of the Body Tissue Equivalent Matter**

| MIXTURE%                              | FREQUENCY(Body) 835MHz                 |
|---------------------------------------|----------------------------------------|
| Water                                 | 52.5                                   |
| Sugar                                 | 45                                     |
| Salt                                  | 1.4                                    |
| Preventol                             | 0.1                                    |
| Cellulose                             | 1.0                                    |
| Dielectric Parameters<br>Target Value | f=835MHz $\epsilon=55.2$ $\sigma=0.97$ |

| MIXTURE%                              | FREQUENCY (Body) 1900MHz                |
|---------------------------------------|-----------------------------------------|
| Water                                 | 69.91                                   |
| Glycol monobutyl                      | 29.96                                   |
| Salt                                  | 0.13                                    |
| Dielectric Parameters<br>Target Value | f=1900MHz $\epsilon=53.3$ $\sigma=1.52$ |

| MIXTURE%                              | FREQUENCY(Body) 2450MHz                  |
|---------------------------------------|------------------------------------------|
| Water                                 | 73.2                                     |
| Glycol                                | 26.7                                     |
| Salt                                  | 0.1                                      |
| Dielectric Parameters<br>Target Value | f=2450MHz $\epsilon=52.70$ $\sigma=1.95$ |

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### 4.2. Tissue-equivalent Liquid Properties

**Table 5: Dielectric Performance of Tissue Simulating Liquid**

| Frequency                 | Test Date | Temp<br>℃ | Measured Dielectric<br>Parameters |                      | Target Dielectric<br>Parameters |                      | Limit<br>(Within ±5%)   |                     |
|---------------------------|-----------|-----------|-----------------------------------|----------------------|---------------------------------|----------------------|-------------------------|---------------------|
|                           |           |           | $\epsilon_r$                      | $\sigma(\text{s/m})$ | $\epsilon_r$                    | $\sigma(\text{s/m})$ | Dev<br>$\epsilon_r(\%)$ | Dev<br>$\sigma(\%)$ |
| <b>835MHz<br/>(head)</b>  | 2014-3-29 | 21.5      | 41.4                              | 0.91                 | 41.5                            | 0.90                 | -0.24                   | 1.11                |
| <b>1900MHz<br/>(head)</b> | 2014-3-29 | 21.5      | 40.5                              | 1.34                 | 40.0                            | 1.40                 | 1.25                    | -4.29               |
| <b>2450MHz<br/>(head)</b> | 2014-3-31 | 21.5      | 39.1                              | 1.80                 | 39.2                            | 1.80                 | -0.26                   | 0.00                |
| <b>835MHz<br/>(body)</b>  | 2014-3-30 | 21.5      | 55.9                              | 0.98                 | 55.2                            | 0.97                 | 1.27                    | 1.03                |
| <b>1900MHz<br/>(body)</b> | 2014-3-31 | 21.5      | 53.1                              | 1.52                 | 53.3                            | 1.52                 | -0.38                   | 0.00                |
| <b>2450MHz<br/>(body)</b> | 2014-3-31 | 21.5      | 52.1                              | 1.99                 | 52.7                            | 1.95                 | -1.14                   | 2.05                |

## 5. System Check

### 5.1. Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulates, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 6 and table 7.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.

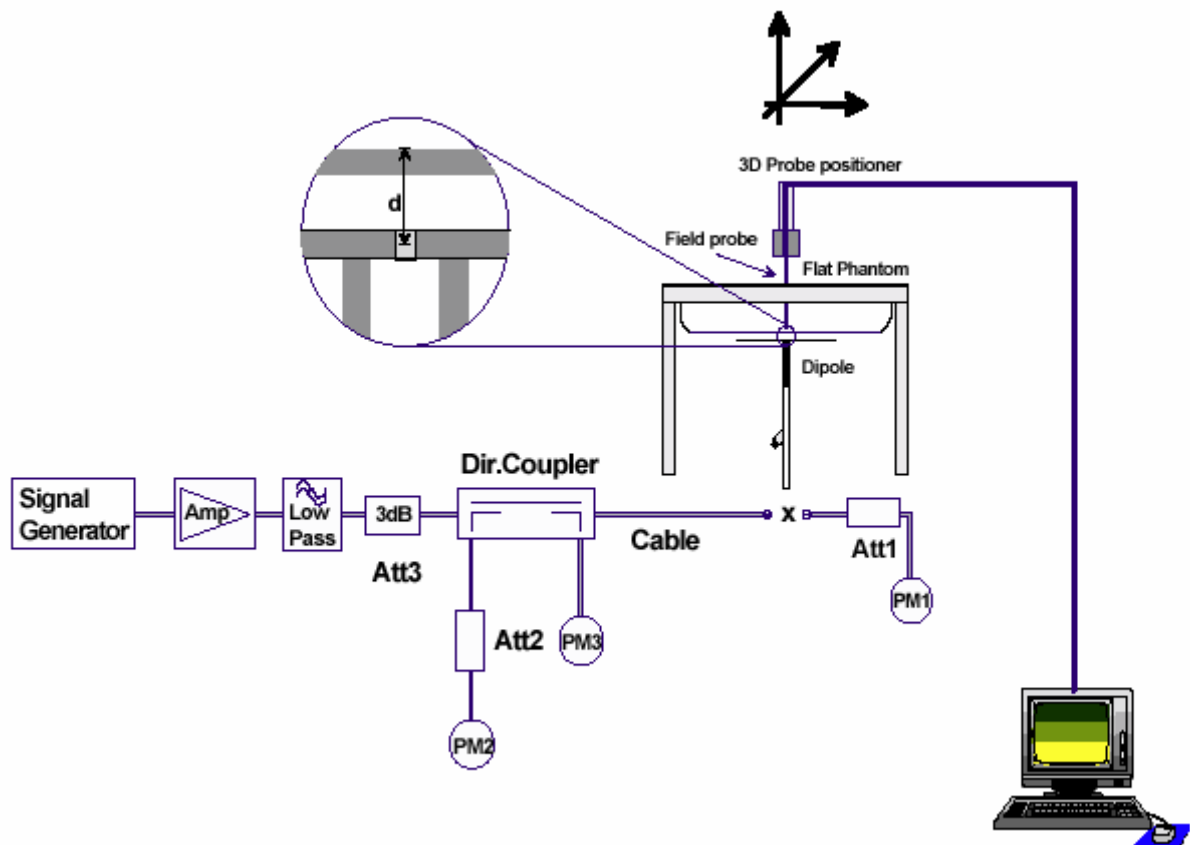


Figure 6 System Check Set-up

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### Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss ( $< -20$  dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

| Dipole D835V2 SN: 4d020 |                 |            |                        |                |
|-------------------------|-----------------|------------|------------------------|----------------|
| Head Liquid             |                 |            |                        |                |
| Date of Measurement     | Return Loss(dB) | $\Delta$ % | Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 8/26/2011               | -27.7           | /          | 52.9                   | /              |
| 8/25/2012               | -29.1           | 5.0%       | 55.0                   | 2.1 $\Omega$   |
| 8/24/2013               | -26.6           | 4.1%       | 55.3                   | 2.4 $\Omega$   |
| Body Liquid             |                 |            |                        |                |
| Date of Measurement     | Return Loss(dB) | $\Delta$ % | Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 8/26/2011               | -25.1           | /          | 48.7                   | /              |
| 8/25/2012               | -24.3           | 3.2%       | 50.6                   | 1.9 $\Omega$   |
| 8/24/2013               | -24.7           | 1.6%       | 51.1                   | 2.4 $\Omega$   |

| Dipole D1900V2 SN: 5d060 |                 |            |                        |                |
|--------------------------|-----------------|------------|------------------------|----------------|
| Head Liquid              |                 |            |                        |                |
| Date of Measurement      | Return Loss(dB) | $\Delta$ % | Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 8/31/2011                | -22.3           | /          | 52.6                   | /              |
| 8/30/2012                | -21.7           | 2.7%       | 51.4                   | 1.2 $\Omega$   |
| 8/29/2013                | -21.4           | 4.2%       | 50.5                   | 2.1 $\Omega$   |
| Body Liquid              |                 |            |                        |                |
| Date of Measurement      | Return Loss(dB) | $\Delta$ % | Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 8/31/2011                | -21.3           | /          | 47.3                   | /              |
| 8/30/2012                | -20.9           | 1.9%       | 45.9                   | 1.4 $\Omega$   |
| 8/29/2013                | -20.4           | 4.4%       | 44.8                   | 2.5 $\Omega$   |

| Dipole D2450V2 SN: 786 |                 |            |                        |                |
|------------------------|-----------------|------------|------------------------|----------------|
| Head Liquid            |                 |            |                        |                |
| Date of Measurement    | Return Loss(dB) | $\Delta$ % | Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 8/29/2011              | -25.5           | /          | 55.0                   | /              |
| 8/28/2012              | -26.8           | 5.1%       | 56.5                   | 1.5 $\Omega$   |
| 8/27/2013              | -26.4           | 3.5%       | 56.9                   | 1.9 $\Omega$   |
| Body Liquid            |                 |            |                        |                |
| Date of Measurement    | Return Loss(dB) | $\Delta$ % | Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 8/29/2011              | -29.0           | /          | 50.4                   | /              |
| 8/28/2012              | -29.9           | 3.1%       | 52.1                   | 1.7 $\Omega$   |
| 8/27/2013              | -28.2           | 2.8%       | 52.7                   | 2.3 $\Omega$   |

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### 5.2. System Check Results

**Table 6: System Check in Head Tissue Simulating Liquid**

| Frequency | Test Date | Dielectric Parameters |        | Temp | 250mW<br>Measured<br>SAR <sub>1g</sub> | 1W<br>Normalized<br>SAR <sub>1g</sub> | 1W<br>Target<br>SAR <sub>1g</sub> | Limit<br>(±10%<br>Deviation) |
|-----------|-----------|-----------------------|--------|------|----------------------------------------|---------------------------------------|-----------------------------------|------------------------------|
|           |           | ε <sub>r</sub>        | σ(s/m) |      |                                        |                                       |                                   |                              |
| 835MHz    | 2014-3-29 | 41.4                  | 0.91   | 21.5 | 2.44                                   | 9.76                                  | 9.34                              | 4.50%                        |
| 1900MHz   | 2014-3-29 | 40.5                  | 1.34   | 21.5 | 9.48                                   | 37.92                                 | 40.30                             | -5.91%                       |
| 2450MHz   | 2014-3-31 | 39.1                  | 1.8    | 21.5 | 13.70                                  | 54.80                                 | 53.80                             | 1.86%                        |

Note: 1. The graph results see ANNEX B.  
2. Target Values used derive from the calibration certificate

**Table 7: System Check in Body Tissue Simulating Liquid**

| Frequency | Test Date | Dielectric Parameters |        | Temp | 250mW<br>Measured<br>SAR <sub>1g</sub> | 1W<br>Normalized<br>SAR <sub>1g</sub> | 1W<br>Target<br>SAR <sub>1g</sub> | Limit<br>(±10%<br>Deviation) |
|-----------|-----------|-----------------------|--------|------|----------------------------------------|---------------------------------------|-----------------------------------|------------------------------|
|           |           | ε <sub>r</sub>        | σ(s/m) |      |                                        |                                       |                                   |                              |
| 835MHz    | 2014-3-30 | 55.9                  | 0.98   | 21.5 | 2.41                                   | 9.64                                  | 9.46                              | 1.90%                        |
| 1900MHz   | 2014-3-31 | 53.1                  | 1.52   | 21.5 | 9.93                                   | 39.72                                 | 41.70                             | -4.75%                       |
| 2450MHz   | 2014-3-31 | 52.1                  | 1.99   | 21.5 | 12.50                                  | 50.00                                 | 51.70                             | -3.29%                       |

Note: 1. The graph results see ANNEX B.  
2. Target Values used derive from the calibration certificate

## **6. Operational Conditions during Test**

### **6.1. General Description of Test Procedures**

A communication link is set up with a System Simulator (SS) by air link, and a call is established. The EUT is commanded to operate at maximum transmitting power.

Connection to the EUT is established via air interface with E5515C, and the EUT is set to maximum output power by E5515C. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30 dB.

### **6.2. Test Positions**

#### **6.2.1. Against Phantom Head**

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

The positions used in the measurements were according to IEEE 1528 - 2003 "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate(SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques".

#### **6.2.2. Body Worn Configuration**

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations.

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. Per FCC KDB Publication 648474 D04, 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 Publication 447498 D01 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 a body-worn accessory, measured without a headset connected to the handset, is  $> 1.2$  W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

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. 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 tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with

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different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

### **6.3. Measurement Variability**

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

- 1) When the original highest measured SAR is  $\geq 0.80$  W/kg, the measurement was repeated once.
- 2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was  $> 1.20$  or when the original or repeated measurement was  $\geq 1.45$  W/kg (~ 10% from the 1-g SAR limit).
- 3) A third repeated measurement was performed only if the original, first or second repeated measurement was  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .
- 4) Repeated measurements are not required when the original highest measured SAR is  $< 0.80$  W/kg

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

## **6.4. Test Configuration**

### **6.4.1. GSM Test Configuration**

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. Using E5515C the power level is set to “5” for GSM 850, set to “0” for GSM 1900. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslots is 5.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following:

Output power of reductions:

**Table 8: The allowed power reduction in the multi-slot configuration**

| <b>Number of timeslots in uplink assignment</b> | <b>Permissible nominal reduction of maximum output power,(dB)</b> |
|-------------------------------------------------|-------------------------------------------------------------------|
| 1                                               | 0                                                                 |
| 2                                               | 0 to 3,0                                                          |
| 3                                               | 1,8 to 4,8                                                        |
| 4                                               | 3,0 to 6,0                                                        |

## **6.4.2. UMTS Test Configuration**

### **6.4.2.1. Output power Verification**

Maximum output power is verified on the High, Middle and Low channel according to the procedures described in section 5.2 of 3GPP TS 34. 121, using the appropriate RMC or AMR with TPC(transmit power control) set to all up bits for WCDMA/HSDPA or applying the required inner loop power control procedures to the maximum output power while HSUPA is active. Results for all applicable physical channel configuration (DPCCH, DPDCH<sub>n</sub> and spreading codes, HSDPA, HSPA) should be tabulated in the SAR report. All configuration that are not supported by the DUT or can not be measured due to technical or equipment limitations should be clearly identified

### **6.4.2.2. Head SAR Measurements**

SAR for head exposure configurations in voice mode is measured using a 12.2kbps RMC with TPC bits configured to all up bits. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2kbps AMR is less than 1/4 dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2kbps AMR with a 3.4 kbps SRB( Signaling radio bearer) using the exposure configuration that results in the highest SAR in 12.2kbps RMC for that RF channel.

### **6.4.2.3. Body SAR Measurements**

SAR for body exposure configurations in voice and data modes is measured using 12.2kbps RMC with TPC bits configured to all up bits. SAR for other spreading codes and multiple DPDCH<sub>n</sub>, when supported by the DUT, are not required when the maximum average output of each RF channel, for each spreading code and DPDCH<sub>n</sub> configuration, are less than 1/4 dB higher than those measured in 12.2kbps RMC. Otherwise, SAR is measured on the maximum output channel with an applicable RMC configuration for the corresponding spreading code or DPDCH<sub>n</sub> using the exposure configuration that results in the highest SAR with 12.2 kbps RMC. When more than 2 DPDCH<sub>n</sub> are supported by the DUT, it may be necessary to configure additional DPDCH<sub>n</sub> for a DUT using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

## **6.4.3. HSDPA Test Configuration**

SAR for body exposure configurations is measured according to the 'Body SAR Measurements' procedures of that section. In addition, body SAR is also measured for HSDPA when the maximum average output of each RF channel with HSDPA active is at least ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

HSDPA should be configured according to the UE category of a test device. The number of HSDSCH/ HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding

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sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors( $\beta_c$ ,  $\beta_d$ ), and HS-DPCCH power offset parameters ( $\Delta_{ACK}$ ,  $\Delta_{NACK}$ ,  $\Delta_{CQI}$ ) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

**Table 9: Subtests for UMTS Release 5 HSDPA**

| Sub-set | $\beta_c$         | $\beta_d$         | $\beta_d$<br>(SF) | $\beta_c/\beta_d$ | $\beta_{hs}$<br>(note 1, note 2) | CM(dB)<br>(note 3) | MPR(dB) |
|---------|-------------------|-------------------|-------------------|-------------------|----------------------------------|--------------------|---------|
| 1       | 2/15              | 15/15             | 64                | 2/15              | 4/15                             | 0.0                | 0.0     |
| 2       | 12/15<br>(note 4) | 15/15<br>(note 4) | 64                | 12/15<br>(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     |

Note1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI}=8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c=30/15 \Leftrightarrow \beta_{hs}=30/15*\beta_c$

Note2: 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 5.13.1.A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA,  $\Delta_{ACK}$  and  $\Delta_{NACK}=8$  ( $A_{hs}=30/15$ ) with  $\beta_{hs}=30/15*\beta_c$ , and  $\Delta_{CQI}=7$  ( $A_{hs}=24/15$ ) with  $\beta_{hs}=24/15*\beta_c$ .

Note3: 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 signaled gain factors for the reference TFC (TFC1, TF1) to  $\beta_c=11/15$  and  $\beta_d=15/15$ .

**Table 10: Settings of required H-Set 1 QPSK in HSDPA mode**

| Parameter                             | Unit      | Value |
|---------------------------------------|-----------|-------|
| Nominal Avg. Inf. Bit Rate            | kbps      | 534   |
| Inter-TTI Distance                    | TTI's     | 3     |
| Number of HARQ Processes              | Processes | 2     |
| Information Bit Payload ( $N_{INF}$ ) | Bits      | 3202  |
| Number Code Blocks                    | Blocks    | 1     |
| Binary Channel Bits Per TTI           | Bits      | 4800  |
| Total Available SML's in UE           | SML's     | 19200 |
| Number of SML's per HARQ Proc.        | SML's     | 9600  |
| Coding Rate                           | /         | 0.67  |
| Number of Physical Channel Codes      | Codes     | 5     |
| Modulation                            | /         | QPSK  |

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### 6.4.4. HSUPA Test Configuration

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.<sup>40</sup>

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA should be configured according to the  $\beta$  values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of 3 G device.

**Table 11: Sub-Test 5 Setup for Release 6 HSUPA**

| Sub-set | $\beta_c$            | $\beta_d$            | $\beta_d$<br>(SF) | $\beta_c/\beta_d$    | $\beta_{hs}^{(1)}$ | $\beta_{ec}$ | $\beta_{ed}$                                           | $\beta_{ed}$<br>(SF) | $\beta_{ed}$<br>(codes) | CM <sup>(2)</sup><br>(dB) | MPR<br>(dB) | AG <sup>(4)</sup><br>Index | E-TFCI |
|---------|----------------------|----------------------|-------------------|----------------------|--------------------|--------------|--------------------------------------------------------|----------------------|-------------------------|---------------------------|-------------|----------------------------|--------|
| 1       | 11/15 <sup>(3)</sup> | 15/15 <sup>(3)</sup> | 64                | 11/15 <sup>(3)</sup> | 22/15              | 209/225      | 1039/225                                               | 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        | $\beta_{ed1} \cdot 47/15$<br>$\beta_{ed2} \cdot 47/15$ | 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 <sup>(4)</sup> | 15/15 <sup>(4)</sup> | 64                | 15/15 <sup>(4)</sup> | 30/15              | 24/15        | 134/15                                                 | 4                    | 1                       | 1.0                       | 0.0         | 21                         | 81     |

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$ .

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

signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .

Note 4: For subtest 5 the  $\beta_c/\beta_d$  ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the

signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Figure 5.1g.

Note 6:  $\beta_{ed}$  can not be set directly; it is set by Absolute Grant Value.

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**Table 12: HSUPA UE category**

| UE<br>E-DCH<br>Category                                                                                                                                                                                          | Maximum<br>E-DCH<br>Codes<br>Transmitted | Number<br>of HARQ<br>Processes | E-<br>DCH<br>TTI<br>(ms) | Minimum<br>Spreading<br>Factor | Maximum<br>E-DCH<br>Transport<br>Block Bits | Max<br>Rate<br>(Mbps) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------|--------------------------|--------------------------------|---------------------------------------------|-----------------------|
| 1                                                                                                                                                                                                                | 1                                        | 4                              | 10                       | 4                              | 7110                                        | 0.7296                |
| 2                                                                                                                                                                                                                | 2                                        | 8                              | 2                        | 4                              | 2798                                        | 1.4592                |
|                                                                                                                                                                                                                  | 2                                        | 4                              | 10                       | 4                              | 14484                                       |                       |
| 3                                                                                                                                                                                                                | 2                                        | 4                              | 10                       | 4                              | 14484                                       | 1.4592                |
| 4                                                                                                                                                                                                                | 2                                        | 8                              | 2                        | 2                              | 5772                                        | 2.9185                |
|                                                                                                                                                                                                                  | 2                                        | 4                              | 10                       | 2                              | 20000                                       | 2.00                  |
| 5                                                                                                                                                                                                                | 2                                        | 4                              | 10                       | 2                              | 20000                                       | 2.00                  |
| 6<br>(No DPDCH)                                                                                                                                                                                                  | 4                                        | 8                              | 2                        | 2 SF2 & 2 SF4                  | 11484                                       | 5.76                  |
|                                                                                                                                                                                                                  | 4                                        | 4                              | 10                       |                                | 20000                                       | 2.00                  |
| 7<br>(No DPDCH)                                                                                                                                                                                                  | 4                                        | 8                              | 2                        | 2 SF2 & 2 SF4                  | 22996                                       | ?                     |
|                                                                                                                                                                                                                  | 4                                        | 4                              | 10                       |                                | 20000                                       | ?                     |
| NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4.<br>UE Categories 1 to 6 supports QPSK only. UE Category 7 supports QPSK and 16QAM.<br>(TS25.306-7.3.0) |                                          |                                |                          |                                |                                             |                       |

### 6.4.5. WIFI Test Configuration

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal. The Tx power is set to 15 for 802.11 b mode by software. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for WIFI mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. Testing at higher data rates is not required when the maximum average output power is less than 0.25dB higher than those measured at the lowest data rate.

802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on the maximum average output channel;

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

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## 7. Test Results

### 7.1. Conducted Power Results

Table 13: Conducted Power Measurement Results

| GSM 850     |          | Burst Conducted Power(dBm) |             |             | /       | Average power(dBm) |              |              |
|-------------|----------|----------------------------|-------------|-------------|---------|--------------------|--------------|--------------|
|             |          | Channel 128                | Channel 190 | Channel 251 |         | Channel 128        | Channel 190  | Channel 251  |
| GSM         |          | 31.4                       | 31.3        | 31.34       | -9.03dB | 22.37              | 22.27        | 22.31        |
| GPRS (GMSK) | 1Txslot  | 31.4                       | 31.33       | 31.37       | -9.03dB | 22.37              | 22.3         | 22.34        |
|             | 2Txslots | 29.05                      | 29          | 28.96       | -6.02dB | 23.03              | 22.98        | 22.94        |
|             | 3Txslots | 27.23                      | 27.11       | 27.2        | -4.26dB | 22.97              | 22.85        | 22.94        |
|             | 4Txslots | 26.14                      | 26.13       | 26.05       | -3.01dB | <b>23.13</b>       | <b>23.12</b> | <b>23.04</b> |
| GSM 1900    |          | Burst Conducted Power(dBm) |             |             | /       | Average power(dBm) |              |              |
|             |          | Channel 512                | Channel 661 | Channel 810 |         | Channel 512        | Channel 661  | Channel 810  |
| GSM         |          | 29                         | 28.98       | 28.86       | -9.03dB | 19.97              | 19.95        | 19.83        |
| GPRS (GMSK) | 1Txslot  | 28.98                      | 29.05       | 28.8        | -9.03dB | 19.95              | 20.02        | 19.77        |
|             | 2Txslots | 26.32                      | 26.31       | 26.11       | -6.02dB | 20.3               | 20.29        | 20.09        |
|             | 3Txslots | 24.64                      | 24.62       | 24.48       | -4.26dB | <b>20.38</b>       | <b>20.36</b> | <b>20.22</b> |
|             | 4Txslots | 23.06                      | 23.06       | 22.9        | -3.01dB | 20.05              | 20.05        | 19.89        |

Note:

#### 1) Division Factors

To average the power, the division factor is as follows:

1Txslot = 1 transmit time slot out of 8 time slots

=> conducted power divided by (8/1) => -9.03 dB

2Txslots = 2 transmit time slots out of 8 time slots

=> conducted power divided by (8/2) => -6.02 dB

3Txslots = 3 transmit time slots out of 8 time slots

=> conducted power divided by (8/3) => -4.26 dB

4Txslots = 4 transmit time slots out of 8 time slots

=> conducted power divided by (8/4) => -3.01 dB

#### 2) Average power numbers

The maximum power numbers are marks in bold.

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| UMTS Band II |              | Conducted Power (dBm) |              |              |
|--------------|--------------|-----------------------|--------------|--------------|
|              |              | Channel 9262          | Channel 9400 | Channel 9538 |
| <b>RMC</b>   | 12.2kbps RMC | 22.03                 | 22.23        | 22.13        |
|              | 64kbps RMC   | 22.01                 | 22.13        | 22.07        |
|              | 144kbps RMC  | 21.91                 | 22.07        | 22.01        |
|              | 384kbps RMC  | 21.89                 | 22.06        | 21.99        |
| <b>HSDPA</b> | Sub - Test 1 | 21.89                 | 22.11        | 22.03        |
|              | Sub - Test 2 | 21.98                 | 22.01        | 22.01        |
|              | Sub - Test 3 | 21.48                 | 21.68        | 21.62        |
|              | Sub - Test 4 | 21.43                 | 21.73        | 21.69        |
| <b>HSUPA</b> | Sub - Test 1 | 20.73                 | 20.92        | 20.89        |
|              | Sub - Test 2 | 19.35                 | 19.59        | 19.45        |
|              | Sub - Test 3 | 19.89                 | 19.99        | 19.96        |
|              | Sub - Test 4 | 19.39                 | 19.68        | 19.58        |
|              | Sub - Test 5 | 20.75                 | 20.99        | 20.94        |
| UMTS Band V  |              | Conducted Power (dBm) |              |              |
|              |              | Channel 4132          | Channel 4183 | Channel 4233 |
| <b>RMC</b>   | 12.2kbps RMC | 21.94                 | 21.86        | 22.16        |
|              | 64kbps RMC   | 21.87                 | 21.81        | 22.04        |
|              | 144kbps RMC  | 21.79                 | 21.72        | 22.13        |
|              | 384kbps RMC  | 21.81                 | 21.68        | 22.01        |
| <b>HSDPA</b> | Sub - Test 1 | 21.75                 | 21.65        | 21.98        |
|              | Sub - Test 2 | 21.67                 | 21.61        | 21.84        |
|              | Sub - Test 3 | 21.39                 | 21.33        | 21.8         |
|              | Sub - Test 4 | 21.31                 | 21.18        | 21.51        |
| <b>HSUPA</b> | Sub - Test 1 | 20.25                 | 20.15        | 20.49        |
|              | Sub - Test 2 | 18.74                 | 18.65        | 18.99        |
|              | Sub - Test 3 | 19.3                  | 19.24        | 19.5         |
|              | Sub - Test 4 | 18.85                 | 18.75        | 19.01        |
|              | Sub - Test 5 | 20.24                 | 20.13        | 20.48        |

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The average output power of BT antenna is as following:

| Channel            | Ch 0<br>2402 MHz | Ch 39<br>2441 MHz | Ch 78<br>2480 MHz |
|--------------------|------------------|-------------------|-------------------|
| GFSK(dBm)          | 2.95             | 3.35              | 3.28              |
| $\pi/4$ DQPSK(dBm) | 3.03             | 3.36              | 3.31              |
| 8DPSK(dBm)         | 3.39             | 3.73              | 3.67              |

The output power of WIFI antenna is as following:

| Mode    | Channel | Data rate<br>(Mbps) | AV Power (dBm) |
|---------|---------|---------------------|----------------|
| 802.11b | 1       | 1                   | 14.87          |
|         |         | 2                   | 14.74          |
|         |         | 5.5                 | 14.45          |
|         |         | 11                  | 14.15          |
|         | 6       | 1                   | 15.5           |
|         |         | 2                   | 15.35          |
|         |         | 5.5                 | 15.08          |
|         |         | 11                  | 14.78          |
|         | 11      | 1                   | 16.36          |
|         |         | 2                   | 16.21          |
|         |         | 5.5                 | 16.01          |
|         |         | 11                  | 15.68          |
| 802.11g | 1       | 6                   | 12.3           |
|         |         | 9                   | 12.06          |
|         |         | 12                  | 11.83          |
|         |         | 18                  | 11.4           |
|         |         | 24                  | 11             |
|         |         | 36                  | 10.38          |
|         |         | 48                  | 9.83           |
|         |         | 54                  | 9.64           |
|         | 6       | 6                   | 13.04          |
|         |         | 9                   | 12.8           |
|         |         | 12                  | 12.55          |
|         |         | 18                  | 12.14          |
|         |         | 24                  | 11.74          |
|         |         | 36                  | 11.1           |
|         |         | 48                  | 10.6           |
|         |         | 54                  | 10.4           |
|         | 11      | 6                   | 13.97          |
|         |         | 9                   | 13.78          |
|         |         | 12                  | 13.53          |

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|              |    |      |       |
|--------------|----|------|-------|
| 802.11n HT20 |    | 18   | 13.12 |
|              |    | 24   | 12.73 |
|              |    | 36   | 12.1  |
|              |    | 48   | 11.57 |
|              |    | 54   | 11.38 |
|              | 1  | MCS0 | 11.05 |
|              |    | MCS1 | 11.83 |
|              |    | MCS2 | 11.31 |
|              |    | MCS3 | 11.04 |
|              |    | MCS4 | 10.44 |
|              |    | MCS5 | 9.94  |
|              |    | MCS6 | 9.74  |
|              |    | MCS7 | 9.53  |
|              | 6  | MCS0 | 11.75 |
|              |    | MCS1 | 12.56 |
|              |    | MCS2 | 12.14 |
|              |    | MCS3 | 11.75 |
|              |    | MCS4 | 11.16 |
|              |    | MCS5 | 10.69 |
|              |    | MCS6 | 10.49 |
|              |    | MCS7 | 10.28 |
|              | 11 | MCS0 | 11.78 |
|              |    | MCS1 | 12.58 |
|              |    | MCS2 | 12.15 |
|              |    | MCS3 | 11.74 |
|              |    | MCS4 | 11.16 |
|              |    | MCS5 | 10.7  |
|              |    | MCS6 | 10.48 |
|              |    | MCS7 | 10.28 |

## **7.2. Standalone SAR Test Exclusion Considerations**

Per FCC KDB 447498 D01, the SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} * \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

Based on the above equation, Bluetooth SAR was not required;

$$\text{Head Evaluation} = [10^{(4.5/10)}/5] * (2.480^{1/2}) = 0.89 < 3.0$$

$$\text{Body Evaluation} = [10^{(4.5/10)}/10] * (2.480^{1/2}) = 0.45 < 3.0$$

Based on the above equation, WIFI SAR was required;

$$\text{Head Evaluation} = [10^{(16.5/10)}/5] * (2.462^{1/2}) = 14.02 > 3.0$$

$$\text{Body Evaluation} = [10^{(16.5/10)}/10] * (2.462^{1/2}) = 7.01 > 3.0$$

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### 7.3. SAR Test Results

#### 7.3.1. GSM 850 (GSM/GPRS)

**Table 14: SAR Values [GSM 850 (GSM/GPRS)]**

| Test Position                         | Channel/<br>Frequency<br>(MHz) | Time slot | Duty Cycle | Maximum Allowed Power (dBm) | Conducted Power (dBm) | Drift<br>± 0.21dB | Limit SAR <sub>1g</sub> 1.6 W/kg  |                |                                   |               |
|---------------------------------------|--------------------------------|-----------|------------|-----------------------------|-----------------------|-------------------|-----------------------------------|----------------|-----------------------------------|---------------|
|                                       |                                |           |            |                             |                       | Drift (dB)        | Measured SAR <sub>1g</sub> (W/kg) | Scaling Factor | Reported SAR <sub>1g</sub> (W/kg) | Graph Results |
| Test Position of Head                 |                                |           |            |                             |                       |                   |                                   |                |                                   |               |
| Left/Cheek                            | 251/848.8                      | GS M      | 1:8.3      | 32.8                        | 31.34                 | -0.120            | 0.652                             | 1.40           | 0.913                             | /             |
|                                       | 190/836.6                      | GSM       | 1:8.3      | 32.8                        | 31.30                 | -0.046            | 0.653                             | 1.41           | 0.922                             | Figure13      |
|                                       | 128/824.4                      | GSM       | 1:8.3      | 32.8                        | 31.40                 | -0.100            | 0.597                             | 1.38           | 0.824                             | /             |
| Left/Tilt                             | 251/848.8                      | GSM       | 1:8.3      | 32.8                        | 31.34                 | -0.040            | 0.434                             | 1.40           | 0.607                             | /             |
|                                       | 190/836.6                      | GSM       | 1:8.3      | 32.8                        | 31.30                 | -0.060            | 0.415                             | 1.41           | 0.586                             | /             |
|                                       | 128/824.4                      | GSM       | 1:8.3      | 32.8                        | 31.40                 | 0.030             | 0.401                             | 1.38           | 0.554                             | /             |
| Right/Cheek                           | 251/848.8                      | GSM       | 1:8.3      | 32.8                        | 31.34                 | 0.020             | 0.559                             | 1.40           | 0.782                             | /             |
|                                       | 190/836.6                      | GSM       | 1:8.3      | 32.8                        | 31.30                 | 0.030             | 0.536                             | 1.41           | 0.757                             | /             |
|                                       | 128/824.4                      | GSM       | 1:8.3      | 32.8                        | 31.40                 | 0.030             | 0.508                             | 1.38           | 0.701                             | /             |
| Right/Tilt                            | 251/848.8                      | GSM       | 1:8.3      | 32.8                        | 31.34                 | 0.100             | 0.452                             | 1.40           | 0.633                             | /             |
|                                       | 190/836.6                      | GSM       | 1:8.3      | 32.8                        | 31.30                 | -0.100            | 0.433                             | 1.41           | 0.612                             | /             |
|                                       | 128/824.4                      | GSM       | 1:8.3      | 32.8                        | 31.40                 | 0.050             | 0.423                             | 1.38           | 0.584                             | /             |
| Test position of Body (Distance 10mm) |                                |           |            |                             |                       |                   |                                   |                |                                   |               |
| Back Side                             | 251/848.8                      | 4Txslots  | 1:2.07491  | 27.4                        | 26.05                 | 0.030             | 0.640                             | 1.36           | 0.873                             | /             |
|                                       | 190/836.6                      | 4Txslots  | 1:2.07491  | 27.4                        | 26.13                 | -0.040            | 0.634                             | 1.34           | 0.849                             | /             |
|                                       | 128/824.4                      | 4Txslots  | 1:2.07491  | 27.4                        | 26.14                 | -0.010            | 0.695                             | 1.34           | 0.929                             | Figure14      |
| Front Side                            | 190/836.6                      | 4Txslots  | 1:2.07491  | 27.4                        | 26.13                 | -0.080            | 0.526                             | 1.34           | 0.705                             | /             |

Note: 1. The value with blue color is the maximum SAR Value of each test band.

- When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.
- Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was  $\leq 1.2$  W/kg, no additional SAR evaluations using a headset cable were required.

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### 7.3.2. GSM 1900 (GSM/GPRS)

**Table 15: SAR Values [GSM 1900(GSM/GPRS)]**

| Test Position                         | Channel/<br>Frequency<br>(MHz) | Time slot | Duty Cycle | Maximum Allowed Power (dBm) | Conducted Power (dBm) | Drift<br>± 0.21dB | Limit SAR <sub>1g</sub> 1.6 W/kg  |                |                                   |               |
|---------------------------------------|--------------------------------|-----------|------------|-----------------------------|-----------------------|-------------------|-----------------------------------|----------------|-----------------------------------|---------------|
|                                       |                                |           |            |                             |                       | Drift (dB)        | Measured SAR <sub>1g</sub> (W/kg) | Scaling Factor | Reported SAR <sub>1g</sub> (W/kg) | Graph Results |
| Test Position of Head                 |                                |           |            |                             |                       |                   |                                   |                |                                   |               |
| Left/Cheek                            | 810/1909.8                     | GSM       | 1:8.3      | 30                          | 28.86                 | 0.020             | 0.357                             | 1.30           | 0.464                             | /             |
|                                       | 661/1880                       | GSM       | 1:8.3      | 30                          | 28.98                 | -0.010            | 0.392                             | 1.26           | 0.496                             | /             |
|                                       | 512/1850.2                     | GSM       | 1:8.3      | 30                          | 29.00                 | -0.080            | 0.413                             | 1.26           | 0.520                             | /             |
| Left/Tilt                             | 810/1909.8                     | GSM       | 1:8.3      | 30                          | 28.86                 | 0.100             | 0.211                             | 1.30           | 0.274                             | /             |
|                                       | 661/1880                       | GSM       | 1:8.3      | 30                          | 28.98                 | 0.070             | 0.234                             | 1.26           | 0.296                             | /             |
|                                       | 512/1850.2                     | GSM       | 1:8.3      | 30                          | 29.00                 | 0.050             | 0.267                             | 1.26           | 0.336                             | /             |
| Right/Cheek                           | 810/1909.8                     | GSM       | 1:8.3      | 30                          | 28.86                 | 0.160             | 0.573                             | 1.30           | 0.745                             | /             |
|                                       | 661/1880                       | GSM       | 1:8.3      | 30                          | 28.98                 | 0.130             | 0.635                             | 1.26           | 0.803                             | /             |
|                                       | 512/1850.2                     | GSM       | 1:8.3      | 30                          | 29.00                 | 0.060             | 0.682                             | 1.26           | 0.859                             | Figure15      |
| Right/Tilt                            | 810/1909.8                     | GSM       | 1:8.3      | 30                          | 28.86                 | 0.010             | 0.200                             | 1.30           | 0.260                             | /             |
|                                       | 661/1880                       | GSM       | 1:8.3      | 30                          | 28.98                 | -0.030            | 0.231                             | 1.26           | 0.292                             | /             |
|                                       | 512/1850.2                     | GSM       | 1:8.3      | 30                          | 29.00                 | 0.040             | 0.263                             | 1.26           | 0.331                             | /             |
| Test position of Body (Distance 10mm) |                                |           |            |                             |                       |                   |                                   |                |                                   |               |
| Back Side                             | 810/1909.8                     | 3Txslots  | 1:2.76694  | 26.1                        | 24.48                 | -0.050            | 0.400                             | 1.45           | 0.581                             | /             |
|                                       | 661/1880                       | 3Txslots  | 1:2.76694  | 26.1                        | 24.62                 | -0.090            | 0.583                             | 1.41           | 0.820                             | /             |
|                                       | 512/1850.2                     | 3Txslots  | 1:2.76694  | 26.1                        | 24.64                 | -0.080            | 0.609                             | 1.40           | 0.852                             | Figure16      |
| Front Side                            | 661/1880                       | 3Txslots  | 1:2.76694  | 26.1                        | 24.62                 | 0.100             | 0.519                             | 1.41           | 0.730                             | /             |

Note: 1. The value with blue color is the maximum SAR Value of each test band.

- When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.
- Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.

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### 7.3.3. UMTS Band II (WCDMA/HSDPA/HSUPA)

**Table 16: SAR Values [UMTS Band II (WCDMA/HSDPA/HSUPA)]**

| Test Position                                                            | Channel/<br>Frequency<br>(MHz) | Channel Type | Duty Cycle | Maximum Allowed Power (dBm) | Conducted Power (dBm) | Drift<br>± 0.21dB | Limit SAR <sub>1g</sub> 1.6 W/kg  |                |                                   |               |
|--------------------------------------------------------------------------|--------------------------------|--------------|------------|-----------------------------|-----------------------|-------------------|-----------------------------------|----------------|-----------------------------------|---------------|
|                                                                          |                                |              |            |                             |                       | Drift (dB)        | Measured SAR <sub>1g</sub> (W/kg) | Scaling Factor | Reported SAR <sub>1g</sub> (W/kg) | Graph Results |
| Test Position of Head                                                    |                                |              |            |                             |                       |                   |                                   |                |                                   |               |
| Left/Cheek                                                               | 9538/1907.6                    | RMC 12.2K    | 1:1        | 23                          | 22.13                 | -0.140            | 0.653                             | 1.22           | 0.798                             | /             |
|                                                                          | 9400/1880                      | RMC 12.2K    | 1:1        | 23                          | 22.23                 | -0.160            | 0.602                             | 1.19           | 0.719                             | /             |
|                                                                          | 9262/1852.4                    | RMC 12.2K    | 1:1        | 23                          | 22.03                 | 0.120             | 0.612                             | 1.25           | 0.765                             | /             |
| Left/Tilt                                                                | 9538/1907.6                    | RMC 12.2K    | 1:1        | 23                          | 22.13                 | 0.001             | 0.352                             | 1.22           | 0.430                             | /             |
|                                                                          | 9400/1880                      | RMC 12.2K    | 1:1        | 23                          | 22.23                 | 0.150             | 0.389                             | 1.19           | 0.464                             | /             |
|                                                                          | 9262/1852.4                    | RMC 12.2K    | 1:1        | 23                          | 22.03                 | -0.048            | 0.381                             | 1.25           | 0.476                             | /             |
| Right/Cheek                                                              | 9538/1907.6                    | RMC 12.2K    | 1:1        | 23                          | 22.13                 | 0.110             | 0.980                             | 1.22           | 1.197                             | Figure17      |
|                                                                          | 9400/1880                      | RMC 12.2K    | 1:1        | 23                          | 22.23                 | 0.090             | 0.968                             | 1.19           | 1.156                             | /             |
|                                                                          | 9262/1852.4                    | RMC 12.2K    | 1:1        | 23                          | 22.03                 | 0.140             | 0.906                             | 1.25           | 1.133                             | /             |
| Right/Tilt                                                               | 9538/1907.6                    | RMC 12.2K    | 1:1        | 23                          | 22.13                 | -0.010            | 0.360                             | 1.22           | 0.440                             | /             |
|                                                                          | 9400/1880                      | RMC 12.2K    | 1:1        | 23                          | 22.23                 | 0.010             | 0.378                             | 1.19           | 0.451                             | /             |
|                                                                          | 9262/1852.4                    | RMC 12.2K    | 1:1        | 23                          | 22.03                 | -0.030            | 0.375                             | 1.25           | 0.469                             | /             |
| Test position of Body (Distance 10mm)                                    |                                |              |            |                             |                       |                   |                                   |                |                                   |               |
| Back Side                                                                | 9538/1907.6                    | RMC 12.2K    | 1:1        | 23                          | 22.13                 | -0.130            | 0.728                             | 1.22           | 0.889                             | Figure18      |
|                                                                          | 9400/1880                      | RMC 12.2K    | 1:1        | 23                          | 22.23                 | -0.021            | 0.715                             | 1.19           | 0.854                             | /             |
|                                                                          | 9262/1852.4                    | RMC 12.2K    | 1:1        | 23                          | 22.03                 | 0.120             | 0.688                             | 1.25           | 0.860                             | /             |
| Front Side                                                               | 9538/1907.6                    | RMC 12.2K    | 1:1        | 23                          | 22.13                 | -0.070            | 0.672                             | 1.22           | 0.821                             | /             |
|                                                                          | 9400/1880                      | RMC 12.2K    | 1:1        | 23                          | 22.23                 | 0.050             | 0.710                             | 1.19           | 0.848                             | /             |
|                                                                          | 9262/1852.4                    | RMC 12.2K    | 1:1        | 23                          | 22.03                 | 0.100             | 0.623                             | 1.25           | 0.779                             | /             |
| Worst Case Position of SAR (1 <sup>st</sup> Repeated SAR, Distance 10mm) |                                |              |            |                             |                       |                   |                                   |                |                                   |               |
| Right/Cheek                                                              | 9538/1907.6                    | RMC 12.2K    | 1:1        | 23                          | 22.13                 | 0.140             | 0.956                             | 1.22           | 1.168                             | /             |

Note: 1. The value with blue color is the maximum SAR Value of each test band.

- Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).
- WCDMA mode were tested under RMC 12.2kbps without HSPA (HSDPA/HSUPA) inactive per KDB Publication 941225 D01. HSPA (HSDPA/HSUPA) SAR for body was not required since the average output power of the HSPA (HSDPA/HSUPA) subtests was not more than 0.25 dB higher than the RMC level and the maximum SAR for 12.2kbps RMC was less than 75% SAR limit.
- Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.

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**Table 17: SAR Measurement Variability Results [UMTS Band II (WCDMA/HSDPA/HSUPA)]**

| Test Position | Channel/<br>Frequency<br>(MHz) | Measured<br>SAR (1g) | 1 <sup>st</sup> Repeated<br>SAR (1g) | Ratio | 2 <sup>nd</sup> Repeated<br>SAR (1g) | 3 <sup>rd</sup> Repeated<br>SAR (1g) |
|---------------|--------------------------------|----------------------|--------------------------------------|-------|--------------------------------------|--------------------------------------|
| Right/Cheek   | 9538/1907.6                    | 0.980                | 0.956                                | 1.02  | N/A                                  | N/A                                  |

Note: 1) When the original highest measured SAR is  $\geq 0.80$  W/kg, the measurement was repeated once.

2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was  $> 1.20$  or when the original or repeated measurement was  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).

3) A third repeated measurement was performed only if the original, first or second repeated measurement was  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

4) Repeated measurements are not required when the original highest measured SAR is  $< 0.80$  W/kg

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### 7.3.4. UMTS Band V (WCDMA/HSDPA/HSUPA)

**Table 18: SAR Values [UMTS Band V (WCDMA/HSDPA/HSUPA)]**

| Test Position                                                            | Channel/<br>Frequency<br>(MHz) | Channel Type | Duty Cycle | Maximum Allowed Power (dBm) | Conducted Power (dBm) | Drift<br>± 0.21dB | Limit SAR <sub>1g</sub> 1.6 W/kg  |                |                                   |               |
|--------------------------------------------------------------------------|--------------------------------|--------------|------------|-----------------------------|-----------------------|-------------------|-----------------------------------|----------------|-----------------------------------|---------------|
|                                                                          |                                |              |            |                             |                       | Drift (dB)        | Measured SAR <sub>1g</sub> (W/kg) | Scaling Factor | Reported SAR <sub>1g</sub> (W/kg) | Graph Results |
| Test Position of Head                                                    |                                |              |            |                             |                       |                   |                                   |                |                                   |               |
| Left/Cheek                                                               | 4233/846.6                     | RMC 12.2K    | 1:1        | 23                          | 22.16                 | -0.140            | 0.578                             | 1.21           | 0.701                             | /             |
|                                                                          | 4183/836.6                     | RMC 12.2K    | 1:1        | 23                          | 21.86                 | -0.130            | 0.659                             | 1.30           | 0.857                             | /             |
|                                                                          | 4132/826.4                     | RMC 12.2K    | 1:1        | 23                          | 21.94                 | -0.138            | 0.889                             | 1.28           | 1.135                             | Figure19      |
| Left/Tilt                                                                | 4233/846.6                     | RMC 12.2K    | 1:1        | 23                          | 22.16                 | 0.100             | 0.371                             | 1.21           | 0.450                             | /             |
|                                                                          | 4183/836.6                     | RMC 12.2K    | 1:1        | 23                          | 21.86                 | -0.040            | 0.412                             | 1.30           | 0.536                             | /             |
|                                                                          | 4132/826.4                     | RMC 12.2K    | 1:1        | 23                          | 21.94                 | 0.020             | 0.527                             | 1.28           | 0.673                             | /             |
| Right/Cheek                                                              | 4233/846.6                     | RMC 12.2K    | 1:1        | 23                          | 22.16                 | 0.010             | 0.5                               | 1.21           | 0.607                             | /             |
|                                                                          | 4183/836.6                     | RMC 12.2K    | 1:1        | 23                          | 21.86                 | -0.030            | 0.597                             | 1.30           | 0.776                             | /             |
|                                                                          | 4132/826.4                     | RMC 12.2K    | 1:1        | 23                          | 21.94                 | -0.080            | 0.764                             | 1.28           | 0.975                             | /             |
| Right/Tilt                                                               | 4233/846.6                     | RMC 12.2K    | 1:1        | 23                          | 22.16                 | 0.070             | 0.384                             | 1.21           | 0.466                             | /             |
|                                                                          | 4183/836.6                     | RMC 12.2K    | 1:1        | 23                          | 21.86                 | 0.040             | 0.442                             | 1.30           | 0.575                             | /             |
|                                                                          | 4132/826.4                     | RMC 12.2K    | 1:1        | 23                          | 21.94                 | 0.070             | 0.561                             | 1.28           | 0.716                             | /             |
| Test position of Body (Distance 10mm)                                    |                                |              |            |                             |                       |                   |                                   |                |                                   |               |
| Back Side                                                                | 4233/846.6                     | RMC 12.2K    | 1:1        | 23                          | 22.16                 | -0.020            | 0.592                             | 1.21           | 0.718                             | /             |
|                                                                          | 4183/836.6                     | RMC 12.2K    | 1:1        | 23                          | 21.86                 | 0.070             | 0.68                              | 1.30           | 0.884                             | /             |
|                                                                          | 4132/826.4                     | RMC 12.2K    | 1:1        | 23                          | 21.94                 | -0.100            | 0.928                             | 1.28           | 1.185                             | Figure20      |
| Front Side                                                               | 4233/846.6                     | RMC 12.2K    | 1:1        | 23                          | 22.16                 | -0.070            | 0.486                             | 1.21           | 0.590                             | /             |
|                                                                          | 4183/836.6                     | RMC 12.2K    | 1:1        | 23                          | 21.86                 | 0.044             | 0.615                             | 1.30           | 0.800                             | /             |
|                                                                          | 4132/826.4                     | RMC 12.2K    | 1:1        | 23                          | 21.94                 | -0.080            | 0.759                             | 1.28           | 0.969                             | /             |
| Worst Case Position of SAR (1 <sup>st</sup> Repeated SAR, Distance 10mm) |                                |              |            |                             |                       |                   |                                   |                |                                   |               |
| Back Side                                                                | 4132/826.4                     | RMC 12.2K    | 1:1        | 23                          | 21.94                 | -0.100            | 0.919                             | 1.28           | 1.173                             | /             |

Note: 1. The value with blue color is the maximum SAR Value of each test band.

- Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8$  W/kg then testing at the other channels is not required for such test configuration(s).
- WCDMA mode were tested under RMC 12.2kbps without HSPA (HSDPA/HSUPA) inactive per KDB Publication 941225 D01. HSPA (HSDPA/HSUPA) SAR for body was not required since the average output power of the HSPA (HSDPA/HSUPA) subtests was not more than 0.25 dB higher than the RMC level and the maximum SAR for 12.2kbps RMC was less than 75% SAR limit.
- Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was  $\leq 1.2$  W/kg, no additional SAR evaluations using a headset cable were required.

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**Table 19: SAR Measurement Variability Results [UMTS Band V (WCDMA/HSDPA/HSUPA)]**

| Test Position | Channel/<br>Frequency<br>(MHz) | Measured<br>SAR (1g) | 1 <sup>st</sup> Repeated<br>SAR (1g) | Ratio | 2 <sup>nd</sup> Repeated<br>SAR (1g) | 3 <sup>rd</sup> Repeated<br>SAR (1g) |
|---------------|--------------------------------|----------------------|--------------------------------------|-------|--------------------------------------|--------------------------------------|
| Back Side     | 4132/826.4                     | 0.928                | 0.919                                | 1.01  | N/A                                  | N/A                                  |

Note: 1) When the original highest measured SAR is  $\geq 0.80$  W/kg, the measurement was repeated once.

2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was  $> 1.20$  or when the original or repeated measurement was  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).

3) A third repeated measurement was performed only if the original, first or second repeated measurement was  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

4) Repeated measurements are not required when the original highest measured SAR is  $< 0.80$  W/kg

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### 7.3.5. WIFI (802.11b)

**Table 20: SAR Values(802.11b)**

| Test Position                         | Channel/<br>Frequency<br>(MHz) | Service | Duty<br>Cycle | Maximum<br>Allowed<br>Power<br>(dBm) | Conducted<br><br>Power<br>(dBm) | Drift<br>± 0.21dB | Limit of SAR 1.6 W/kg                   |                   |                                         |                  |
|---------------------------------------|--------------------------------|---------|---------------|--------------------------------------|---------------------------------|-------------------|-----------------------------------------|-------------------|-----------------------------------------|------------------|
|                                       |                                |         |               |                                      |                                 | Drift<br>(dB)     | Measured<br>SAR <sub>1g</sub><br>(W/kg) | Scaling<br>Factor | Reported<br>SAR <sub>1g</sub><br>(W/kg) | Graph<br>Results |
| Test Position of Head                 |                                |         |               |                                      |                                 |                   |                                         |                   |                                         |                  |
| Left/Cheek                            | 11/2462                        | DSSS    | 1:1           | 16.5                                 | 16.36                           | 0.034             | 0.144                                   | 1.03              | 0.149                                   | Figure21         |
| Left/Tilt                             | 11/2462                        | DSSS    | 1:1           | 16.5                                 | 16.36                           | 0.109             | 0.072                                   | 1.03              | 0.074                                   | /                |
| Right/Cheek                           | 11/2462                        | DSSS    | 1:1           | 16.5                                 | 16.36                           | 0.026             | 0.081                                   | 1.03              | 0.084                                   | /                |
| Right/Tilt                            | 11/2462                        | DSSS    | 1:1           | 16.5                                 | 16.36                           | 0.055             | 0.044                                   | 1.03              | 0.046                                   | /                |
| Test position of Body (Distance 10mm) |                                |         |               |                                      |                                 |                   |                                         |                   |                                         |                  |
| Back Side                             | 11/2462                        | DSSS    | 1:1           | 16.5                                 | 16.36                           | 0.038             | 0.144                                   | 1.03              | 0.149                                   | Figure22         |
| Front Side                            | 11/2462                        | DSSS    | 1:1           | 16.5                                 | 16.36                           | 0.021             | 0.034                                   | 1.03              | 0.035                                   | /                |

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is  $\leq 0.8 \text{ W/kg}$  then testing at the other channels is not required for such test configuration(s).
3. KDB 248227-SAR is not required for 802.11g/n channels when the maximum average output power is less than  $\frac{1}{4} \text{ dB}$  higher than measured on the corresponding 802.11b channels.
4. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was  $\leq 1.2 \text{ W/kg}$ , no additional SAR evaluations using a headset cable were required.

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### 7.4. Simultaneous Transmission Conditions

| Air-Interface  | Band (MHz) | Type  | Simultaneous Transmissions                   | Voice Over Digital Transport (Data) |
|----------------|------------|-------|----------------------------------------------|-------------------------------------|
| GSM/UMTS       | 850        | Voice | Yes<br>BT or WIFI                            | NA                                  |
|                | 1900       | Voice |                                              |                                     |
|                | 850        | Data  |                                              |                                     |
|                | 1900       | Data  |                                              |                                     |
| WIFI           | 2450       | Data  | Yes<br>GSM/WCDMA, GPRS, HSDPA, HSUPA, HSPA+  | Yes                                 |
| Bluetooth (BT) | 2450       | Data  | Yes<br>GSM/WCDMA, GPRS, HSDPA, HSUPA , HSPA+ | NA                                  |

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The location of the antennas inside EUT is shown in ANNEX I:

When standalone SAR is not required to be measured per FCC KDB 447498 D01, the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR} = \frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} * \frac{\sqrt{f \text{ (GHz)}}}{7.5}$$

So, Head Estimated SAR<sub>Max.BT</sub> =  $[10^{(4.5/10)}/5] * (2.480^{1/2}/7.5) = 0.12 \text{ W/kg}$

Body Estimated SAR<sub>Max.BT</sub> =  $[10^{(4.5/10)}/10] * (2.480^{1/2}/7.5) = 0.06 \text{ W/kg}$

Per FCC KDB 447498 D01, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is  $\leq 1.6 \text{ W/kg}$ . When the sum is greater than the SAR limit, SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio} = \frac{(\text{SAR}_1 + \text{SAR}_2)^{1.5}}{(\text{peak location separation, mm})} < 0.04$$

### About BT and GSM/UMTS antenna

| SAR <sub>1g</sub> (W/kg)<br>Test Position | GSM<br>850 | GSM<br>1900 | UMTS<br>Band II | UMTS<br>Band V | BT          | MAX.<br>ΣSAR <sub>1g</sub> | Peak location<br>separation<br>ratio |
|-------------------------------------------|------------|-------------|-----------------|----------------|-------------|----------------------------|--------------------------------------|
| Left, Touch                               | 0.922      | 0.520       | 0.798           | <b>1.135</b>   | <b>0.12</b> | 1.255                      | NA                                   |
| Left, Tilt                                | 0.607      | 0.336       | 0.476           | <b>0.673</b>   | <b>0.12</b> | 0.793                      | NA                                   |
| Right, Touch                              | 0.782      | 0.859       | <b>1.197</b>    | 0.975          | <b>0.12</b> | <b>1.317</b>               | NA                                   |
| Right, Tilt                               | 0.633      | 0.331       | 0.469           | <b>0.716</b>   | <b>0.12</b> | 0.836                      | NA                                   |
| Back Side                                 | 0.929      | 0.852       | 0.889           | <b>1.185</b>   | <b>0.06</b> | 1.245                      | NA                                   |
| Front Side                                | 0.705      | 0.730       | 0.848           | <b>0.969</b>   | <b>0.06</b> | 1.029                      | NA                                   |

Note: 1. The value with blue color is the maximum ΣSAR<sub>1g</sub> Value.

2. MAX. ΣSAR<sub>1g</sub> = Unlicensed SAR<sub>MAX</sub> + Licensed SAR<sub>MAX</sub>

MAX. ΣSAR<sub>1g</sub> = 1.317 W/kg < 1.6 W/kg, So the Simultaneous transimition SAR with volum scan are not required for BT and GSM/UMTS antenna.

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### About WIFI and GSM/UMTS antenna

| SAR <sub>1g</sub> (W/kg)<br>Test Position | GSM 850 | GSM 1900 | UMTS Band II | UMTS Band V  | WIFI  | MAX. $\Sigma$ SAR <sub>1g</sub> | Peak location separation ratio |
|-------------------------------------------|---------|----------|--------------|--------------|-------|---------------------------------|--------------------------------|
| Left, Touch                               | 0.922   | 0.520    | 0.798        | <b>1.135</b> | 0.149 | 1.284                           | NA                             |
| Left, Tilt                                | 0.607   | 0.336    | 0.476        | <b>0.673</b> | 0.074 | 0.747                           | NA                             |
| Right, Touch                              | 0.782   | 0.859    | <b>1.197</b> | 0.975        | 0.084 | 1.281                           | NA                             |
| Right, Tilt                               | 0.633   | 0.331    | 0.469        | <b>0.716</b> | 0.046 | 0.762                           | NA                             |
| Back Side                                 | 0.929   | 0.852    | 0.889        | <b>1.185</b> | 0.149 | 1.334                           | NA                             |
| Front Side                                | 0.705   | 0.730    | 0.848        | <b>0.969</b> | 0.035 | 1.004                           | NA                             |

Note: 1.The value with blue color is the maximum  $\Sigma$ SAR<sub>1g</sub> Value.

2. MAX.  $\Sigma$ SAR<sub>1g</sub> =Unlicensed SAR<sub>MAX</sub> +Licensed SAR<sub>MAX</sub>

MAX.  $\Sigma$ SAR<sub>1g</sub> = 1.334 W/kg <1.6 W/kg, So the Simultaneous transimition SAR with volum scan are not required for WIFI and GSM/UMTS antenna.

### WIFI & BT Mode

BT and WIFI antenna cannot transmit simultaneously.

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### 8. 700MHz to 3GHz Measurement Uncertainty

| No.                 | source                                                                           | Type | Uncertainty Value (%) | Probability Distribution | k          | c <sub>i</sub> | Standard ncertainty $u_i$ (%) | Degree of freedom $V_{eff}$ or $V_i$ |
|---------------------|----------------------------------------------------------------------------------|------|-----------------------|--------------------------|------------|----------------|-------------------------------|--------------------------------------|
| 1                   | System repetivity                                                                | A    | 0.5                   | N                        | 1          | 1              | 0.5                           | 9                                    |
| Measurement system  |                                                                                  |      |                       |                          |            |                |                               |                                      |
| 2                   | -probe calibration                                                               | B    | 6.0                   | N                        | 1          | 1              | 6.0                           | $\infty$                             |
| 3                   | -axial isotropy of the probe                                                     | B    | 4.7                   | R                        | $\sqrt{3}$ | $\sqrt{0.5}$   | 1.9                           | $\infty$                             |
| 4                   | - Hemispherical isotropy of the probe                                            | B    | 9.4                   | R                        | $\sqrt{3}$ | $\sqrt{0.5}$   | 3.9                           | $\infty$                             |
| 5                   | -boundary effect                                                                 | B    | 1.9                   | R                        | $\sqrt{3}$ | 1              | 1.1                           | $\infty$                             |
| 6                   | -probe linearity                                                                 | B    | 4.7                   | R                        | $\sqrt{3}$ | 1              | 2.7                           | $\infty$                             |
| 7                   | - System detection limits                                                        | B    | 1.0                   | R                        | $\sqrt{3}$ | 1              | 0.6                           | $\infty$                             |
| 8                   | -readout Electronics                                                             | B    | 1.0                   | N                        | 1          | 1              | 1.0                           | $\infty$                             |
| 9                   | -response time                                                                   | B    | 0.8                   | R                        | $\sqrt{3}$ | 1              | 0.5                           | $\infty$                             |
| 10                  | -integration time                                                                | B    | 4.3                   | R                        | $\sqrt{3}$ | 1              | 2.5                           | $\infty$                             |
| 11                  | -RF Ambient noise                                                                | B    | 3.0                   | R                        | $\sqrt{3}$ | 1              | 1.7                           | $\infty$                             |
| 12                  | -RF Ambient Conditions                                                           | B    | 3.0                   | R                        | $\sqrt{3}$ | 1              | 1.7                           | $\infty$                             |
| 13                  | -Probe Positioner Mechanical Tolerance                                           | B    | 0.4                   | R                        | $\sqrt{3}$ | 1              | 0.2                           | $\infty$                             |
| 14                  | -Probe Positioning with respect to Phantom Shell                                 | B    | 2.9                   | R                        | $\sqrt{3}$ | 1              | 1.7                           | $\infty$                             |
| 15                  | -Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation | B    | 3.9                   | R                        | $\sqrt{3}$ | 1              | 2.3                           | $\infty$                             |
| Test sample Related |                                                                                  |      |                       |                          |            |                |                               |                                      |
| 16                  | -Test Sample Positioning                                                         | A    | 2.9                   | N                        | 1          | 1              | 2.9                           | 71                                   |
| 17                  | -Device Holder Uncertainty                                                       | A    | 4.1                   | N                        | 1          | 1              | 4.1                           | 5                                    |
| 18                  | - Power drift                                                                    | B    | 5.0                   | R                        | $\sqrt{3}$ | 1              | 2.9                           | $\infty$                             |
| Physical parameter  |                                                                                  |      |                       |                          |            |                |                               |                                      |
| 19                  | -phantom Uncertainty                                                             | B    | 4.0                   | R                        | $\sqrt{3}$ | 1              | 2.3                           | $\infty$                             |

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|                                                    |                                                                              |                                             |     |   |            |      |       |          |
|----------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------|-----|---|------------|------|-------|----------|
| 20                                                 | Algorithm for correcting SAR for deviations in permittivity and conductivity | B                                           | 1.9 | N | 1          | 0.84 | 0.9   | $\infty$ |
| 21                                                 | -Liquid conductivity (measurement uncertainty)                               | B                                           | 2.5 | N | 1          | 0.71 | 1.8   | 9        |
| 22                                                 | -Liquid permittivity (measurement uncertainty)                               | B                                           | 2.5 | N | 1          | 0.26 | 0.7   | 9        |
| 23                                                 | -Liquid conductivity -temperature uncertainty                                | B                                           | 1.7 | R | $\sqrt{3}$ | 0.71 | 0.7   | $\infty$ |
| 24                                                 | -Liquid permittivity -temperature uncertainty                                | B                                           | 0.3 | R | $\sqrt{3}$ | 0.26 | 0.05  | $\infty$ |
| Combined standard uncertainty                      |                                                                              | $u_c' = \sqrt{\sum_{i=1}^{24} c_i^2 u_i^2}$ |     |   |            |      | 11.34 |          |
| Expanded uncertainty (confidence interval of 95 %) |                                                                              | $u_e = 2u_c$                                |     | N | k=2        |      | 22.68 |          |

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### 9. Main Test Instruments

**Table 21: List of Main Instruments**

| No. | Name                     | Type           | Serial Number | Calibration Date         | Valid Period |
|-----|--------------------------|----------------|---------------|--------------------------|--------------|
| 01  | Network analyzer         | Agilent 8753E  | US37390326    | September 10, 2013       | One year     |
| 02  | Dielectric Probe Kit     | Agilent 85070E | US44020115    | No Calibration Requested |              |
| 03  | Power meter              | Agilent E4417A | GB41291714    | March 9, 2014            | One year     |
| 04  | Power sensor             | Agilent N8481H | MY50350004    | September 23, 2013       | One year     |
| 05  | Power sensor             | E9327A         | US40441622    | January 1, 2014          | One year     |
| 06  | Signal Generator         | HP 8341B       | 2730A00804    | September 9, 2013        | One year     |
| 07  | Dual directional coupler | 778D-012       | 50519         | March 24, 2014           | One year     |
| 08  | Dual directional coupler | 777D           | 50146         | March 24, 2014           | One year     |
| 09  | Amplifier                | IXA-020        | 0401          | No Calibration Requested |              |
| 10  | BTS                      | E5515C         | MY48360988    | November 30, 2013        | One year     |
| 11  | E-field Probe            | EX3DV4         | 3677          | November 28, 2013        | One year     |
| 12  | DAE                      | DAE4           | 1317          | January 16, 2014         | One year     |
| 13  | Validation Kit 835MHz    | D835V2         | 4d020         | August 26, 2011          | Three years  |
| 14  | Validation Kit 1900MHz   | D1900V2        | 5d060         | August 31, 2011          | Three years  |
| 15  | Validation Kit 2450MHz   | D2450V2        | 786           | August 29, 2011          | Three years  |
| 16  | Temperature Probe        | JM222          | AA1009129     | March 13, 2014           | One year     |
| 17  | Hygrothermograph         | WS-1           | 64591         | September 26, 2013       | One year     |

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

## **ANNEX A: Test Layout**



Picture 1: Specific Absorption Rate Test Layout

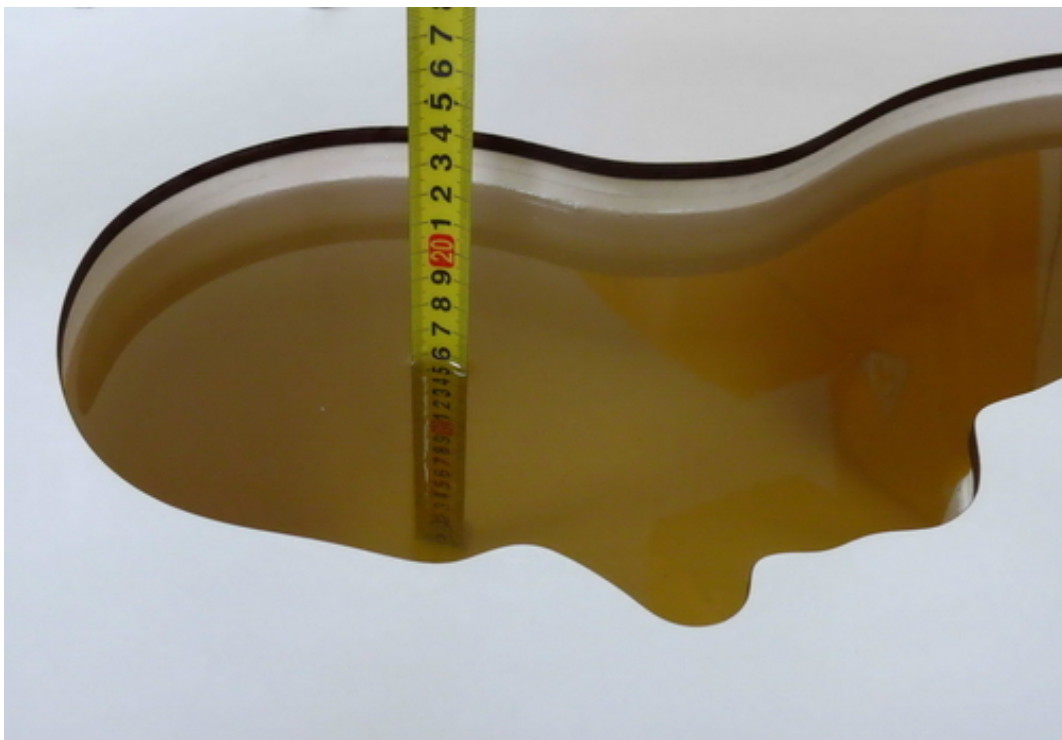
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Picture 2: Liquid depth in the flat Phantom (835MHz, 15.4cm depth)

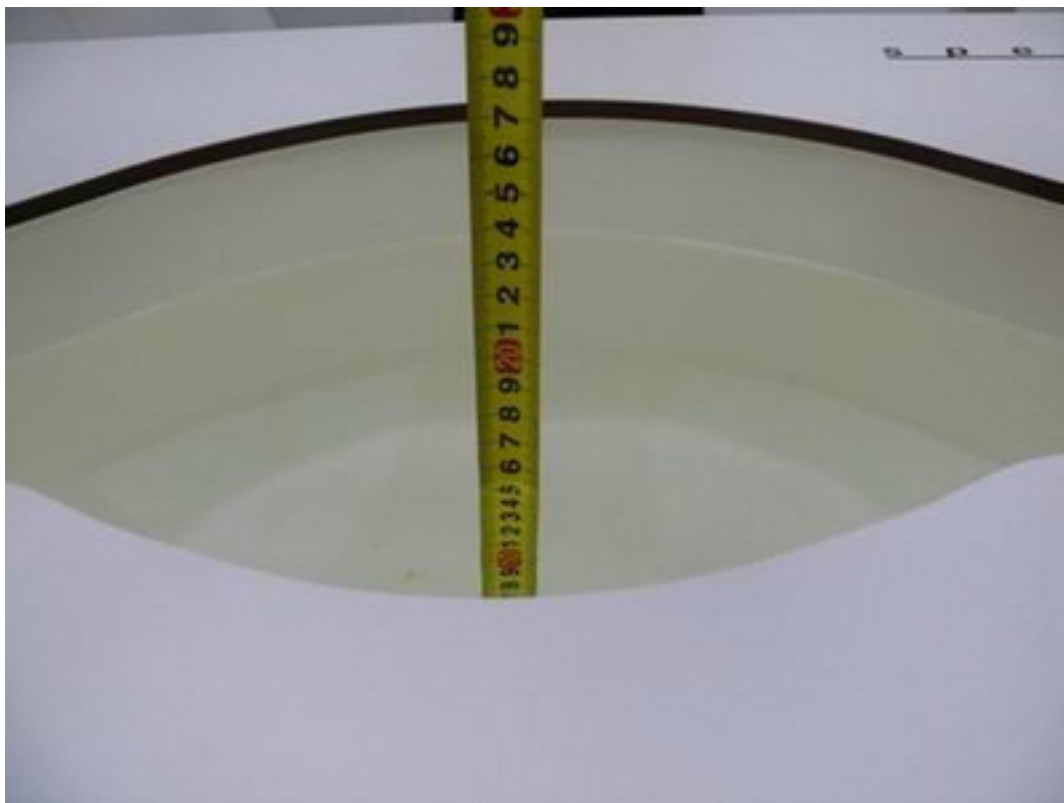


Picture 3: Liquid depth in the head Phantom (835MHz, 15.3cm depth)

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Picture 4: Liquid depth in the flat Phantom (1900 MHz, 15.2cm depth)

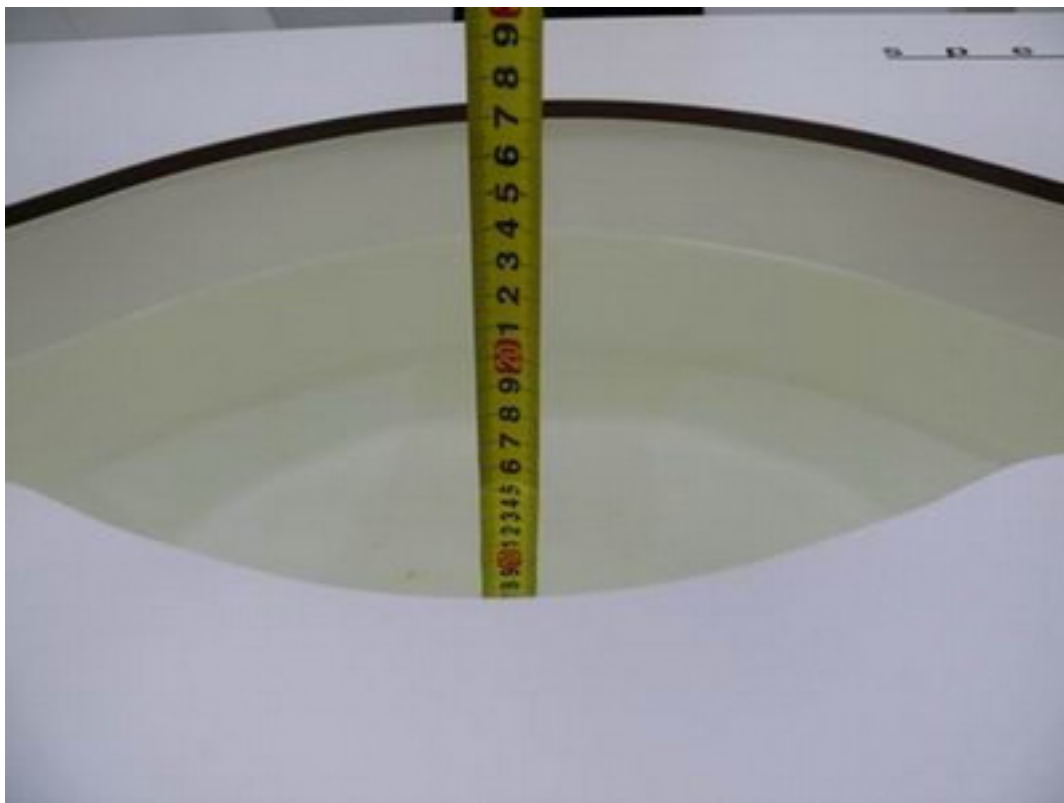


Picture 5: liquid depth in the head Phantom (1900 MHz, 15.3cm depth)

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Picture 6: Liquid depth in the flat Phantom (2450 MHz, 15.3cm depth)



Picture 7: Liquid depth in the head Phantom (2450 MHz, 15.4cm depth)

## ANNEX B: System Check Results

### System Performance Check at 835 MHz Head TSL

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Date: 3/29/2014

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.91 \text{ mho/m}$ ;  $\epsilon_r = 41.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(9.41, 9.41, 9.41); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**d=15mm, Pin=250mW/Area Scan (41x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.64 mW/g

**d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.4 V/m; Power Drift = -0.076 dB

Peak SAR (extrapolated) = 3.67 W/kg

**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**

Maximum value of SAR (measured) = 2.64 mW/g

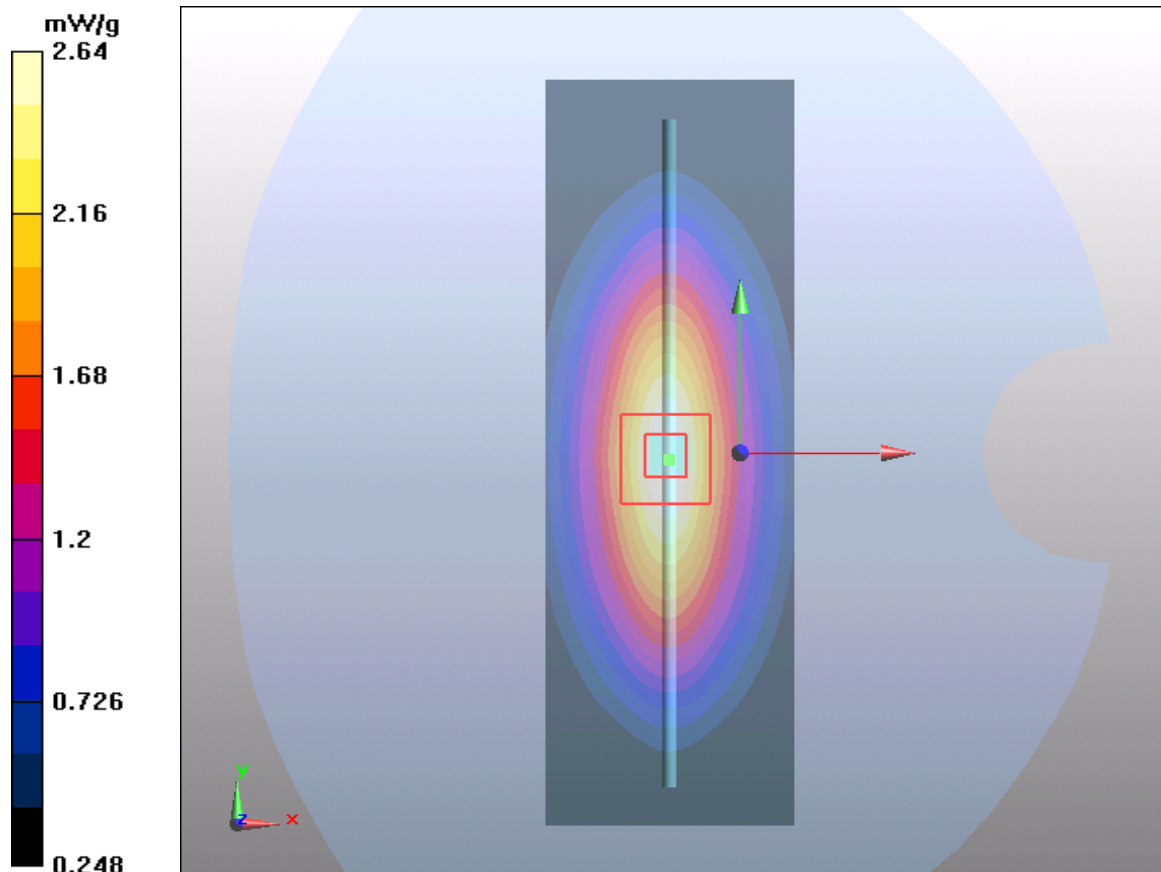


Figure 7 System Performance Check 835MHz 250mW

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### System Performance Check at 835 MHz Body TSL

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Date: 3/30/2014

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.98 \text{ mho/m}$ ;  $\epsilon_r = 55.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(9.51, 9.51, 9.51); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**d=15mm, Pin=250mW/Area Scan (41x121x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $2.58 \text{ mW/g}$

**d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $51.9 \text{ V/m}$ ; Power Drift =  $-0.058 \text{ dB}$

Peak SAR (extrapolated) =  $3.5 \text{ W/kg}$

**SAR(1 g) =  $2.41 \text{ mW/g}$ ; SAR(10 g) =  $1.6 \text{ mW/g}$**

Maximum value of SAR (measured) =  $2.6 \text{ mW/g}$

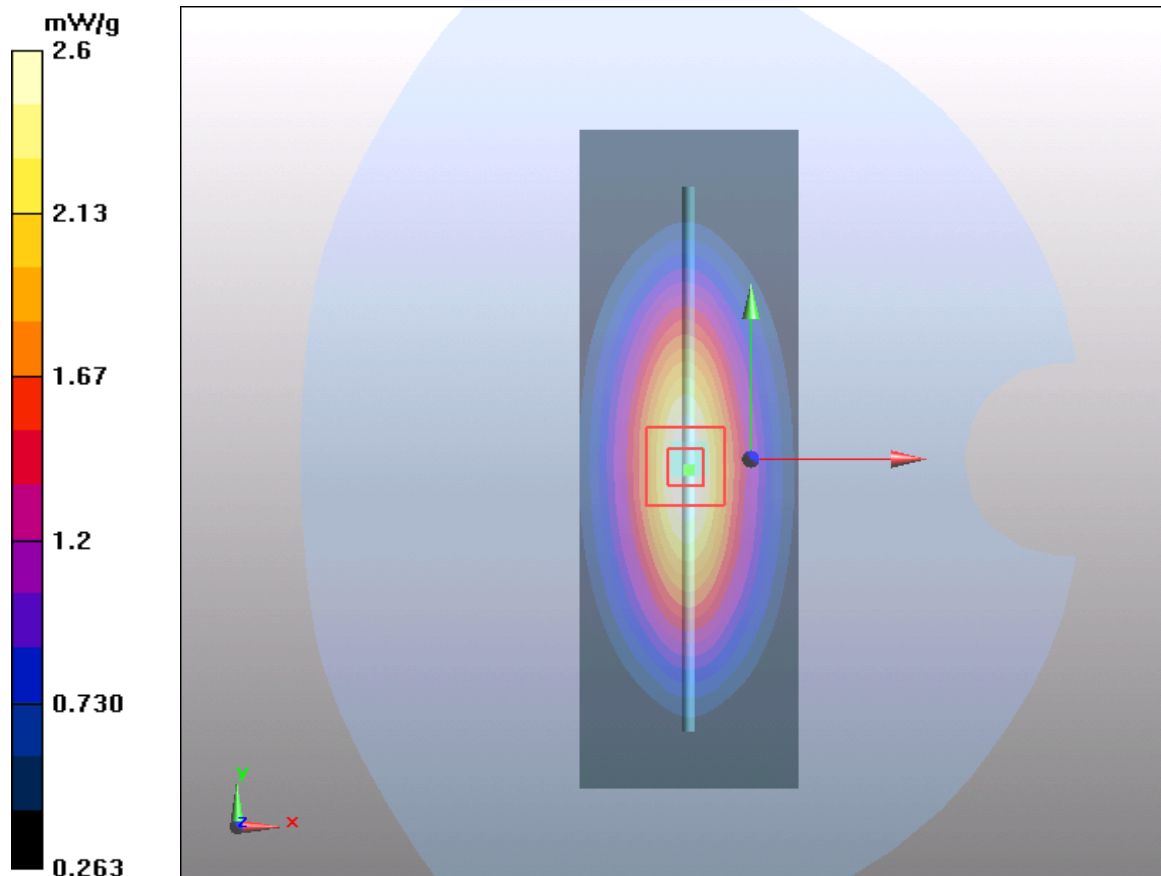


Figure 8 System Performance Check 835MHz 250Mw

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**System Performance Check at 1900 MHz Head TSL**

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Date: 3/29/2014

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\sigma = 1.34 \text{ mho/m}$ ;  $\epsilon_r = 40.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.3^\circ\text{C}$       Liquid Temperature:  $21.5^\circ\text{C}$

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(8.15, 8.15, 8.15); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM2; Type: SAM; Serial: TP-1524

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (interpolated) =  $11.3 \text{ mW/g}$

**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $85.5 \text{ V/m}$ ; Power Drift =  $0.028 \text{ dB}$

Peak SAR (extrapolated) =  $17.8 \text{ W/kg}$

**SAR(1 g) =  $9.48 \text{ mW/g}$ ; SAR(10 g) =  $4.9 \text{ mW/g}$**

Maximum value of SAR (measured) =  $10.7 \text{ mW/g}$

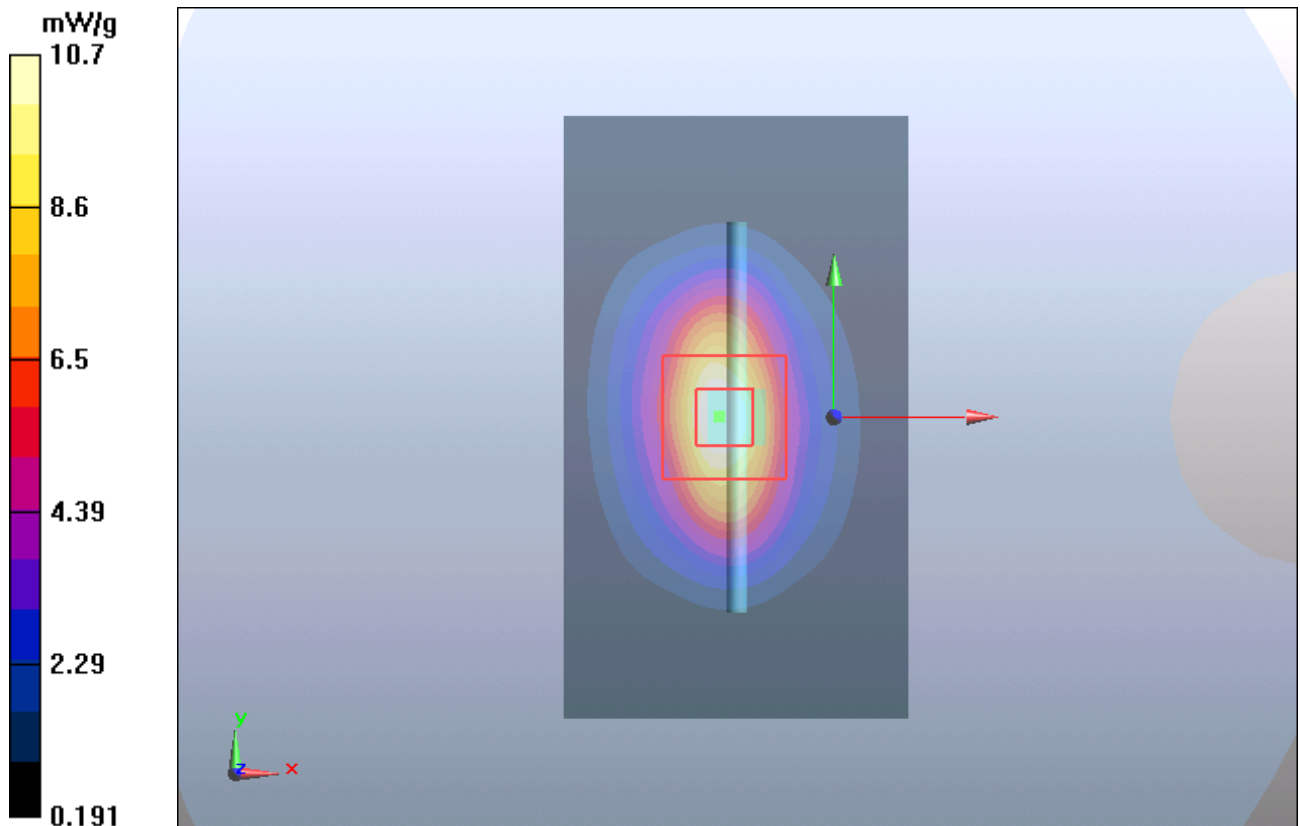


Figure 9 System Performance Check 1900MHz 250mW

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**System Performance Check at 1900 MHz Body TSL**

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Date: 3/31/2014

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.52$  mho/m;  $\epsilon_r = 53.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(7.63, 7.63, 7.63); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM2; Type: SAM; Serial: TP-1524

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 12.2 mW/g

**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 82.3 V/m; Power Drift = 0.068 dB

Peak SAR (extrapolated) = 17.8 W/kg

**SAR(1 g) = 9.93 mW/g; SAR(10 g) = 5.25 mW/g**

Maximum value of SAR (measured) = 11.3 mW/g

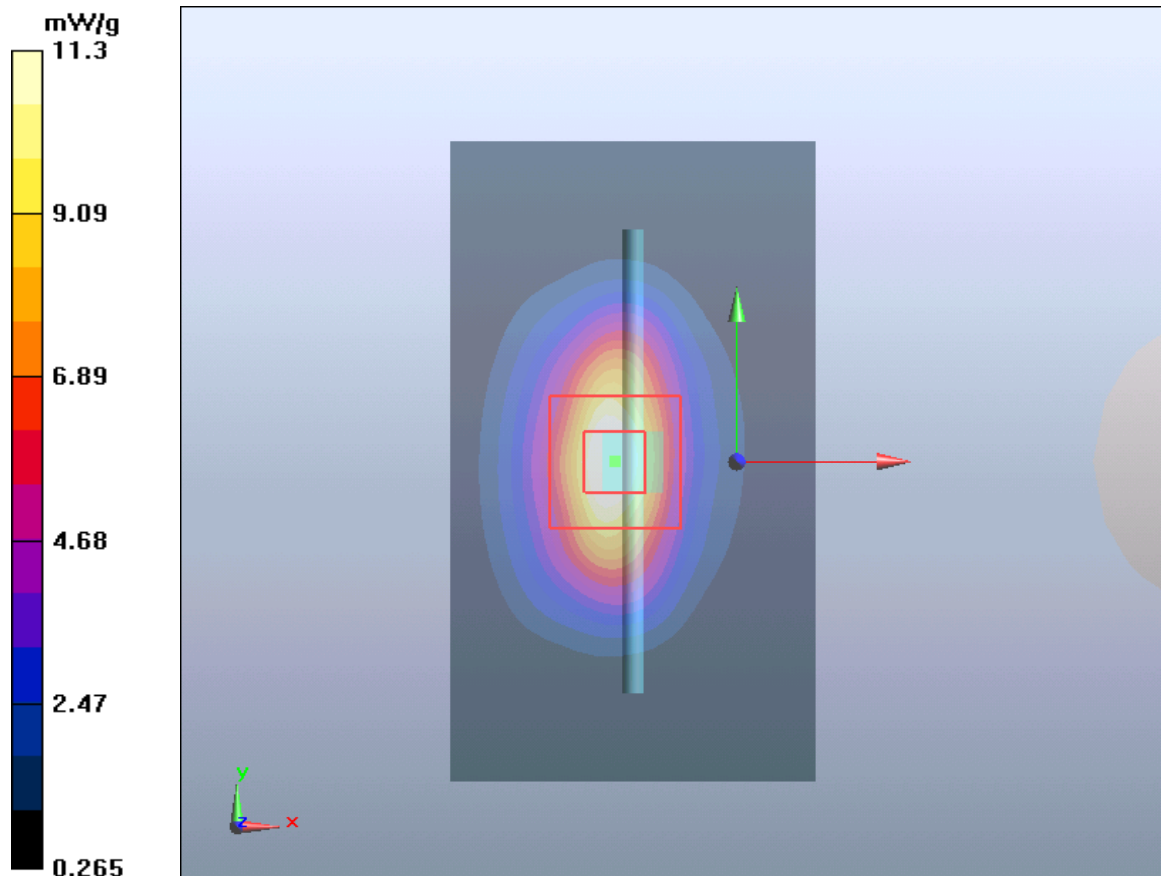


Figure 10 System Performance Check 1900MHz 250mW

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### System Performance Check at 2450 MHz Head TSL

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

Date: 3/31/2014

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.80$  mho/m;  $\epsilon_r = 39.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(7.64, 7.64, 7.64); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM2; Type: SAM; Serial: TP-1524

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 18.2 mW/g

**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.8 V/m; Power Drift = 0.075 dB

Peak SAR (extrapolated) = 30 W/kg

**SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.22 mW/g**

Maximum value of SAR (measured) = 15.9 mW/g

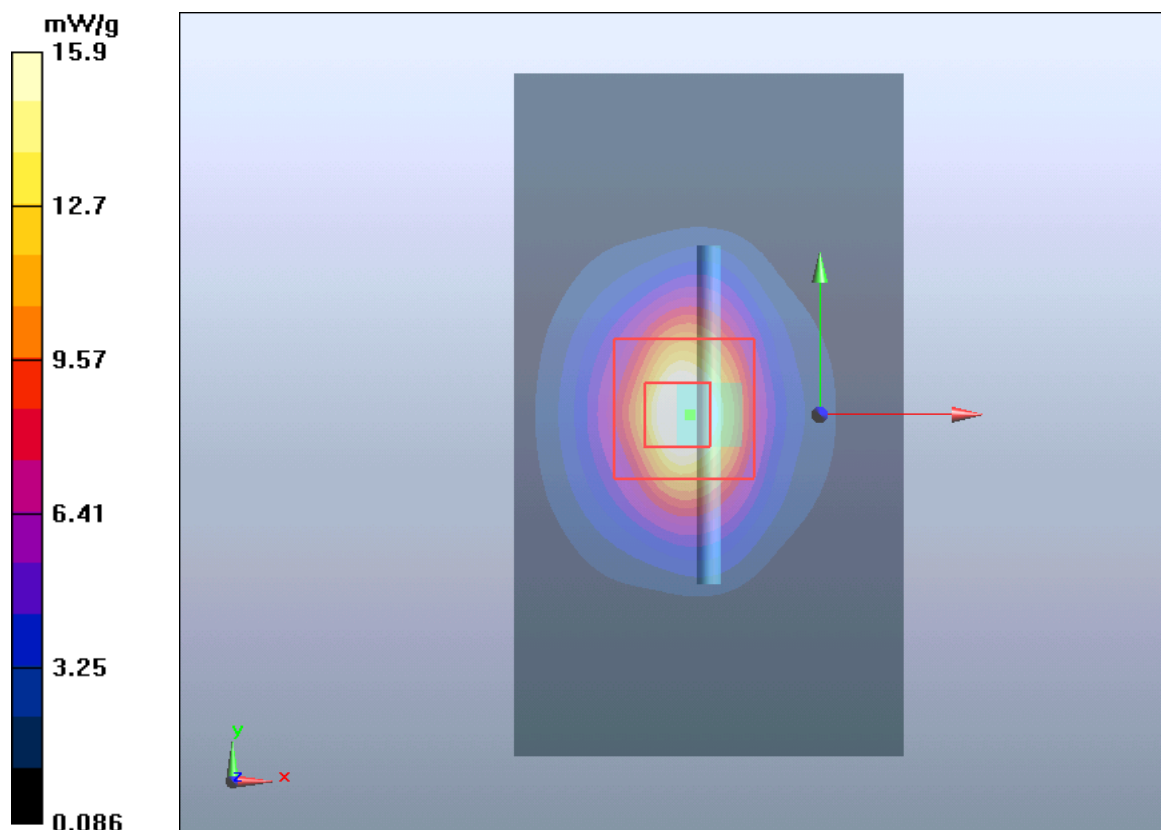


Figure 11 System Performance Check 2450MHz 250mW

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**System Performance Check at 2450 MHz Body TSL**

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

Date: 3/31/2014

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.99$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(7.61, 7.61, 7.61); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM2; Type: SAM; Serial: TP-1524

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 16 mW/g

**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 81.2 V/m; Power Drift = 0.003 dB

Peak SAR (extrapolated) = 25.4 W/kg

**SAR(1 g) = 12.5 mW/g; SAR(10 g) = 6.20 mW/g**

Maximum value of SAR (measured) = 14.4 mW/g

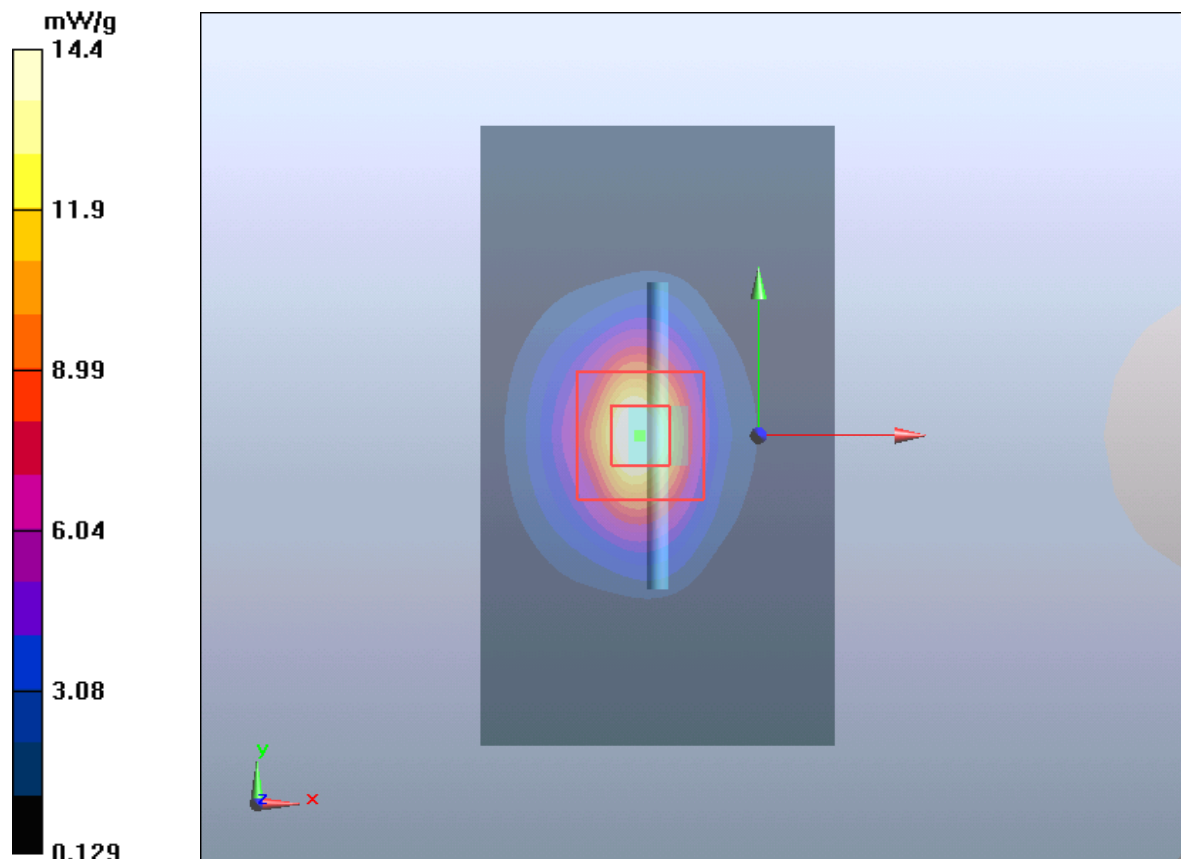


Figure 12 System Performance Check 2450MHz 250mW

## ANNEX C: Graph Results

### GSM 850 Left Cheek Middle

Date: 3/29/2014

Communication System: GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.30042

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.932$  S/m;  $\epsilon_r = 41.357$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(9.41, 9.41, 9.41); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Left Cheek Middle /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.695 W/kg

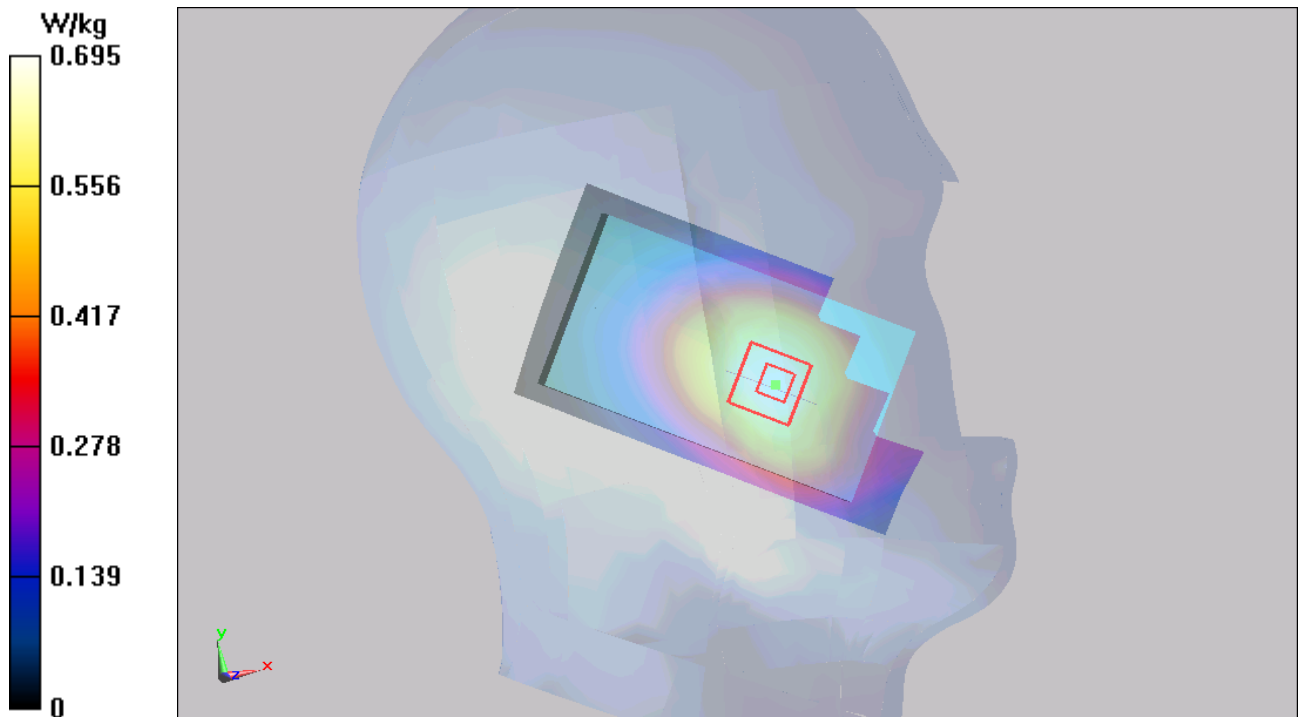
**Left Cheek Middle /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.990 V/m; Power Drift = -0.046 dB

Peak SAR (extrapolated) = 0.826 W/kg

**SAR(1 g) = 0.653 W/kg; SAR(10 g) = 0.490 W/kg**

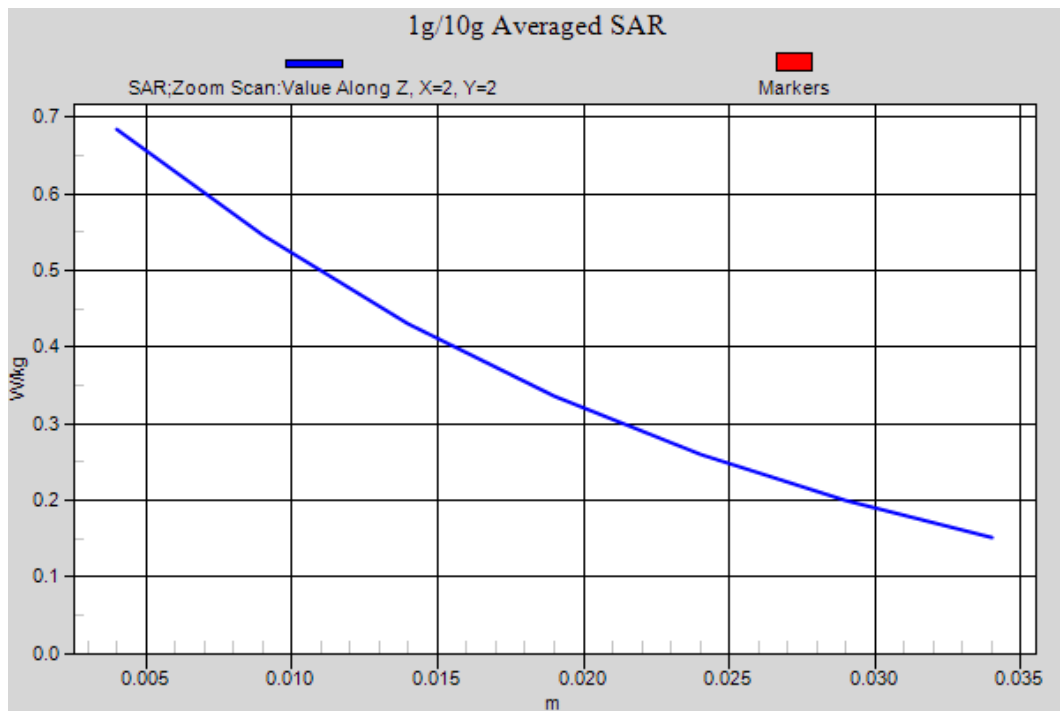
Maximum value of SAR (measured) = 0.684 W/kg



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**Figure 13 Left Hand Touch Cheek GSM 850 Channel 190**

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### GSM 850 GPRS (2Txslots) Back Side Low

Date: 3/30/2014

Communication System: GPRS 4TX; Frequency: 824.2 MHz; Duty Cycle: 1:2.07491

Medium parameters used (interpolated):  $f = 824.2$  MHz;  $\sigma = 0.978$  S/m;  $\epsilon_r = 55.938$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(9.51, 9.51, 9.51); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Back Side Low /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.743 W/kg

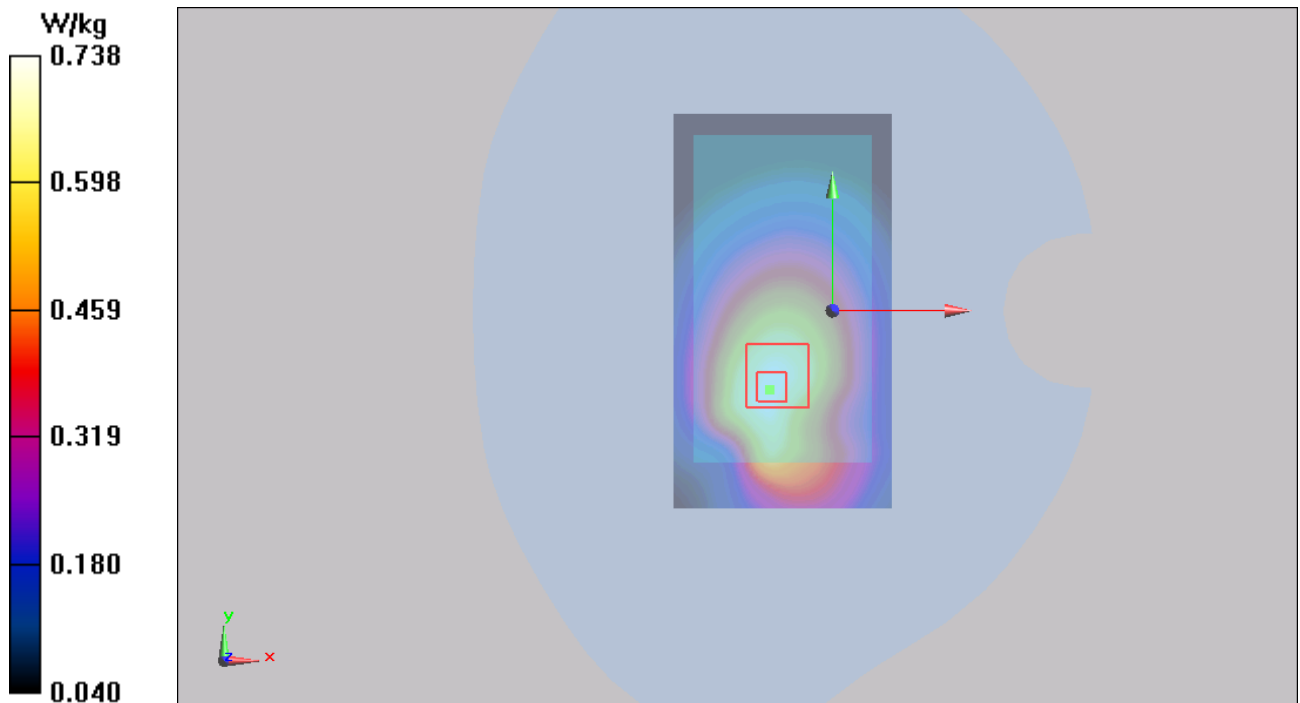
**Back Side Low /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 23.121 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.981 W/kg

**SAR(1 g) = 0.695 W/kg; SAR(10 g) = 0.489 W/kg**

Maximum value of SAR (measured) = 0.738 W/kg



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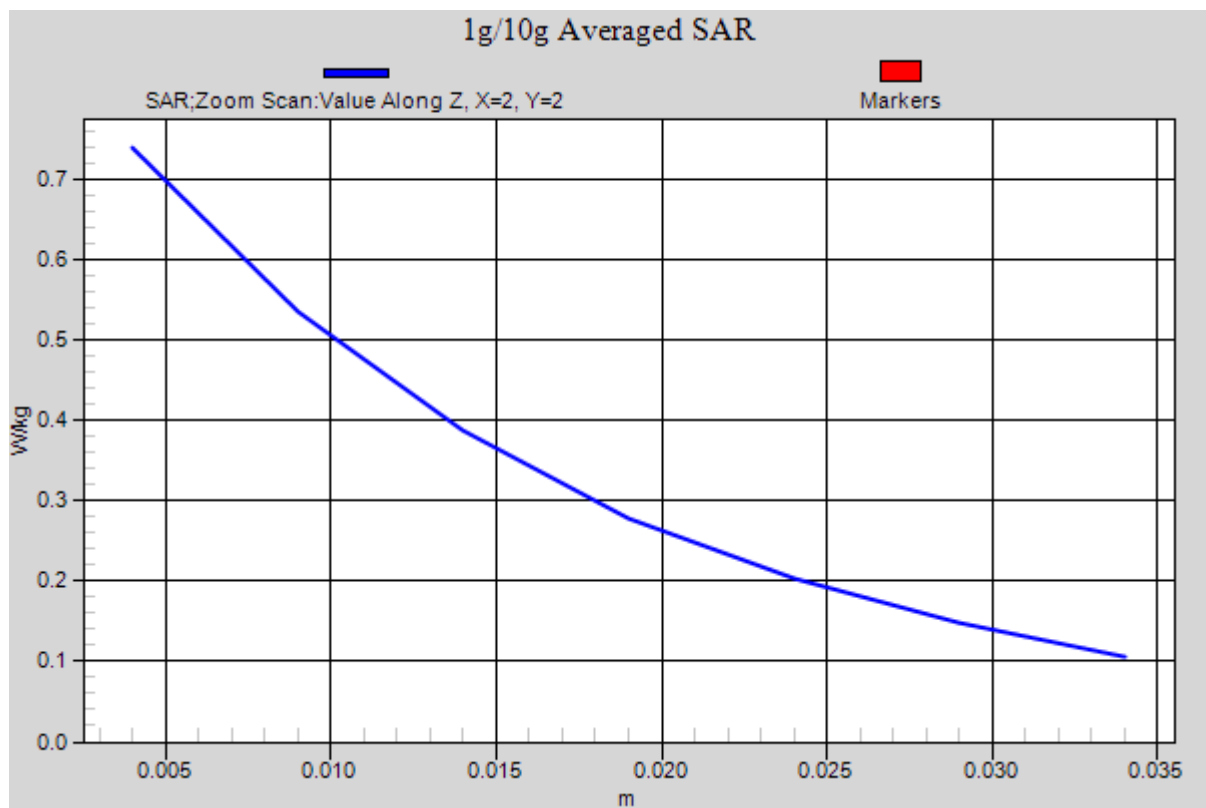


Figure 14 Body, Back Side, GSM 850 GPRS (2Txslots) Channel 128

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### GSM 1900 Right Cheek Low

Date: 3/29/2014

Communication System: GSM; Frequency: 1850.2 MHz; Duty Cycle: 1:8.30042

Medium parameters used (interpolated):  $f = 1850.2$  MHz;  $\sigma = 1.386$  S/m;  $\epsilon_r = 39.813$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(8.15, 8.15, 8.15); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM 2; Type: SAM;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Right Cheek Low /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.776 W/kg

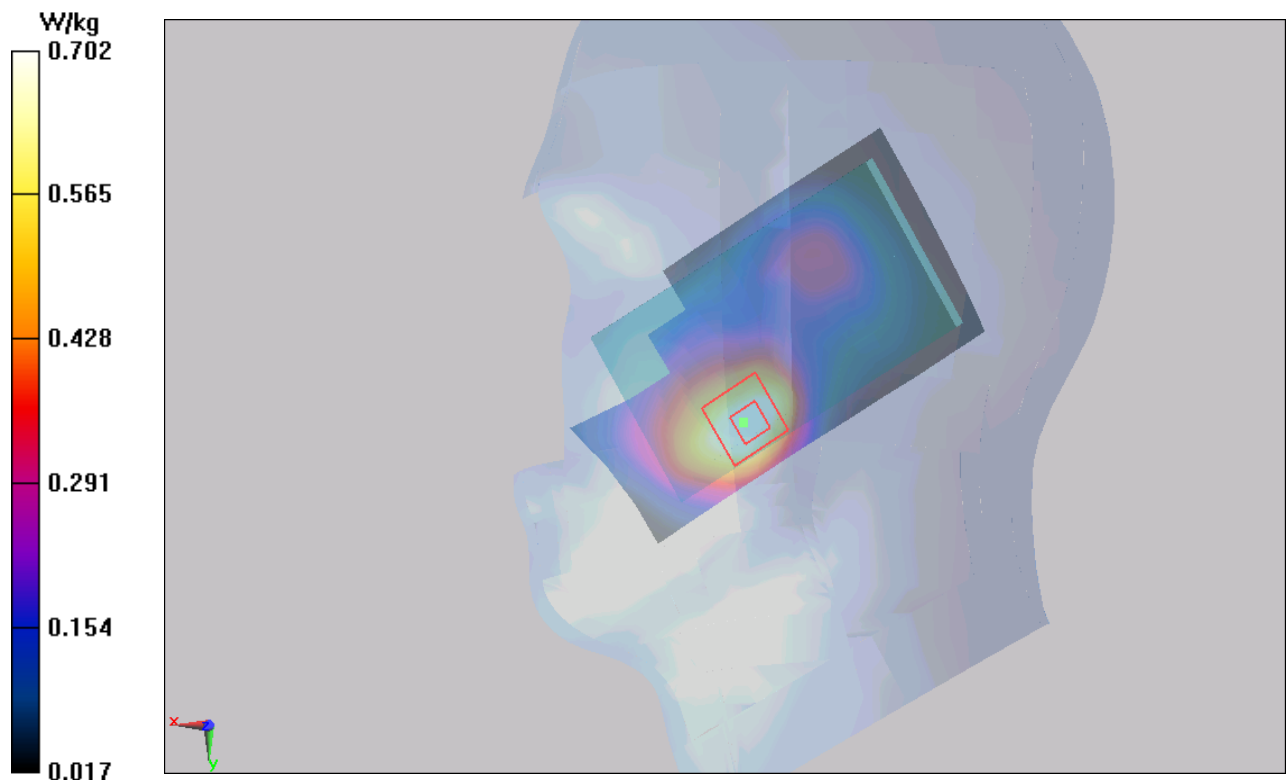
**Right Cheek Low /Zoom Scan (4x4x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.700 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.07 W/kg

**SAR(1 g) = 0.682 W/kg; SAR(10 g) = 0.406 W/kg**

Maximum value of SAR (measured) = 0.702 W/kg



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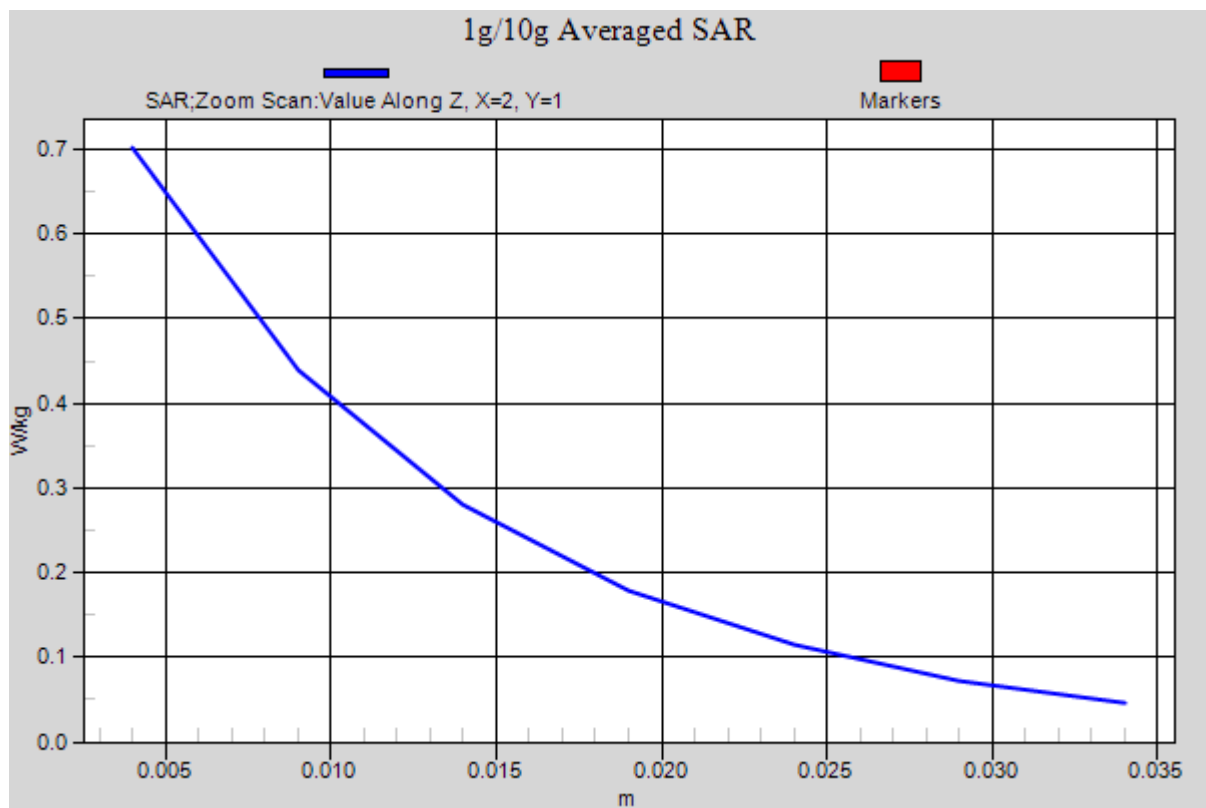


Figure 15 Right Hand Touch Cheek GSM 1900 Channel 512

# TA Technology (Shanghai) Co., Ltd.

## Test Report

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### GSM 1900 GPRS (4Txslots) Back Side Low

Date: 3/31/2014

Communication System: GPRS 3TX; Frequency: 1850.2 MHz; Duty Cycle: 1:2.76694

Medium parameters used (interpolated):  $f = 1850.2$  MHz;  $\sigma = 1.476$  S/m;  $\epsilon_r = 53.266$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(7.63, 7.63, 7.63); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM 2; Type: SAM;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Back Side Low /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.677 W/kg

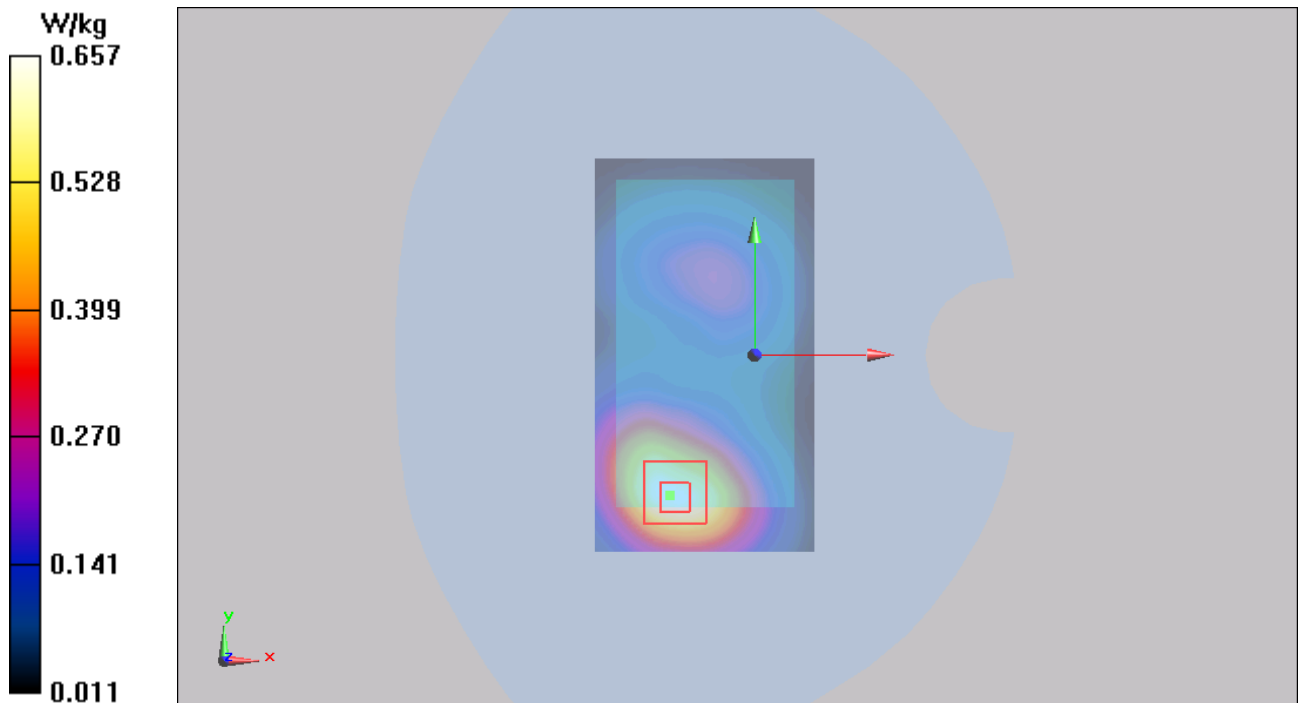
**Back Side Low /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.346 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.980 W/kg

**SAR(1 g) = 0.609 W/kg; SAR(10 g) = 0.371 W/kg**

Maximum value of SAR (measured) = 0.657 W/kg



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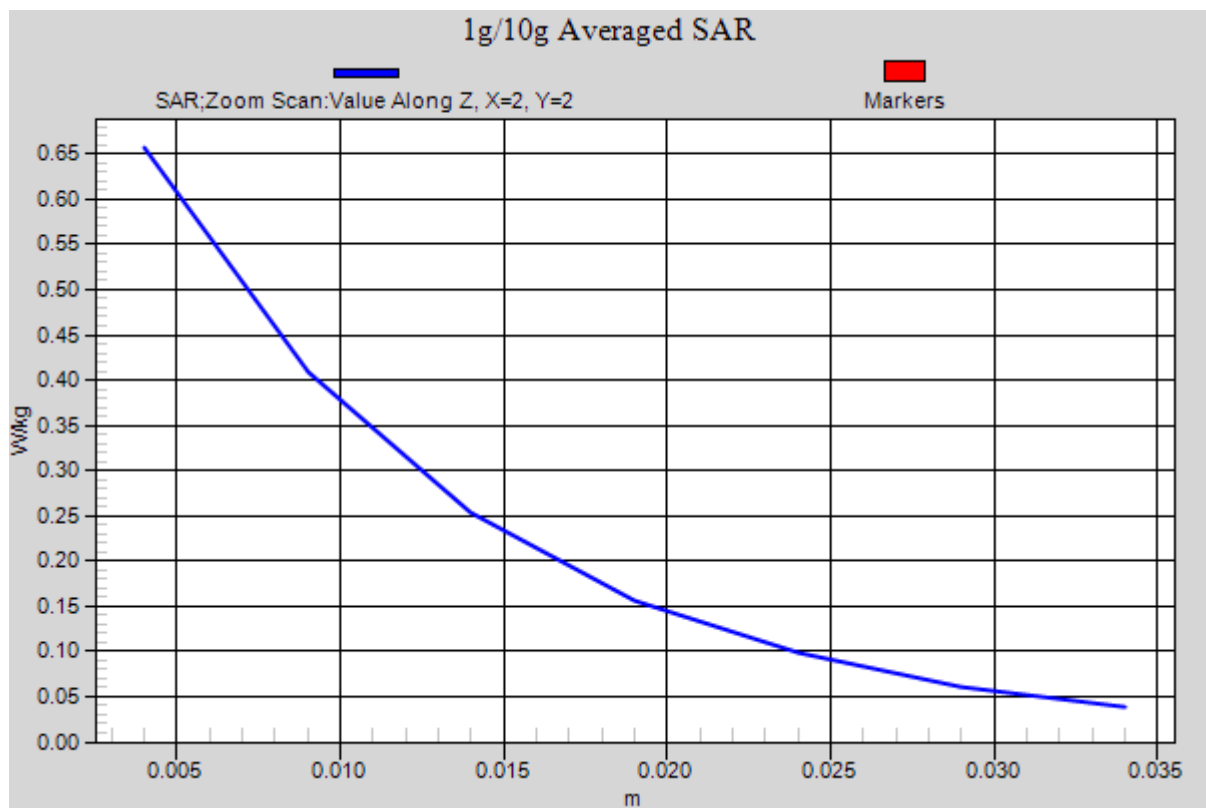


Figure 16 Body, Back Side, GSM 1900 GPRS (4Txslots) Channel 512

# TA Technology (Shanghai) Co., Ltd.

## Test Report

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### UMTS Band II Right Cheek High

Date: 3/29/2014

Communication System: WCDMA; Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1908$  MHz;  $\sigma = 1.438$  S/m;  $\epsilon_r = 39.572$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(8.15, 8.15, 8.15); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM 2; Type: SAM;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Right Cheek High /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 1.11 W/kg

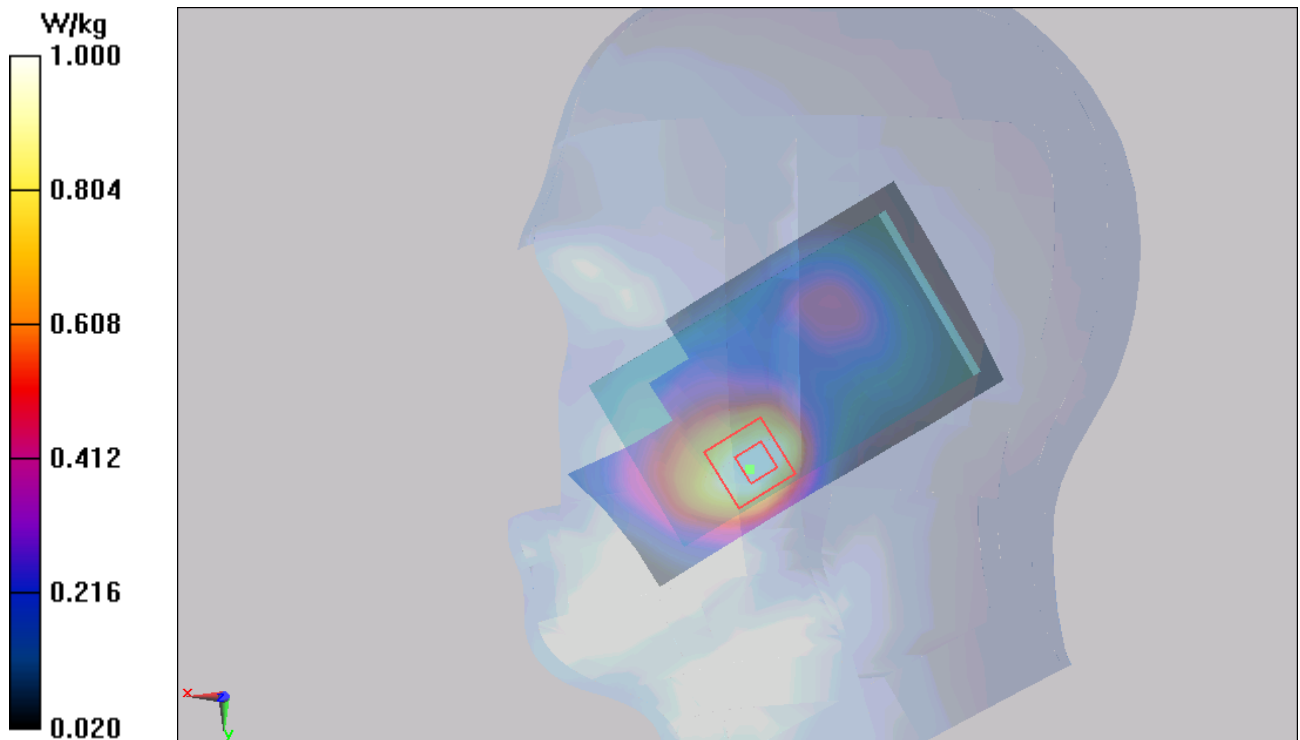
**Right Cheek High /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.491 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 1.57 W/kg

**SAR(1 g) = 0.980 W/kg; SAR(10 g) = 0.577 W/kg**

Maximum value of SAR (measured) = 1.00 W/kg



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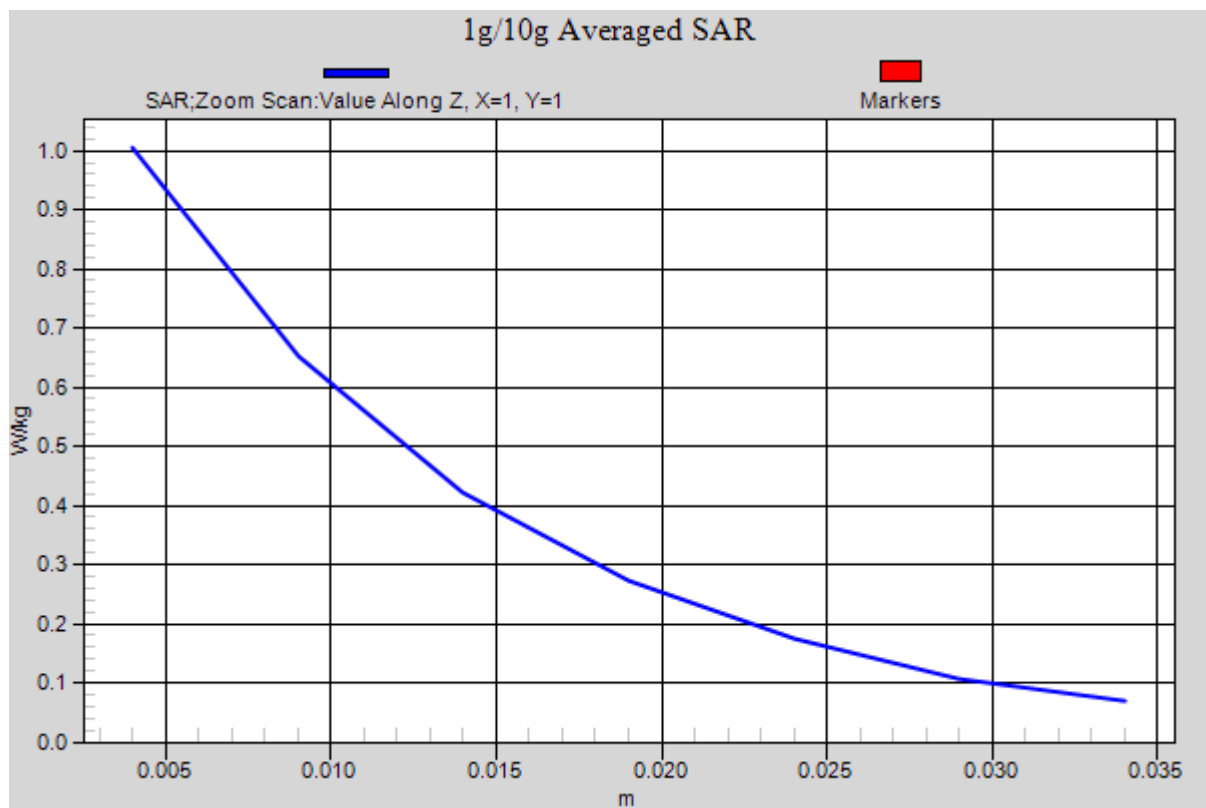


Figure 17 Right Hand Touch Cheek UMTS Band II Channel 9538

# TA Technology (Shanghai) Co., Ltd.

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### UMTS Band II Back Side High

Date: 3/31/2014

Communication System: WCDMA; Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1908$  MHz;  $\sigma = 1.532$  S/m;  $\epsilon_r = 53.111$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(7.63, 7.63, 7.63); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM 2; Type: SAM;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Back Side High /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.826 W/kg

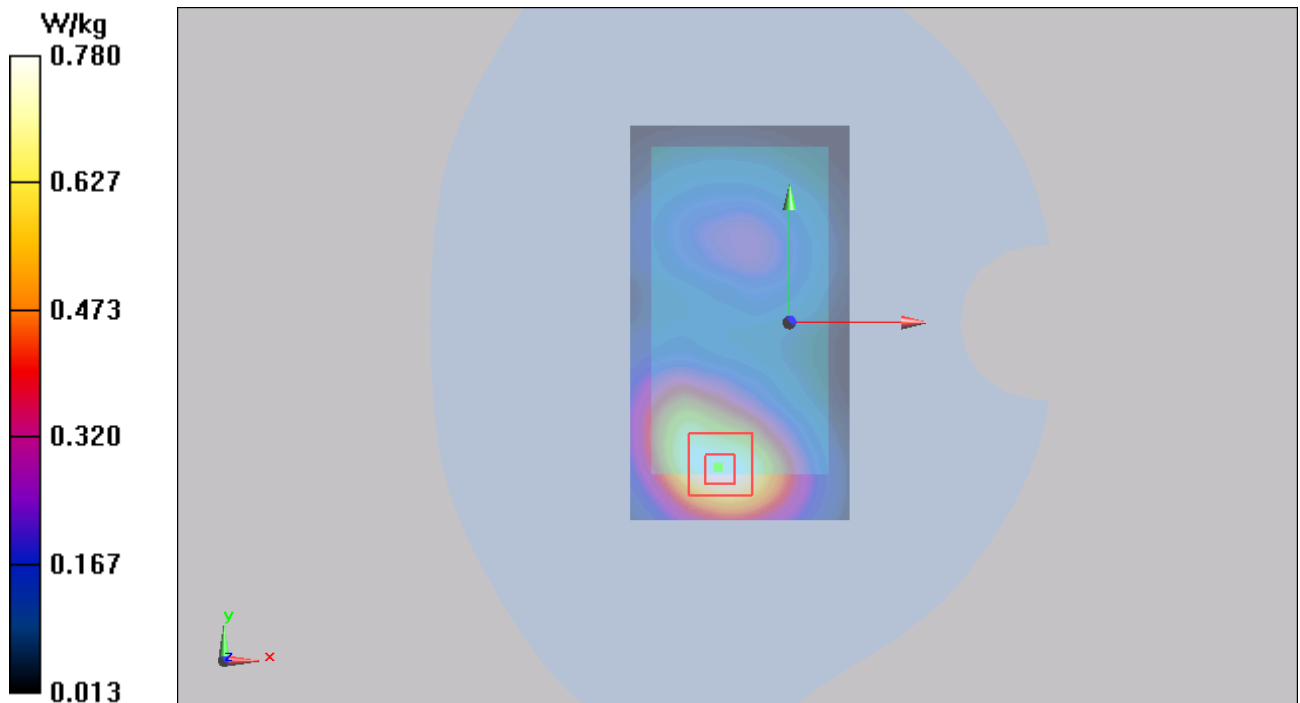
**Back Side High /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.291 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 1.19 W/kg

**SAR(1 g) = 0.728 W/kg; SAR(10 g) = 0.440 W/kg**

Maximum value of SAR (measured) = 0.780 W/kg



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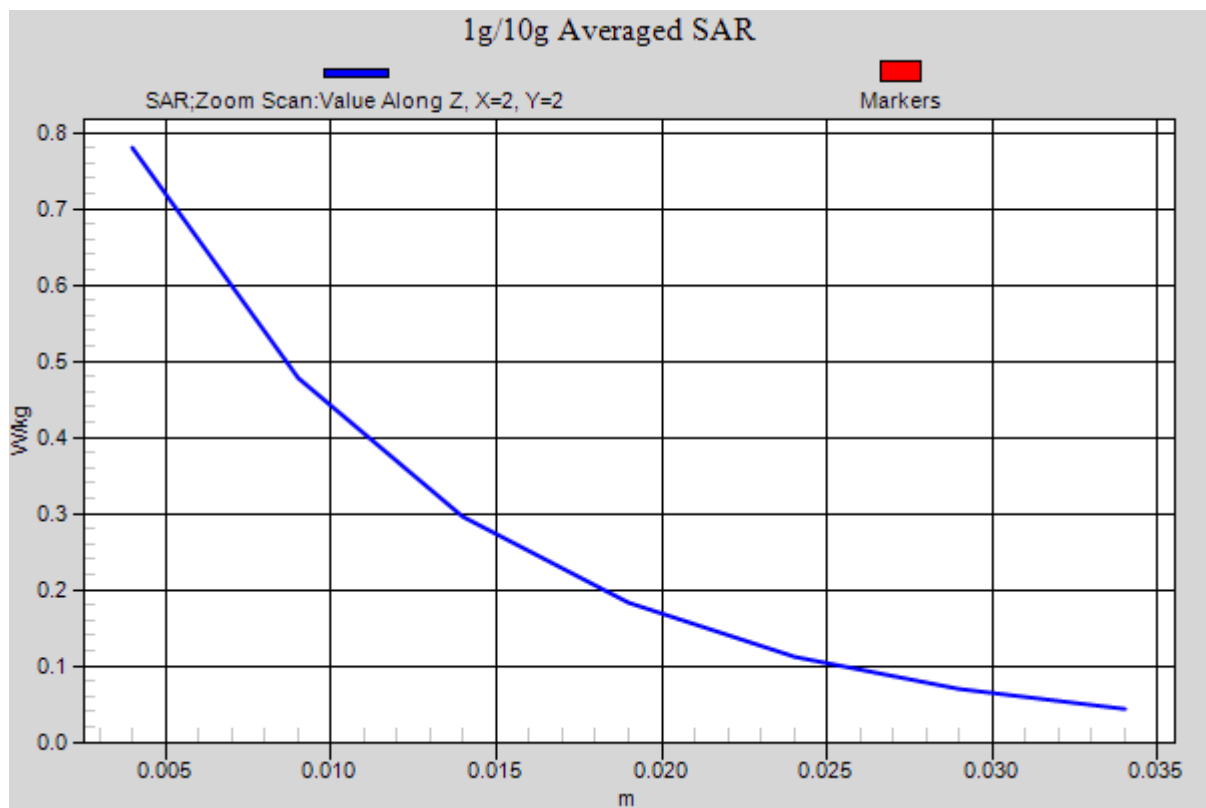


Figure 18 Body, Back Side, UMTS Band II Channel 9538

# TA Technology (Shanghai) Co., Ltd.

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### UMTS Band V Left Cheek Low

Date: 3/29/2014

Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 826.4$  MHz;  $\sigma = 0.921$  S/m;  $\epsilon_r = 41.437$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(9.41, 9.41, 9.41); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Left Cheek Low /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.954 W/kg

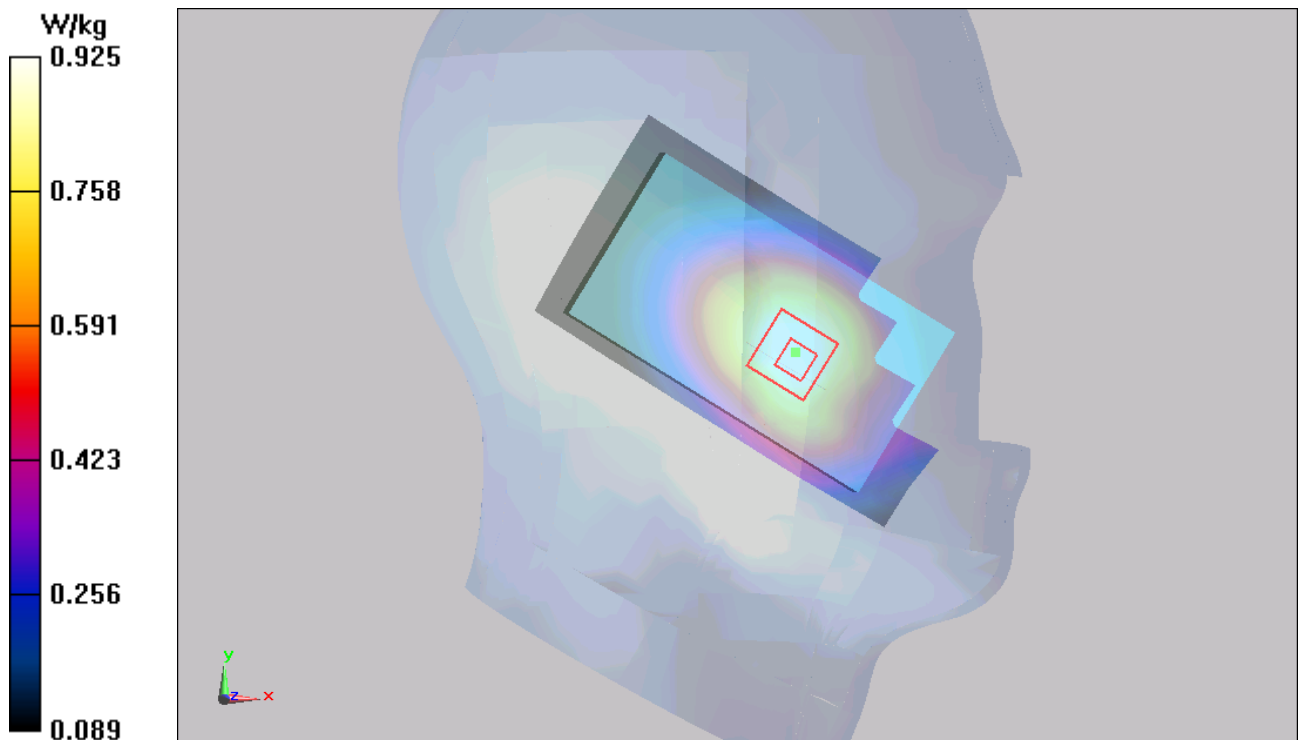
**Left Cheek Low /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.415 V/m; Power Drift = -0.138 dB

Peak SAR (extrapolated) = 1.12 W/kg

**SAR(1 g) = 0.889 W/kg; SAR(10 g) = 0.664 W/kg**

Maximum value of SAR (measured) = 0.925 W/kg



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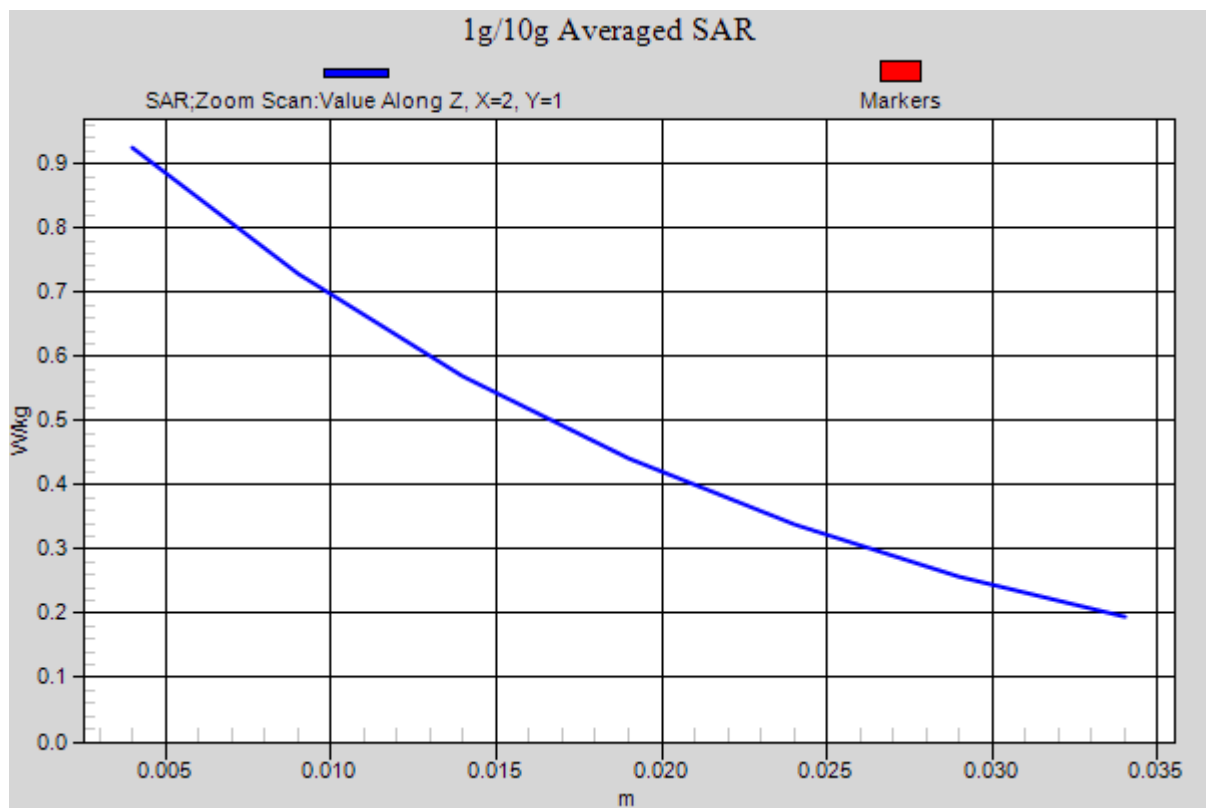


Figure 19 Left Hand Touch Cheek UMTS Band V Channel 4132

# TA Technology (Shanghai) Co., Ltd.

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### UMTS Band V Back Side Low

Date: 3/30/2014

Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 826.4$  MHz;  $\sigma = 0.98$  S/m;  $\epsilon_r = 55.933$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(9.51, 9.51, 9.51); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Back Side Low /Area Scan (51x91x1):** Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.985 W/kg

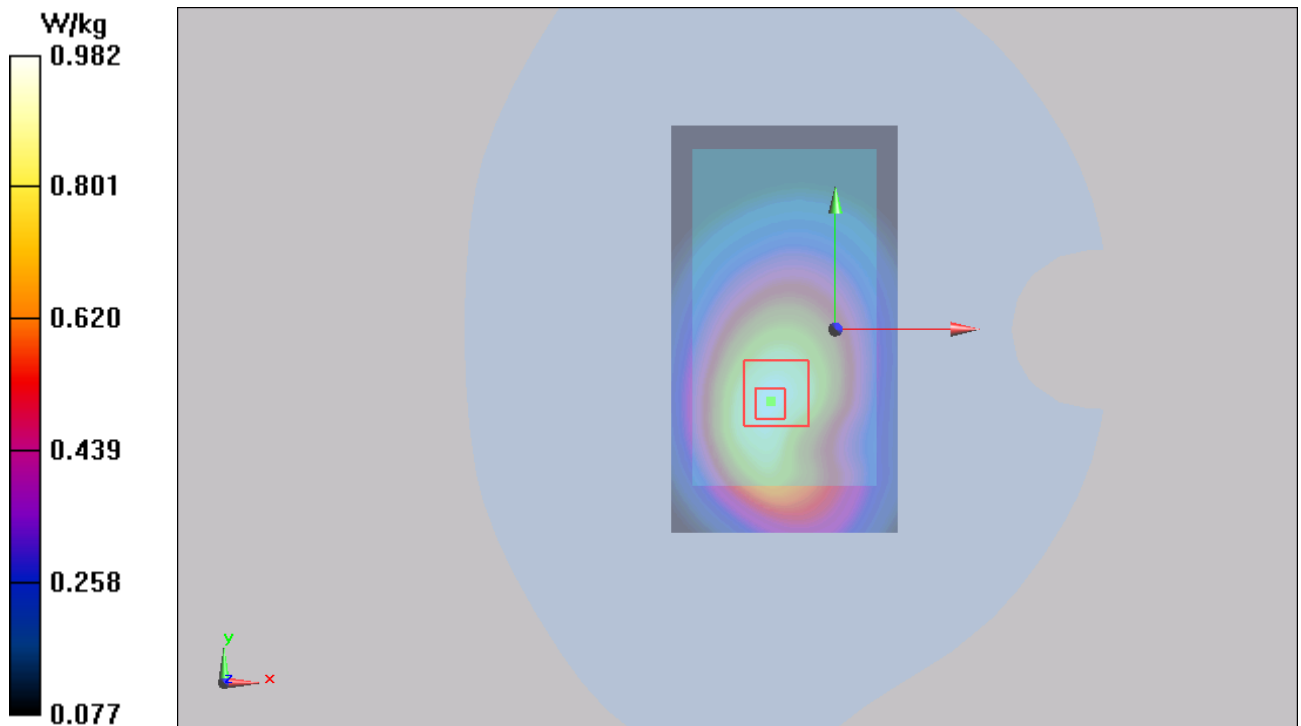
**Back Side Low /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 27.141 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 1.32 W/kg

**SAR(1 g) = 0.928 W/kg; SAR(10 g) = 0.652 W/kg**

Maximum value of SAR (measured) = 0.982 W/kg



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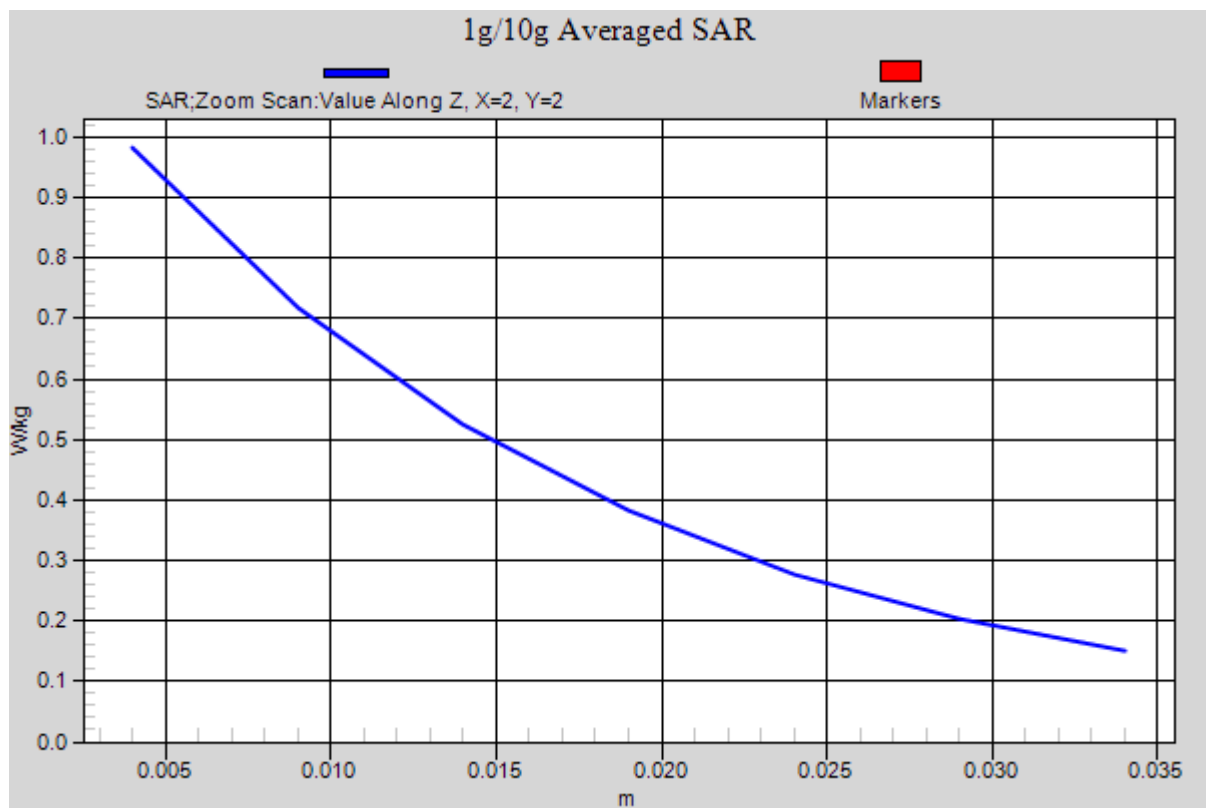


Figure 20 Body, Back Side, UMTS Band V Channel 4132

# TA Technology (Shanghai) Co., Ltd.

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### 802.11b Left Cheek High

Date: 3/31/2014

Communication System: 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.818$  S/m;  $\epsilon_r = 39.076$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(7.64, 7.64, 7.64); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM 2; Type: SAM;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Left Cheek High /Area Scan (51x91x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.151 W/kg

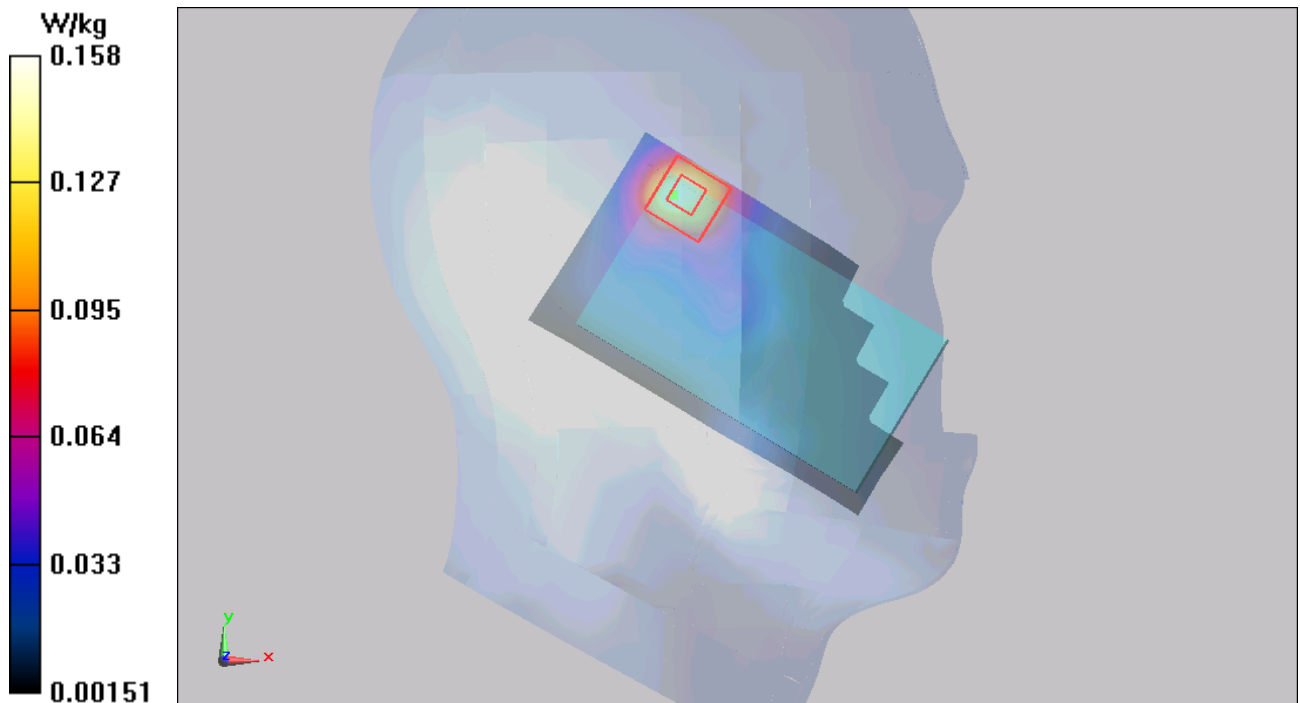
**Left Cheek High /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.069 V/m; Power Drift = 0.034 dB

Peak SAR (extrapolated) = 0.326 W/kg

**SAR(1 g) = 0.144 W/kg; SAR(10 g) = 0.068 W/kg**

Maximum value of SAR (measured) = 0.158 W/kg



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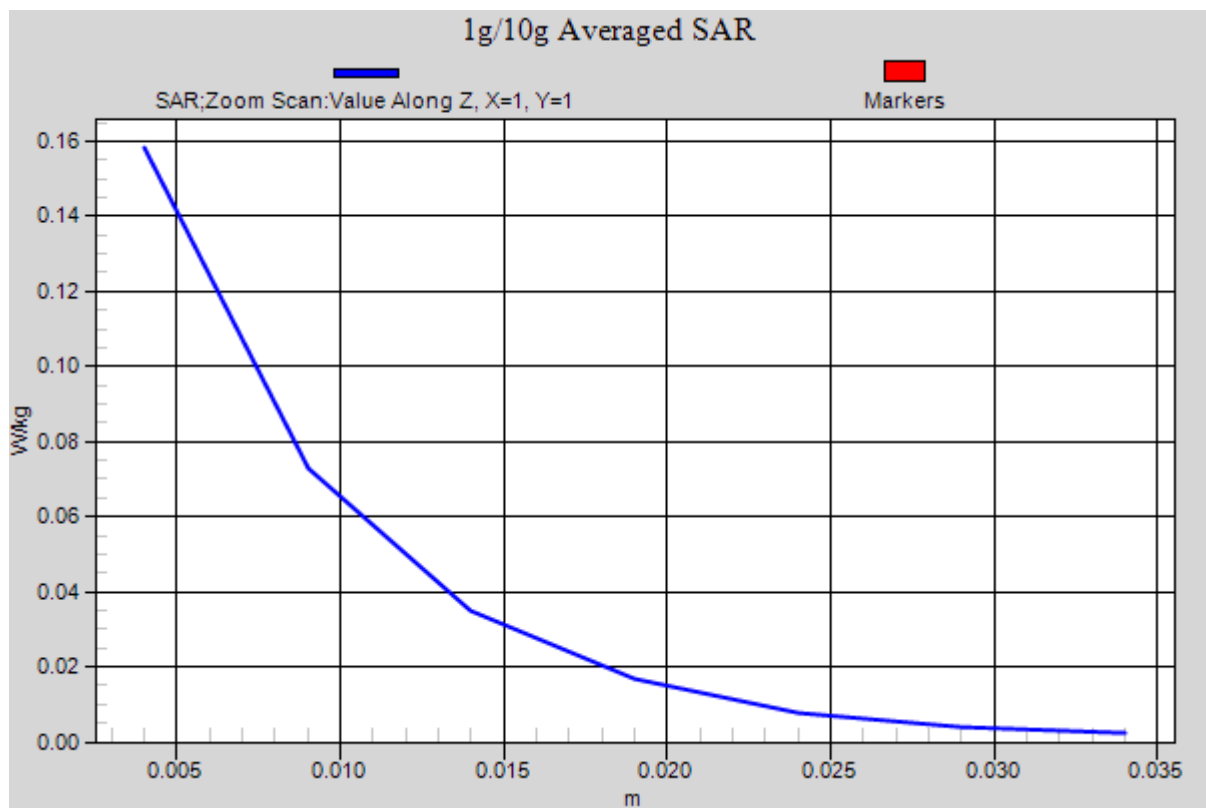


Figure 21 Left Hand Touch Cheek 802.11b Channel 11

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### 802.11b Back Side High

Date: 3/31/2014

Communication System: 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2462$  MHz;  $\sigma = 2.009$  S/m;  $\epsilon_r = 52.109$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 – SN3677; ConvF(7.61, 7.61, 7.61); Calibrated: 11/28/2013;

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: SAM 2; Type: SAM;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

**Back Side High /Area Scan (51x91x1):** Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.136 W/kg

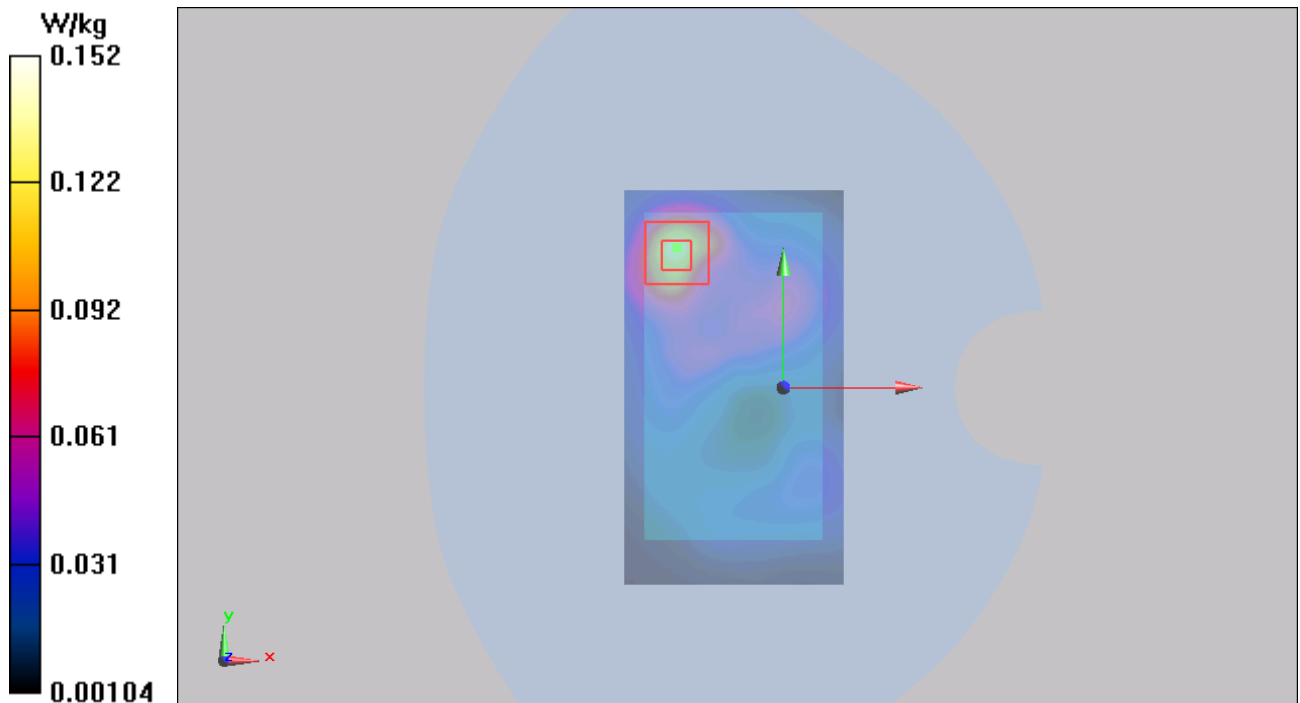
**Back Side High /Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.444 V/m; Power Drift = 0.038 dB

Peak SAR (extrapolated) = 0.291 W/kg

**SAR(1 g) = 0.144 W/kg; SAR(10 g) = 0.065 W/kg**

Maximum value of SAR (measured) = 0.152 W/kg



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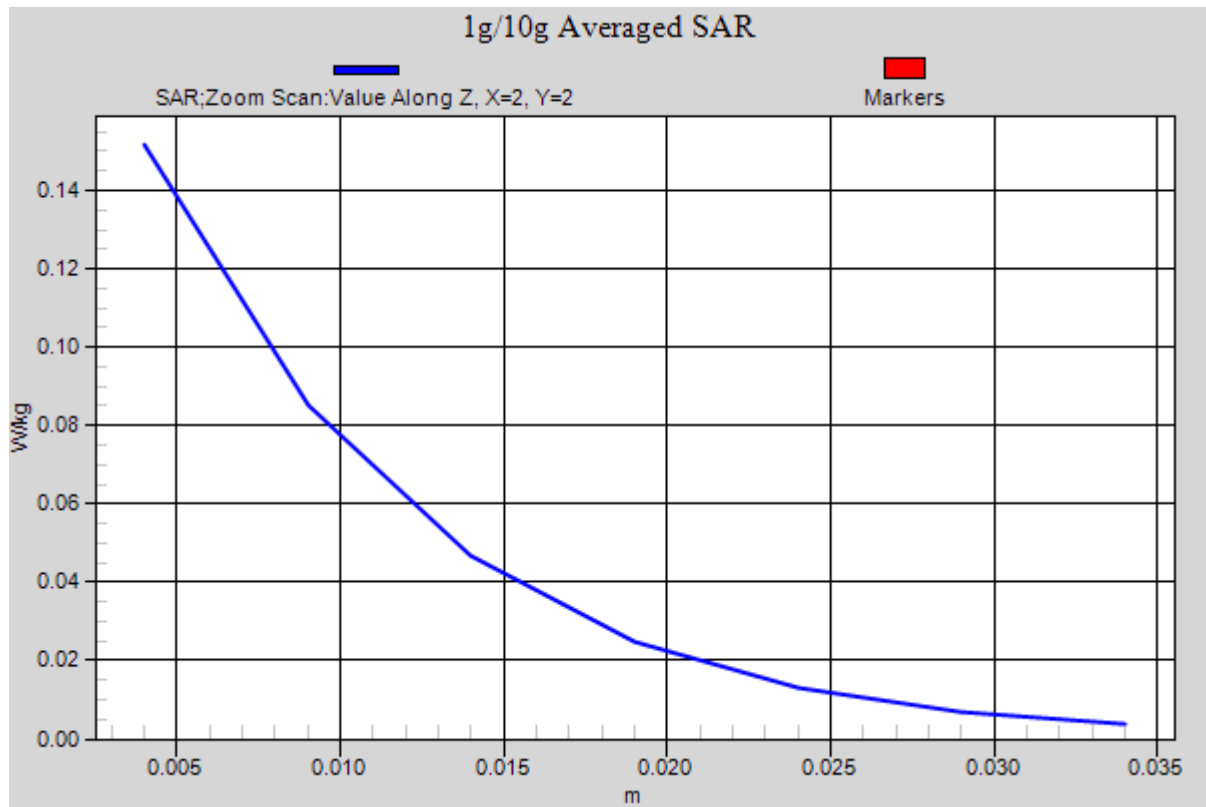


Figure 22 Body, Back Side, 802.11b Channel 11

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## ANNEX D: Probe Calibration Certificate



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China  
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E-mail: Info@emcete.com Http://www.emcete.com

Client **TA-ShangHai**

Certificate No: **J13-2-2971**

### CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3677**

Calibration Procedure(s) **TMC-OS-E-02-195**  
**Calibration Procedures for Dosimetric E-field Probes**

Calibration date: **November 28, 2013**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards       | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|------------------------------------------|-----------------------|
| Power Meter NRP2        | 101919     | 01-Jul-13 (TMC, No.JW13-044)             | Jun-14                |
| Power sensor NRP-Z91    | 101547     | 01-Jul-13 (TMC, No.JW13-044)             | Jun-14                |
| Power sensor NRP-Z91    | 101548     | 01-Jul-13 (TMC, No.JW13-044)             | Jun-14                |
| Reference10dBAttenuator | BT0520     | 12-Dec-12(TMC, No.JZ12-867)              | Dec-14                |
| Reference20dBAttenuator | BT0267     | 12-Dec-12(TMC, No.JZ12-866)              | Dec-14                |
| Reference Probe EX3DV4  | SN 3846    | 03-Sep-13(SPEAG, No.EX3-3846_Sep13)      | Sep-14                |
| DAE4                    | SN 777     | 22-Feb-13 (SPEAG, DAE4-777_Feb13)        | Feb-14                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| SignalGeneratorMG3700A  | 6201052605 | 01-Jul-13 (TMC, No.JW13-045)             | Jun-14                |
| Network Analyzer E5071C | MY46110673 | 15-Feb-13 (TMC, No.JZ13-781)             | Feb-14                |

|                | Name        | Function                          | Signature |
|----------------|-------------|-----------------------------------|-----------|
| Calibrated by: | Yu Zongying | SAR Test Engineer                 |           |
| Reviewed by:   | Qi Dianyuan | SAR Project Leader                |           |
| Approved by:   | Lu Bingsong | Deputy Director of the Laboratory |           |

Issued: November 29, 2013

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

Certificate No: J13-2-2971

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# TA Technology (Shanghai) Co., Ltd.

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Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China  
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### Glossary:

|                       |                                                                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                   | tissue simulating liquid                                                                                                                    |
| NORM <sub>x,y,z</sub> | sensitivity in free space                                                                                                                   |
| ConvF                 | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                  |
| DCP                   | diode compression point                                                                                                                     |
| CF                    | crest factor (1/duty_cycle) of the RF signal                                                                                                |
| A,B,C,D               | modulation dependent linearization parameters                                                                                               |
| Polarization $\Phi$   | $\Phi$ rotation around probe axis                                                                                                           |
| Polarization $\theta$ | $\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i<br>$\theta=0$ is normal to probe axis |

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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

### Methods Applied and Interpretation of Parameters:

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



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# Probe EX3DV4

## SN: 3677

Calibrated: November 28, 2013

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

# TA Technology (Shanghai) Co., Ltd.

## Test Report

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Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China  
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E-mail: Info@emcite.com Http://www.emcite.com

### DASY – Parameters of Probe: EX3DV4 - SN: 3677

#### Basic Calibration Parameters

|                                      | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--------------------------------------|----------|----------|----------|-----------|
| Norm( $\mu V/(V/m)^2$ ) <sup>A</sup> | 0.38     | 0.44     | 0.38     | ±10.8%    |
| DCP(mV) <sup>B</sup>                 | 99.8     | 100.9    | 101.9    |           |

#### Modulation Calibration Parameters

| UID | Communication System Name |   | A dB | B dB, $\mu V$ | C   | D dB | VR mV | Unc <sup>E</sup> (k=2) |
|-----|---------------------------|---|------|---------------|-----|------|-------|------------------------|
| 0   | CW                        | X | 0.0  | 0.0           | 1.0 | 0.00 | 93.3  | ±2.6%                  |
|     |                           | Y | 0.0  | 0.0           | 1.0 |      | 101.7 |                        |
|     |                           | Z | 0.0  | 0.0           | 1.0 |      | 92.1  |                        |

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

<sup>A</sup> The uncertainties of Norm X, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 5 and Page 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

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



Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: Info@emcite.com Http://www.emcite.com

## DASY – Parameters of Probe: EX3DV4 - SN: 3677

### Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 41.9                               | 0.89                            | 9.94    | 9.94    | 9.94    | 0.16  | 1.13       | ± 12%       |
| 850                  | 41.5                               | 0.92                            | 9.41    | 9.41    | 9.41    | 0.11  | 1.47       | ± 12%       |
| 1750                 | 40.1                               | 1.37                            | 8.22    | 8.22    | 8.22    | 0.14  | 2.11       | ± 12%       |
| 1900                 | 40.0                               | 1.40                            | 8.15    | 8.15    | 8.15    | 0.14  | 2.34       | ± 12%       |
| 2100                 | 39.8                               | 1.49                            | 7.87    | 7.87    | 7.87    | 0.13  | 3.21       | ± 12%       |
| 2450                 | 39.2                               | 1.80                            | 7.64    | 7.64    | 7.64    | 0.39  | 0.95       | ± 12%       |
| 5200                 | 36.0                               | 4.66                            | 5.73    | 5.73    | 5.73    | 0.95  | 0.62       | ± 13%       |
| 5300                 | 35.9                               | 4.76                            | 5.68    | 5.68    | 5.68    | 0.87  | 0.67       | ± 13%       |
| 5500                 | 35.6                               | 4.96                            | 5.62    | 5.62    | 5.62    | 0.97  | 0.62       | ± 13%       |
| 5600                 | 35.5                               | 5.07                            | 5.29    | 5.29    | 5.29    | 0.89  | 0.63       | ± 13%       |
| 5800                 | 35.3                               | 5.27                            | 5.29    | 5.29    | 5.29    | 1.02  | 0.61       | ± 13%       |

<sup>C</sup> Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

# TA Technology (Shanghai) Co., Ltd.

## Test Report

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E-mail: Info@emcite.com Http://www.emcite.com

### DASY – Parameters of Probe: EX3DV4 - SN: 3677

#### Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750                  | 55.5                               | 0.96                            | 9.72    | 9.72    | 9.72    | 0.11  | 1.97       | ± 12%       |
| 850                  | 55.2                               | 0.99                            | 9.51    | 9.51    | 9.51    | 0.15  | 1.55       | ± 12%       |
| 1750                 | 53.4                               | 1.49                            | 7.77    | 7.77    | 7.77    | 0.14  | 3.23       | ± 12%       |
| 1900                 | 53.3                               | 1.52                            | 7.63    | 7.63    | 7.63    | 0.15  | 2.81       | ± 12%       |
| 2100                 | 53.2                               | 1.62                            | 7.97    | 7.97    | 7.97    | 0.16  | 4.09       | ± 12%       |
| 2450                 | 52.7                               | 1.95                            | 7.61    | 7.61    | 7.61    | 0.45  | 0.92       | ± 12%       |
| 5200                 | 49.0                               | 5.30                            | 4.72    | 4.72    | 4.72    | 0.66  | 1.10       | ± 13%       |
| 5300                 | 48.9                               | 5.42                            | 4.67    | 4.67    | 4.67    | 0.64  | 1.19       | ± 13%       |
| 5500                 | 48.6                               | 5.65                            | 4.34    | 4.34    | 4.34    | 0.73  | 0.80       | ± 13%       |
| 5600                 | 48.5                               | 5.77                            | 4.29    | 4.29    | 4.29    | 0.74  | 0.81       | ± 13%       |
| 5800                 | 48.2                               | 6.00                            | 4.46    | 4.46    | 4.46    | 0.78  | 0.80       | ± 13%       |

<sup>C</sup> Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

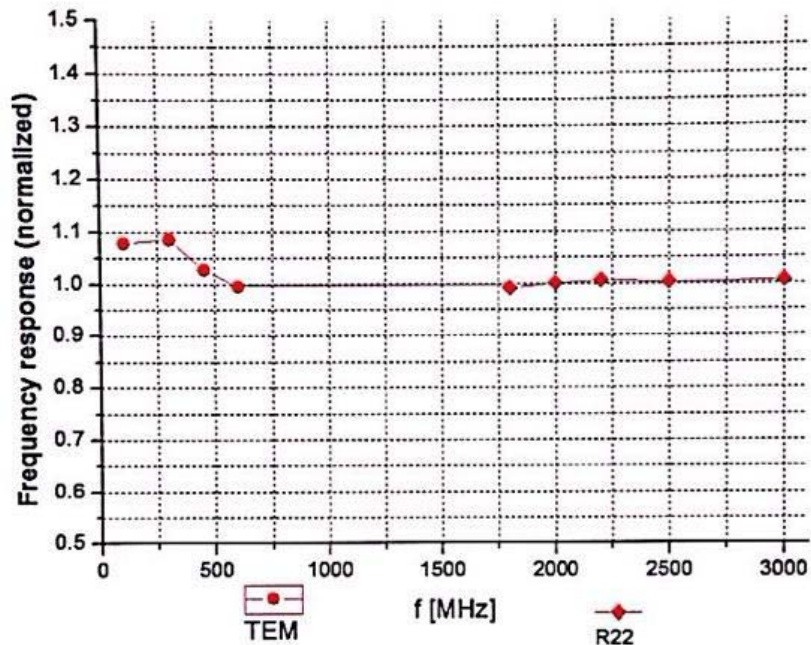
TA Technology (Shanghai) Co., Ltd.  
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Frequency Response of E-Field  
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field:  $\pm 7.5\%$  ( $k=2$ )

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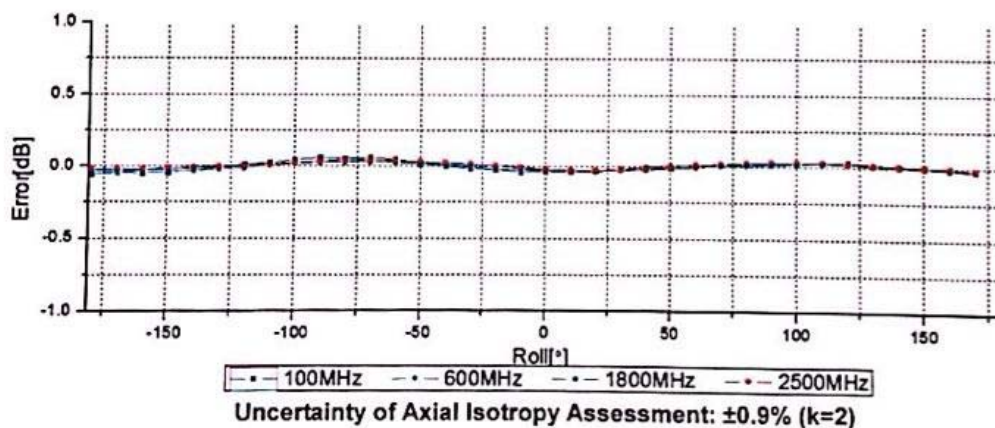
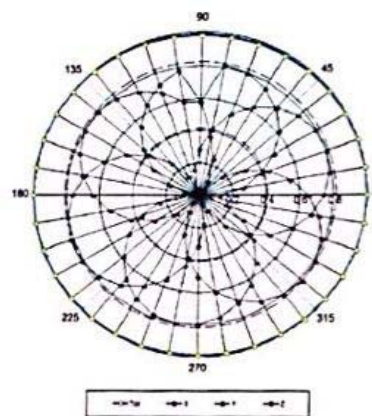
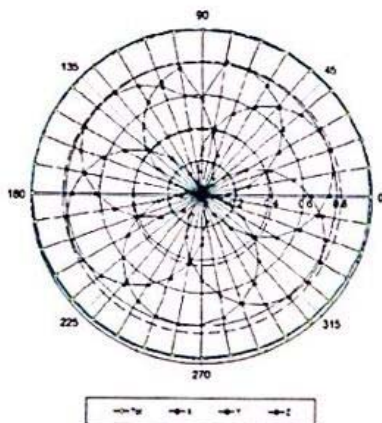


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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: Info@emcite.com Http://www.emcite.com

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

f=600 MHz, TEM

f=1800 MHz, R22



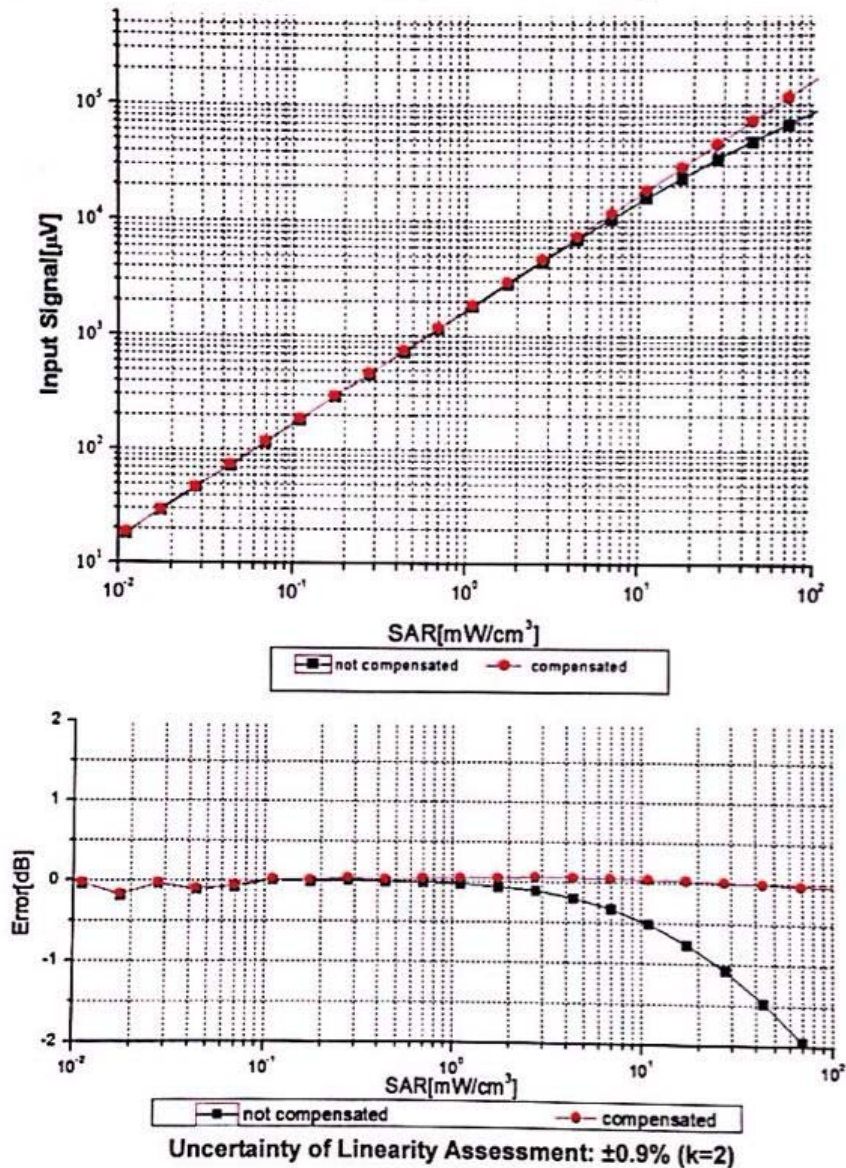
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## Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f = 900 \text{ MHz}$ )

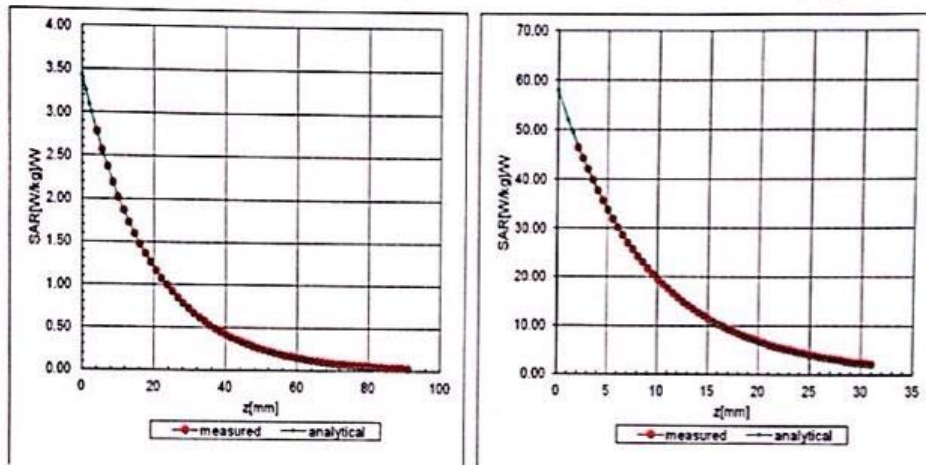




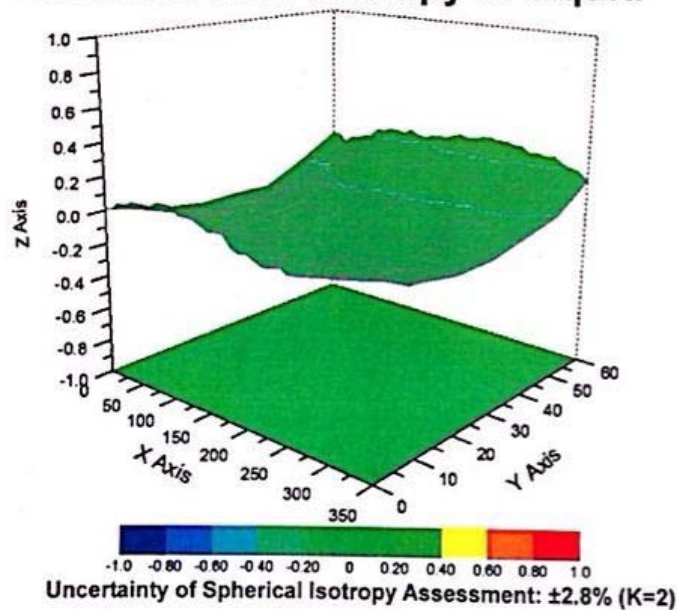
## Conversion Factor Assessment

f=850 MHz, WGLS R9(H\_convF)

f=2450 MHz, WGLS R26(H\_convF)



## Deviation from Isotropy in Liquid



**TA Technology (Shanghai) Co., Ltd.**  
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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: Info@emcite.com Http://www.emcite.com

**DASY - Parameters of Probe: EX3DV4 - SN: 3677**

**Other Probe Parameters**

|                                                      |                   |
|------------------------------------------------------|-------------------|
| <b>Sensor Arrangement</b>                            | <b>Triangular</b> |
| <b>Connector Angle (°)</b>                           | <b>117</b>        |
| <b>Mechanical Surface Detection Mode</b>             | <b>enabled</b>    |
| <b>Optical Surface Detection Mode</b>                | <b>disable</b>    |
| <b>Probe Overall Length</b>                          | <b>337mm</b>      |
| <b>Probe Body Diameter</b>                           | <b>10mm</b>       |
| <b>Tip Length</b>                                    | <b>9mm</b>        |
| <b>Tip Diameter</b>                                  | <b>2.5mm</b>      |
| <b>Probe Tip to Sensor X Calibration Point</b>       | <b>1mm</b>        |
| <b>Probe Tip to Sensor Y Calibration Point</b>       | <b>1mm</b>        |
| <b>Probe Tip to Sensor Z Calibration Point</b>       | <b>1mm</b>        |
| <b>Recommended Measurement Distance from Surface</b> | <b>2mm</b>        |

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

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**ANNEX E: D835V2 Dipole Calibration Certificate**

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



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

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

Accreditation No.: **SCS 108**

Client **TA-Shanghai (Auden)**

Certificate No: **D835V2-4d020\_Aug11**

**CALIBRATION CERTIFICATE**

Object **D835V2 - SN: 4d020**

Calibration procedure(s) **QA CAL-05.v8**  
**Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **August 26, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Reference 20 dB Attenuator  | SN: S5086 (20b)    | 29-Mar-11 (No. 217-01367)      | Apr-12                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)      | Apr-12                |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11) | Apr-12                |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11) | Jul-12                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06   | 100006           | 04-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

|                |                               |                                          |               |
|----------------|-------------------------------|------------------------------------------|---------------|
| Calibrated by: | Name<br><b>Jeton Kastrati</b> | Function<br><b>Laboratory Technician</b> | Signature<br> |
| Approved by:   | Name<br><b>Katja Pokovic</b>  | Technical Manager                        |               |

Issued: August 26, 2011

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

Certificate No: D835V2-4d020\_Aug11

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# TA Technology (Shanghai) Co., Ltd.

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

### Glossary:

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

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

# TA Technology (Shanghai) Co., Ltd.

## Test Report

Report No.: RXA1403-0053SAR

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### Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 835 MHz $\pm$ 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 $\pm$ 0.2) °C | 41.1 $\pm$ 6 % | 0.89 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Head TSL

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 2.32 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 9.34 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 1.52 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.11 mW / g $\pm$ 16.5 % (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 $\pm$ 0.2) °C | 53.4 $\pm$ 6 % | 0.99 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Body TSL

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 2.42 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 9.46 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (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   | 6.26 mW / g $\pm$ 16.5 % (k=2) |

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### Appendix

#### Antenna Parameters with Head TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 52.9 $\Omega$ - 3.1 j $\Omega$ |
| Return Loss                          | - 27.7 dB                      |

#### Antenna Parameters with Body TSL

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 48.7 $\Omega$ - 5.4 j $\Omega$ |
| Return Loss                          | - 25.1 dB                      |

#### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.391 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.

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          |
| Manufactured on | April 22, 2004 |

### DASY5 Validation Report for Head TSL

Date: 25.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.89 \text{ mho/m}$ ;  $\epsilon_r = 41.1$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

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

Reference Value = 56.930 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.421 W/kg

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

Maximum value of SAR (measured) = 2.708 mW/g

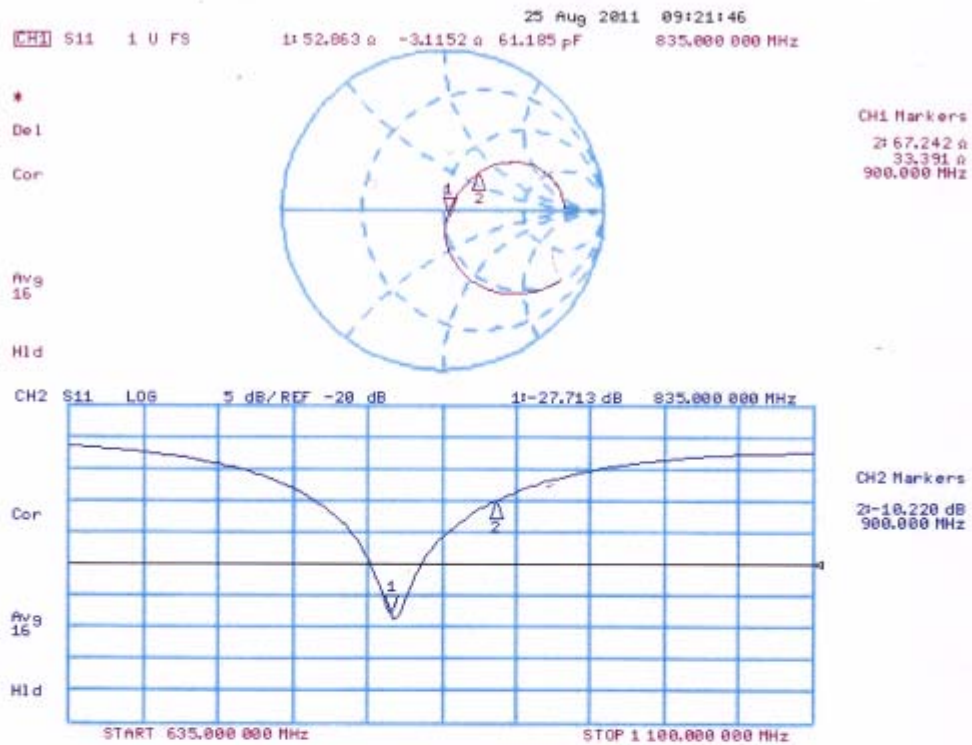


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Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 26.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.99 \text{ mho/m}$ ;  $\epsilon_r = 53.4$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

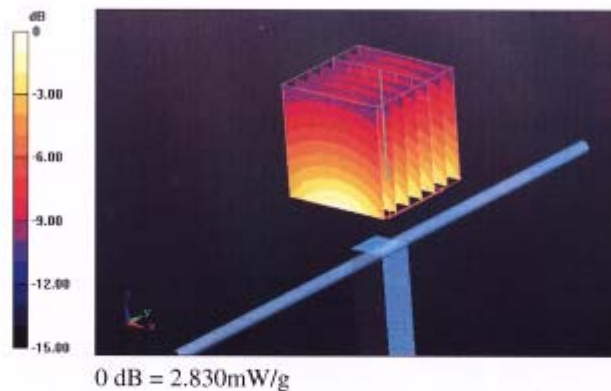
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.406 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.509 W/kg

**SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.59 mW/g**

Maximum value of SAR (measured) = 2.827 mW/g

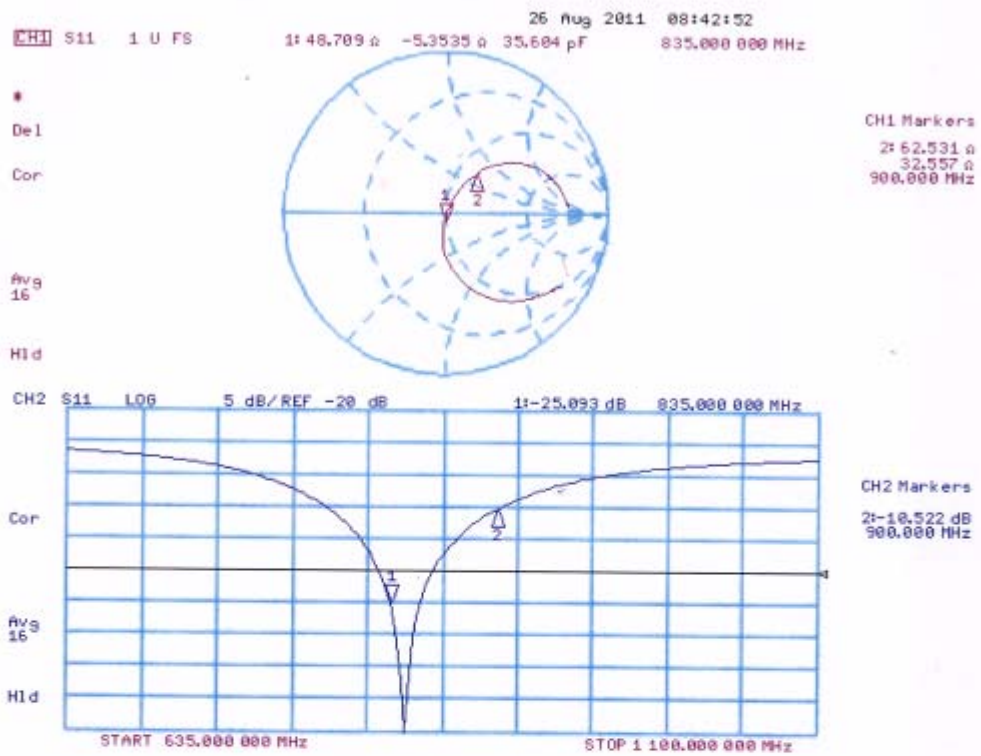


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Impedance Measurement Plot for Body TSL



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Test Report

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ANNEX F: D1900V2 Dipole Calibration Certificate

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



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

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

Accreditation No.: SCS 108

Client TA-Shanghai (Auden)

Certificate No: D1900V2-5d060\_Aug11

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 5d060

Calibration procedure(s) QA CAL-05.v8  
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: August 31, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Reference 20 dB Attenuator  | SN: S5086 (20b)    | 29-Mar-11 (No. 217-01367)         | Apr-12                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)         | Apr-12                 |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11)    | Apr-12                 |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11)    | Jul-12                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06     | 100005             | 04-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

|                |                     |                                   |               |
|----------------|---------------------|-----------------------------------|---------------|
| Calibrated by: | Name<br>Dimce Iliev | Function<br>Laboratory Technician | Signature<br> |
| Approved by:   | Katja Pokovic       | Technical Manager                 |               |

Issued: August 31, 2011

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

Certificate No: D1900V2-5d060\_Aug11

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# TA Technology (Shanghai) Co., Ltd.

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

### Glossary:

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

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

# TA Technology (Shanghai) Co., Ltd.

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### Measurement Conditions

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

|                                     |                        |             |
|-------------------------------------|------------------------|-------------|
| <b>DASY Version</b>                 | DASY5                  | V52.6.2     |
| <b>Extrapolation</b>                | Advanced Extrapolation |             |
| <b>Phantom</b>                      | Modular Flat Phantom   |             |
| <b>Distance Dipole Center - TSL</b> | 10 mm                  | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm      |             |
| <b>Frequency</b>                    | 1900 MHz $\pm$ 1 MHz   |             |

### Head TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 40.0           | 1.40 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 39.5 $\pm$ 6 % | 1.42 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

### SAR result with Head TSL

|                                                             |                    |                                                  |
|-------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition          |                                                  |
| SAR measured                                                | 250 mW input power | 10.2 mW / g                                      |
| SAR for nominal Head TSL parameters                         | normalized to 1W   | <b>40.3 mW / g <math>\pm</math> 17.0 % (k=2)</b> |

|                                                               |                    |                                                  |
|---------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition          |                                                  |
| SAR measured                                                  | 250 mW input power | 5.30 mW / g                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>21.1 mW / g <math>\pm</math> 16.5 % (k=2)</b> |

### Body TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Body TSL parameters</b>             | 22.0 °C             | 53.3           | 1.52 mho/m           |
| <b>Measured Body TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 53.9 $\pm$ 6 % | 1.57 mho/m $\pm$ 6 % |
| <b>Body TSL temperature change during test</b> | < 0.5 °C            | ----           | ----                 |

### SAR result with Body TSL

|                                                             |                    |                                                  |
|-------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b> | Condition          |                                                  |
| SAR measured                                                | 250 mW input power | 10.6 mW / g                                      |
| SAR for nominal Body TSL parameters                         | normalized to 1W   | <b>41.7 mW / g <math>\pm</math> 17.0 % (k=2)</b> |

|                                                               |                    |                                                  |
|---------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | condition          |                                                  |
| SAR measured                                                  | 250 mW input power | 5.55 mW / g                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>22.0 mW / g <math>\pm</math> 16.5 % (k=2)</b> |

# TA Technology (Shanghai) Co., Ltd.

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### Appendix

#### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $52.6 \Omega + 7.5 j\Omega$ |
| Return Loss                          | - 22.3 dB                   |

#### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $47.3 \Omega + 7.9 j\Omega$ |
| Return Loss                          | - 21.3 dB                   |

#### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.194 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.

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             |
| Manufactured on | December 10, 2004 |

### **DASY5 Validation Report for Head TSL**

Date: 30.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.42$  mho/m;  $\epsilon_r = 39.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

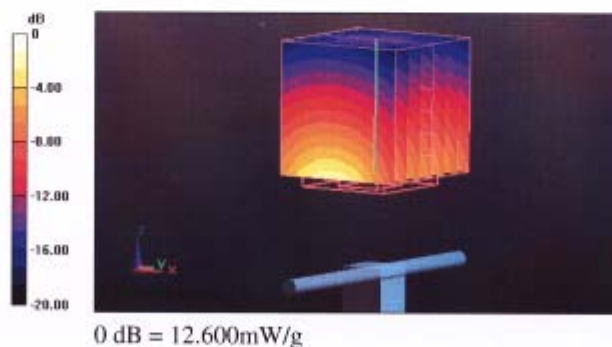
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.636 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 18.535 W/kg

**SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.3 mW/g**

Maximum value of SAR (measured) = 12.600 mW/g

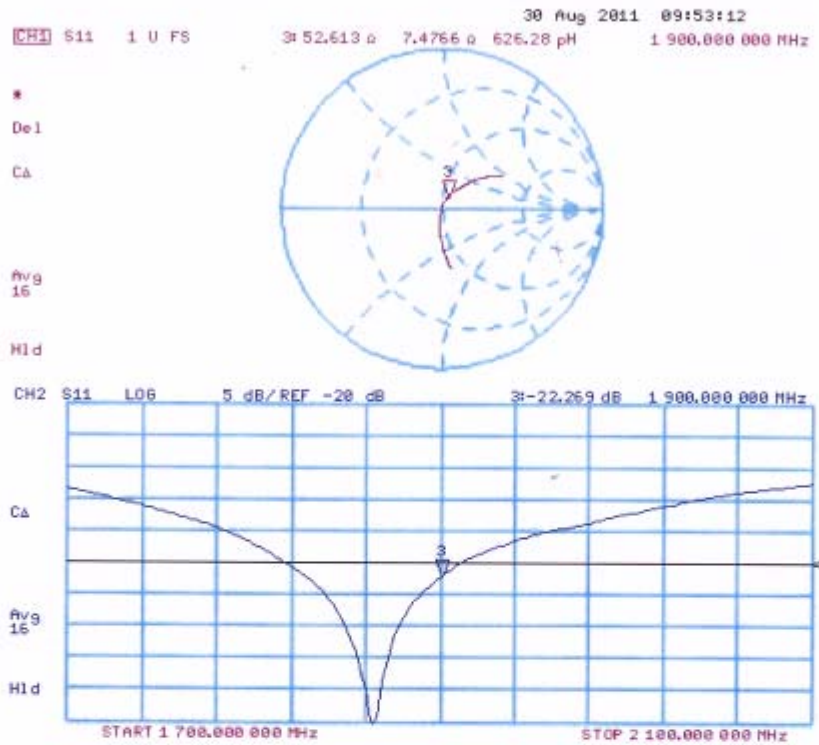


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Impedance Measurement Plot for Head TSL



### **DASY5 Validation Report for Body TSL**

Date: 31.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060**

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.57$  mho/m;  $\epsilon_r = 53.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

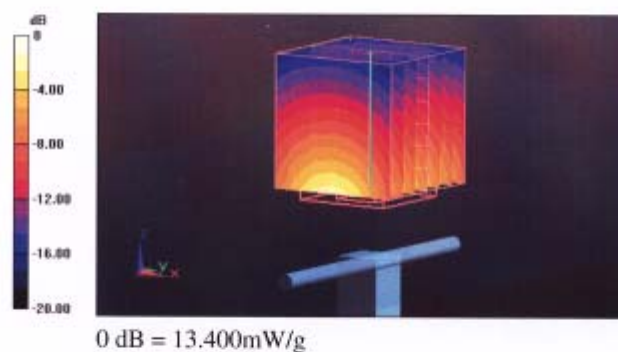
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.435 V/m; Power Drift = -0.0099 dB

Peak SAR (extrapolated) = 18.663 W/kg

**SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.55 mW/g**

Maximum value of SAR (measured) = 13.397 mW/g

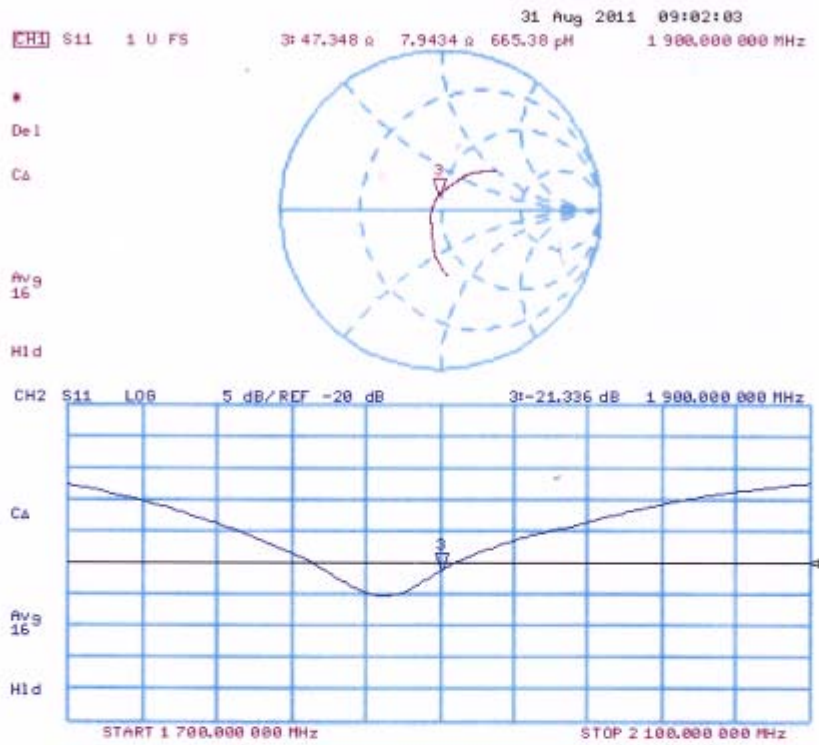


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# TA Technology (Shanghai) Co., Ltd.

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### ANNEX G: D2450V2 Dipole Calibration Certificate

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



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

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **TA-Shanghai (Auden)**

Certificate No: **D2450V2-786\_Aug11**

#### CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 786**

Calibration procedure(s) **QA CAL-05.v8**  
**Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **August 29, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)      | Oct-11                |
| Reference 20 dB Attenuator  | SN: S5086 (20b)    | 29-Mar-11 (No. 217-01367)      | Apr-12                |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-11 (No. 217-01371)      | Apr-12                |
| Reference Probe ES3DV3      | SN: 3205           | 29-Apr-11 (No. ES3-3205_Apr11) | Apr-12                |
| DAE4                        | SN: 601            | 04-Jul-11 (No. DAE4-601_Jul11) | Jul-12                |

| Secondary Standards       | ID #             | Check Date (in house)             | Scheduled Check        |
|---------------------------|------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A     | MY41092317       | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06   | 100005           | 04-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

|                |               |                       |           |
|----------------|---------------|-----------------------|-----------|
|                | Name          | Function              | Signature |
| Calibrated by: | Dimce Iliev   | Laboratory Technician |           |
| Approved by:   | Katja Pokovic | Technical Manager     |           |

Issued: August 29, 2011

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Certificate No: D2450V2-786\_Aug11

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# TA Technology (Shanghai) Co., Ltd.

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

### Glossary:

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

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

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

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### Measurement Conditions

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

|                              |                        |             |
|------------------------------|------------------------|-------------|
| DASY Version                 | DASY5                  | V52.6.2     |
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 2450 MHz $\pm$ 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 $\pm$ 0.2) °C | 38.4 $\pm$ 6 % | 1.85 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Head TSL

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 13.7 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 53.8 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 6.41 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.4 mW / g $\pm$ 16.5 % (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 $\pm$ 0.2) °C | 51.8 $\pm$ 6 % | 2.02 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | ----           | ----                 |

### SAR result with Body TSL

|                                                       |                    |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 13.2 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 51.7 mW / g $\pm$ 17.0 % (k=2) |

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                                |
| SAR measured                                            | 250 mW input power | 6.10 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 24.2 mW / g $\pm$ 16.5 % (k=2) |

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### Appendix

#### Antenna Parameters with Head TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $55.0 \Omega + 2.4 j\Omega$ |
| Return Loss                          | - 25.5 dB                   |

#### Antenna Parameters with Body TSL

|                                      |                             |
|--------------------------------------|-----------------------------|
| Impedance, transformed to feed point | $50.4 \Omega + 3.5 j\Omega$ |
| Return Loss                          | - 29.0 dB                   |

#### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.154 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.

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        |
| Manufactured on | May 06, 2005 |

## DASY5 Validation Report for Head TSL

Date: 29.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.85$  mho/m;  $\epsilon_r = 38.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

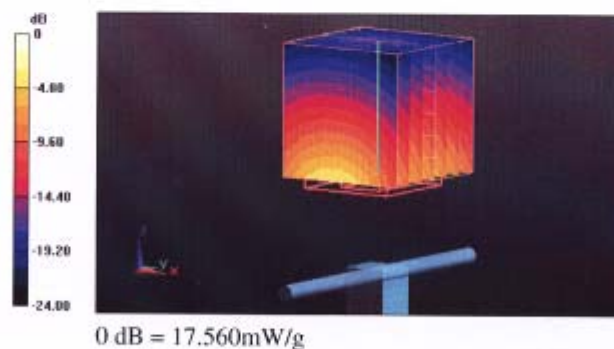
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.5 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 28.303 W/kg

**SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.41 mW/g**

Maximum value of SAR (measured) = 17.561 mW/g

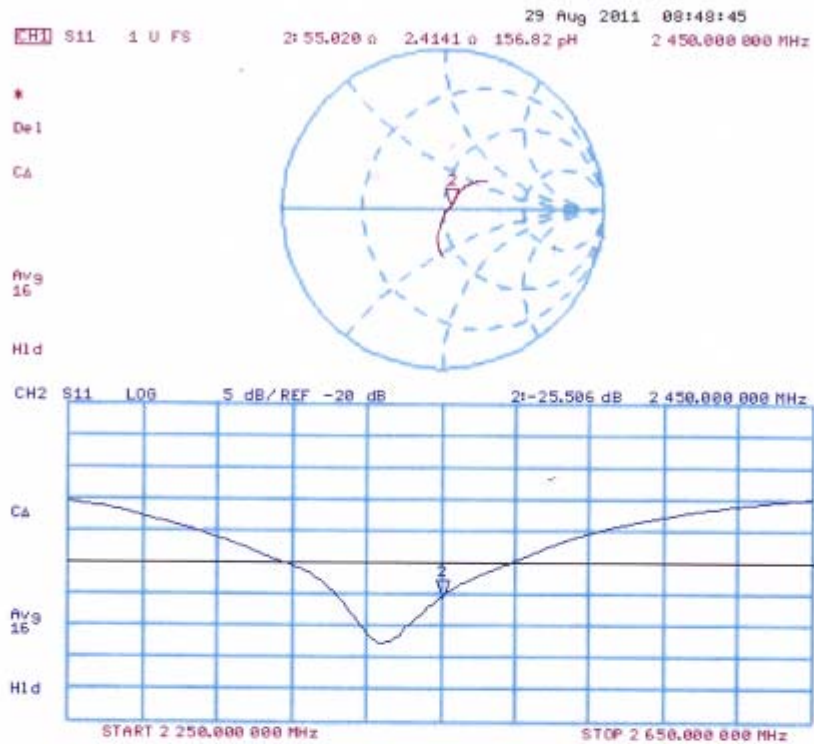


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Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 29.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.02$  mho/m;  $\epsilon_r = 51.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

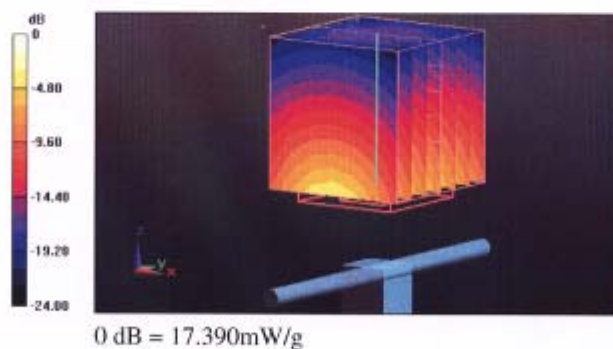
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.118 V/m; Power Drift = 0.0072 dB

Peak SAR (extrapolated) = 27.129 W/kg

**SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.1 mW/g**

Maximum value of SAR (measured) = 17.387 mW/g

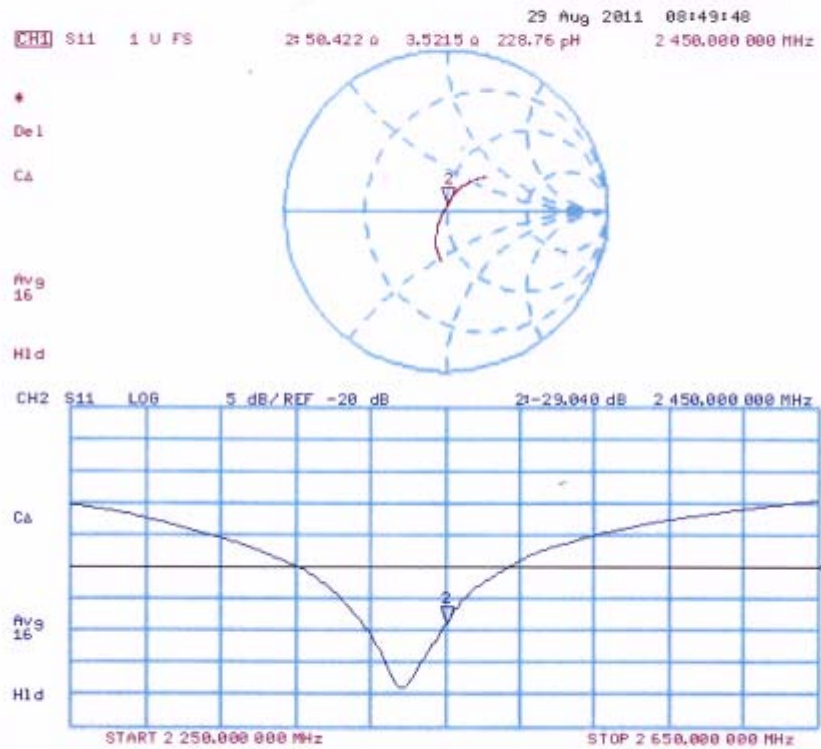


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Impedance Measurement Plot for Body TSL



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ANNEX H: DAE4 Calibration Certificate



Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China  
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E-mail: [info@emcste.com](mailto:info@emcste.com) Http://www.emcste.com

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Client : TA(Shanghai)

Certificate No: J14-2-0052

**CALIBRATION CERTIFICATE**

Object DAE4 - SN: 1317

Calibration Procedure(s) TMC-OS-E-01-198  
Calibration Procedure for the Data Acquisition Electronics (DAEx)

Calibration date: January 16, 2014

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

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards                  | ID #    | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|------------------------------------|---------|------------------------------------------|-----------------------|
| Documenting Process Calibrator 753 | 1971018 | 01-July-13 (TMC, No:JW13-049)            | July-14               |

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

Issued: January 16, 2014

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

Certificate No: J14-2-0052

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**Glossary:**

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

**Methods Applied and Interpretation of Parameters:**

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

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E-mail: [info@emcite.com](mailto:info@emcite.com) [Http://www.emcite.com](http://www.emcite.com)

**DC Voltage Measurement**

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV, full range = -100...+300 mV  
Low Range: 1LSB = 61nV, full range = -1.....+3mV

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

| Calibration Factors | X                     | Y                     | Z                     |
|---------------------|-----------------------|-----------------------|-----------------------|
| High Range          | 404.058 ± 0.15% (k=2) | 404.060 ± 0.15% (k=2) | 403.954 ± 0.15% (k=2) |
| Low Range           | 3.99002 ± 0.7% (k=2)  | 3.99910 ± 0.7% (k=2)  | 3.98303 ± 0.7% (k=2)  |

**Connector Angle**

|                                           |           |
|-------------------------------------------|-----------|
| Connector Angle to be used in DASY system | 119° ± 1° |
|-------------------------------------------|-----------|

## ANNEX I: The EUT Appearances and Test Configuration

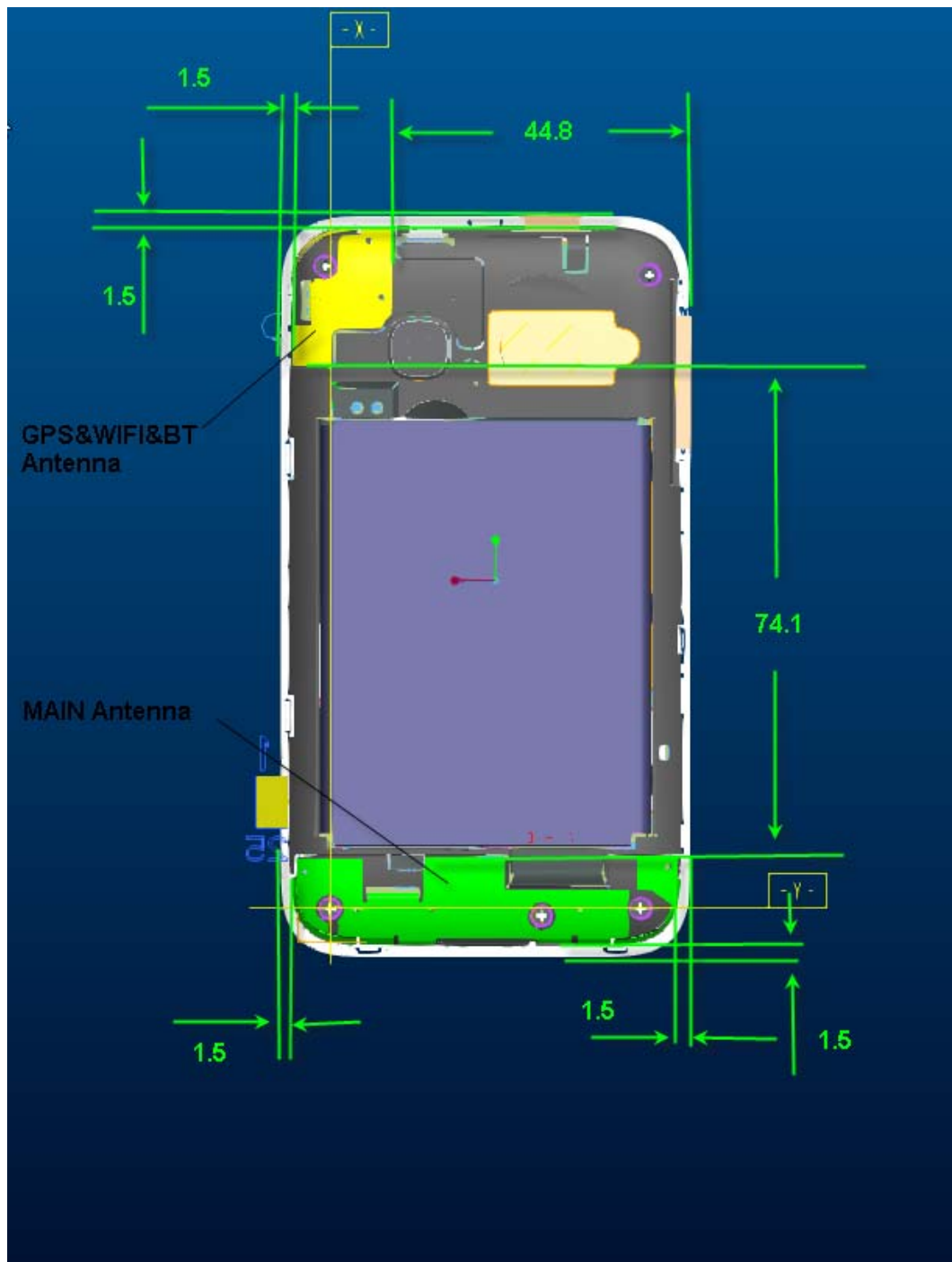


a: EUT

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b: Antenna

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Earphone 3



Earphone 4  
c: Earphone

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d: Battery

Picture 8: Constituents of EUT



Picture 9: Left Hand Touch Cheek Position



Picture 10: Left Hand Tilt 15 Degree Position



Picture 11: Right Hand Touch Cheek Position



Picture 12: Right Hand Tilt 15 Degree Position



Picture 13: Back Side, the distance from handset to the bottom of the Phantom is 10mm



Picture 14: Front Side, the distance from handset to the bottom of the Phantom is 10mm