# TEST REPORT

## FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)

| | |
|---|---|
| **Report Reference No.**......................: | **TRE13080076 R/C: 25560** |
| **FCC ID**.............................................: | **2AAPBKS-UMD** |
| Compiled by ( position+printed name+signature)..: | File administrators Jerome Luo |
| Supervised by ( position+printed name+signature)..: | Test Engineer Yuchao Wang |
| Approved by ( position+printed name+signature)..: | Manager Wenliang Li |
| Date of issue....................................: | Aug 23, 2013 |
| **Representative Laboratory Name** .: | **Shenzhen Huatongwei International Inspection Co., Ltd** |
| Address.............................................: | Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China |
| **Applicant's name**............................: | **Shenzhen Kinstone D&T Develop Co.,Ltd** |
| Address.............................................: | 5F A2 Building, XinJianXing Tech Industrial Park, Fengxin Rd., Guangming New Dist., Bao'an Dist., Shenzhen, China |
| **Test specification:** | |
| Standard ...........................................: | **ANSI C95.1–1999**<br>**FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)**<br>**47CFR §2.1093** |
| TRF Originator..................................: | Shenzhen Huatongwei International Inspection CO., Ltd |
| Master TRF.......................................: | Dated 2006-06 |



| | |
|---|---|
| **Test item description** .....................: | MID |
| Trade Mark .......................................: | Kinstone |
| Manufacturer ....................................: | **Shenzhen Kinstone D&T Develop Co.,Ltd** |
| Model/Type reference.......................: | KS-UMD102TA |
| Listed Models .................................: | KS-UMD102TA, KS-UMD102ZA, KS-UMD097RS, KS-UMD102RS, KS-UMD080ZA, KS-UMD070TA, KS-UMD080TA, KS-UMD070TB, KS-UMD097RB, KS-UMD102TB |
| Operation Frequency........................ | GSM850&DCS1900&WCDMA850&WCDMA1900&WLAN |
| Modilation Type ................................ | GMSK (GSM),QPSK (WCDMA),CCK&OFDM (WLAN) |
| Result...............................................: | **Positive** |

# TEST REPORT

| Test Report No. : | TRE13080076 | Aug 23, 2013<br>Date of issue |
|---|---|---|

| | | |
|---|---|---|
| Equipment under Test | : | MID |
| Model /Type | : | KS-UMD102TA |
| Listed Models | : | KS-UMD102TA, KS-UMD102ZA, KS-UMD097RS, KS-UMD102RS, KS-UMD080ZA, KS-UMD070TA, KS-UMD080TA, KS-UMD070TB, KS-UMD097RB, KS-UMD102TB |
| **Applicant** | : | **Shenzhen Kinstone D&T Develop Co.,Ltd** |
| Address | : | 5F A2 Building, XinJianXing Tech Industrial Park, Fengxin Rd., Guangming New Dist., Bao'an Dist., Shenzhen, China |
| **Manufacturer** | : | **Shenzhen Kinstone D&T Develop Co.,Ltd** |
| Address | : | 5F A2 Building, XinJianXing Tech Industrial Park, Fengxin Rd., Guangming New Dist., Bao'an Dist., Shenzhen, China |

| **Test Result** according to the standards on page 4: | **Positive** |
|---|---|

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

# Contents

# 1. TEST STANDARDS

The tests were performed according to following standards:

IEEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.
IEEE Std 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.
SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438 June 19, 2002: Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions.
KDB 447498 D01 Mobile Portable RF Exposure v05r01: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 616217 D04 SAR for laptop and tablets v01: SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers
KDB941225 D01: SAR Measurement Procedures for 3G Devices.
KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01: SAR Measurement Requirements for 100 MHz to 6 GHz
KDB865664 D02 SAR Reporting v01: RF Exposure Compliance Reporting and Documentation Considerations
KDB 941225 D04 v01: SAR for GSM E GPRS Dual Xfer Mode

# 2. SUMMARY

## 2.1. General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | Aug 15, 2013 |
| | | |
| | | |
| Testing commenced on | : | Aug 15, 2013 |
| | | |
| | | |
| Testing concluded on | : | Aug 23, 2013 |

## 2.2. Product Description

The **Shenzhen Kinstone D&T Develop Co.,Ltd**'s Model: KS-UMD102TA or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

| | |
|---|---|
| Name of EUT | MID |
| Model Number | KS-UMD102TA |
| Modilation Type | GMSK (GSM),QPSK (WCDMA),CCK&OFDM (WLAN) |
| Antenna Type | Internal |
| GPRS Multislot Class | 12 |
| EGPRS Multislot Class | 12 |
| Release version | GSM/GPRS:R99;WCDMA:R6;HSDPA:8;HSUPA:6 |
| Operation mode | GSM 850/1900,WCDMA 850/1900,BT,WiFi |
| WLAN | Supported 802.11b/802.11g/802.11n20/802.11n40 |
| Power class | GSM850: tested with power level 5 |
| | GSM1900: tested with power level 0 |
| | WCDMA: class 3, tested with power control all up bits |
| Operation Frequency | GSM850:824MHz-849MHz |
| | GSM1900:1850-1910MHz |
| | WCDMA850: 824MHz-849MHz |
| | WCDMA1900: 1850-1910MHz |
| | WiFi:2412-2462MHz |
| Bluetooth | Supported Bluetooth 4.0,Bluetooth 2.1+EDR |
| Antenna type | Integrated antenna |
| Accessories/Body-worn configurations | No Headset |
| Maximum SAR Values | **1.583 W/Kg** |

## 2.3. Equipment under Test

**Power supply system utilised**

| | | | | | |
|---|---|---|---|---|---|
| Power supply voltage | : | ○ | 120V / 60 Hz | ○ | 115V / 60Hz |
| | | ○ | 12 V DC | ○ | 24 V DC |
| | | ● | Other (specified in blank below) | | |

DC 3.70 V

## 2.4. Short description of the Equipment under Test (EUT)

Tablet PC (Model: KS-UMD102TA).

The EUT battery must be fully charged and checked periodically during the test to ascertain maximum power output.

## 2.5. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

## 2.6. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| ○ | Power Cable | Length (m) : | / |
| | | Shield : | / |
| | | Detachable : | / |
| ○ | Multimeter | Manufacturer : | / |
| | | Model No. : | / |

**Adapter information:** Model: WRP12U-050200C
Inout: 100~240Vac, 50/60Hz, 0.4A max
Output: DC 5V, 2A

## 2.7. Note

The EUT is an 802.11b/g/n MID with GSM/WCDMA/WLAN and Bluetooth function ,The functions of the EUT listed as below:

| Function | Test Standards | Reference Report |
|---|---|---|
| SAR | OET 65 | TRE13080076 |

# 3. TEST ENVIRONMENT

## 3.1. Address of the test laboratory

Shenzhen Huatongwei International Inspection Co., Ltd
Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China
Phone: 86-755-26715686 Fax: 86-755-26748089

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

## 3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

### CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: Mar. 29, 2012. Valid time is until Feb. 28, 2015.

### A2LA-Lab Cert. No. 2243.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until Sept. 30, 2013.

### FCC-Registration No.: 662850

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 662850, Renewal date June. 01, 2012, valid time is until June. 01, 2015.

### IC-Registration No.: 5377A

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A on Jan. 25, 2011, valid time is until Jan. 24, 2014.

### ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

### VCCI

The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) and Shielded Room (8m×4m×3m) of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-292. Date of Registration: Dec. 24, 2010. Valid time is until Dec. 23, 2013.

Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: Dec. 20, 2012. Valid time is until Dec. 19, 2015.

Telecommunication Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-1837. Date of Registration: May 07, 2013. Valid time is until May 06, 2016.

### DNV

Shenzhen Huatongwei International Inspection Co., Ltd. has been found to comply with the requirements of DNV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Directives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-ups according to relevant parts of ISO/IEC Guide 17025 (2005), in accordance with the requirements of the DNV Laboratory Quality Manual towards subcontractors. Valid time is until Aug. 24, 2013.

## 3.3. Environmental conditions

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

| | |
|---|---|
| Temperature: | 18-25 ° C |
| | |
| Humidity: | 40-65 % |
| | |
| Atmospheric pressure: | 950-1050mbar |

## 3.4. SAR Limits

FCC Limit (1g Tissue)

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

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

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

## 3.5. Equipments Used during the Test

| Test Equipment | Manufacturer | Type/Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Calibration | Calibration Interval |
| Data Acquisition Electronics DAEx | SPEAG | DAE4 | 1315 | 2013.2.27 | 1 |
| E-field Probe | SPEAG | ES3DV3 | 3292 | 2013.2.24 | 1 |
| System Validation Dipole 835V2 | SPEAG | D835V2 | 4d134 | 2013.2.27 | 1 |
| System Validation Dipole 1900V2 | SPEAG | D1900V2 | Sd150 | 2013.2.28 | 1 |
| System Validation Dipole D2450V2 | SPEAG | D2450V2 | 884 | 2013.2.29 | 1 |
| Network analyzer | Agilent | 8753E | US37390562 | 2013.3.25 | 1 |
| Universal Radio Communication Tester | ROHDE & SCHWARZ | CMU200 | 112012 | 2012.10.23 | 1 |

# 4. SAR Measurements System configuration

## 4.1. 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.

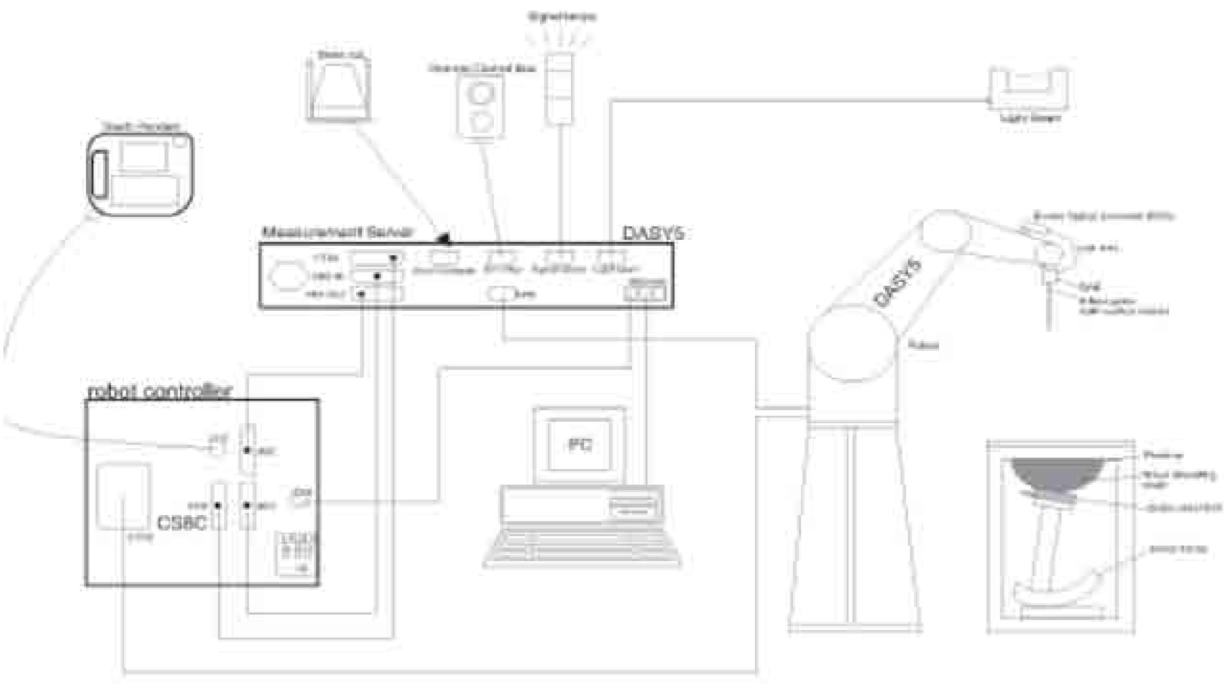
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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.



## 4.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

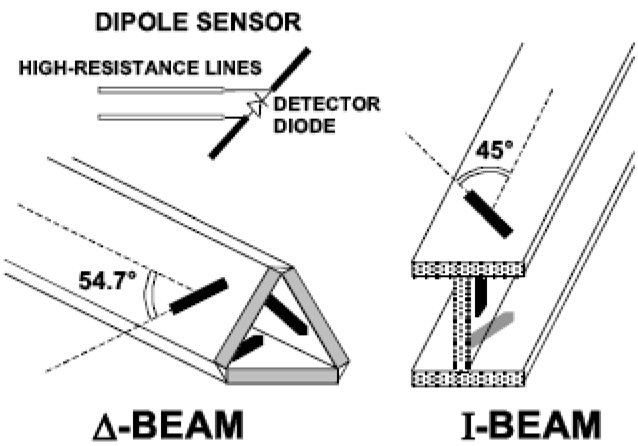
Probe Specification

| | |
|---|---|
| Construction | Symmetrical design with triangular core<br>Interleaved sensors<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Calibration | ISO/IEC 17025 calibration service available. |
| Frequency | 10 MHz to 4 GHz;<br>Linearity: ± 0.2 dB (30 MHz to 4 GHz) |
| Directivity | ± 0.2 dB in HSL (rotation around probe axis)<br>± 0.3 dB in tissue material (rotation normal to probe axis) |
| Dynamic Range | 5 µW/g to > 100 mW/g;<br>Linearity: ± 0.2 dB |
| Dimensions | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 3.9 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.0 mm |
| Application | General dosimetry up to 4 GHz<br>Dosimetry in strong gradient fields<br>Compliance tests of mobile phones |
| Compatibility | DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI |

Isotropic E-Field Probe

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

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



## 4.3. Phantoms

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

SAM Twin Phantom

## 4.4. Device Holder

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

Device holder supplied by SPEAG

## 4.5. 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. ± 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 ± 0.1mm). 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 ± 30°.)
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 spacing of 15 mm x 15 mm is set. During the 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
Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

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. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

## 4.6. Data Storage and Evaluation

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

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 4.7. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

| Ingredients (% by weight) | Frequency (MHz) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 450 | | 835 | | 915 | | 1900 | | 2450 | |
| Tissue Type | Head | Body | Head | Body | Head | Body | Head | Body | Head | Body |
| Water | 38.56 | 51.16 | 41.45 | 52.4 | 41.05 | 56.0 | 54.9 | 40.4 | 62.7 | 73.2 |
| Salt (Nacl) | 3.95 | 1.49 | 1.45 | 1.4 | 1.35 | 0.76 | 0.18 | 0.5 | 0.5 | 0.04 |
| Sugar | 56.32 | 46.78 | 56.0 | 45.0 | 56.5 | 41.76 | 0.0 | 58.0 | 0.0 | 0.0 |
| HEC | 0.98 | 0.52 | 1.0 | 1.0 | 1.0 | 1.21 | 0.0 | 1.0 | 0.0 | 0.0 |
| Bactericide | 0.19 | 0.05 | 0.1 | 0.1 | 0.1 | 0.27 | 0.0 | 0.1 | 0.0 | 0.0 |
| Triton x-100 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.8 | 0.0 |
| DGBE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.92 | 0.0 | 0.0 | 26.7 |
| Dielectric Constant | 43.42 | 58.0 | 42.54 | 56.1 | 42.0 | 56.8 | 39.9 | 54.0 | 39.8 | 52.5 |
| Conductivity (s/m) | 0.85 | 0.83 | 0.91 | 0.95 | 1.0 | 1.07 | 1.42 | 1.45 | 1.88 | 1.78 |

IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

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

## 4.8. Tissue equivalent liquid properties

Dielectric performance of Body tissue simulating liquid

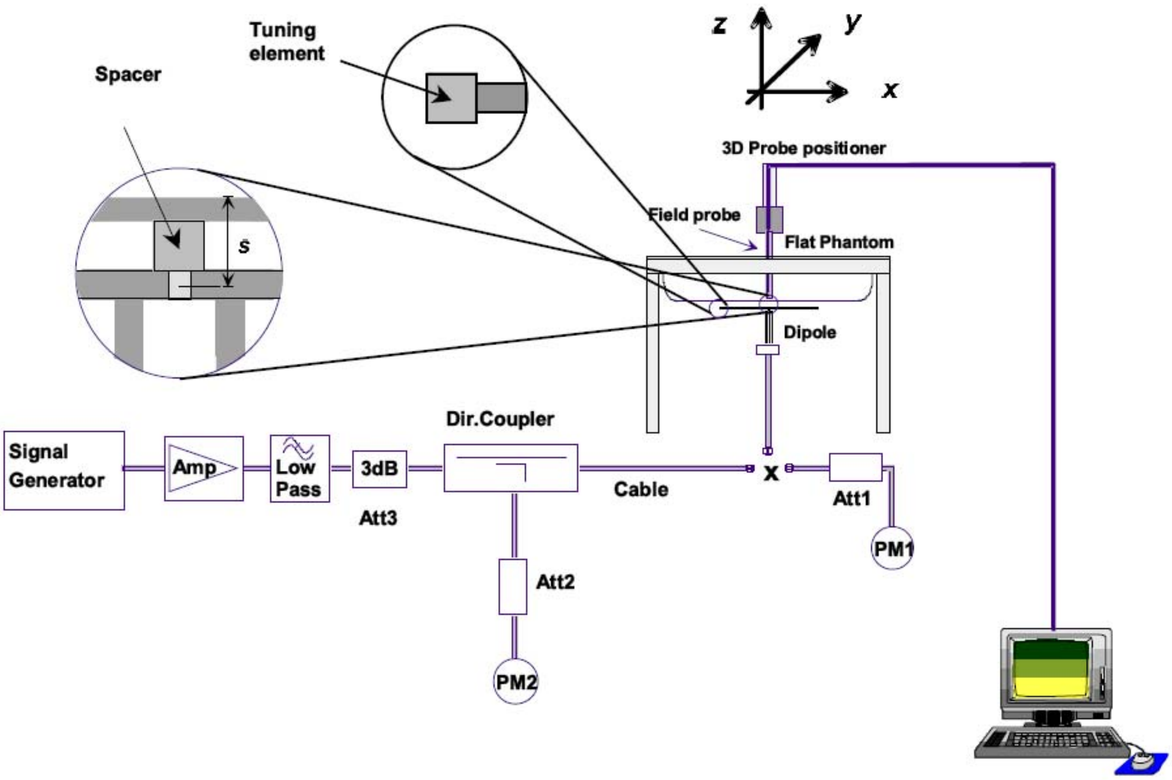
| Frequency | Description | Dielectric paramenters | |
|---|---|---|---|
| | | $\varepsilon_r$ | σ |
| 835MHz(Body) | Target Value ±5% | 56.1 (53.30-58.91) | 0.95 (0.90-1.00) |
| | Measurement Value 2013-08-15 | 55.80 | 0.98 |
| 1900MHz(Body) | Target Value ±5% | 54.00 (51.30-56.70) | 1.45 (1.38-1.52) |
| | Measurement Value 2013-08-16 | 53.10 | 1.42 |
| 2450MHz(Body) | Target Value ±5% | 52.70 (50.07-55.33) | 1.95 (1.85-2.05) |
| | Measurement Value 2013-08-16 | 53.40 | 1.90 |

## 4.9. System Check

The purpose of the system check is to verify that the system operates within its specifications at the decice test frequency.The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

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

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



The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected.

Photo of Dipole Setup

System Validation of Body

<table>
<tr><td colspan="8">Measurement is made at temperature 22.0 ℃ and relative humidity 55%.</td></tr>
<tr><td colspan="8">Measurement is made at temperature 22.0 ℃ and relative humidity 55%.</td></tr>
<tr><td colspan="8">Measurement Date: 835MHz Aug 15th, 2013, 1900MHz Aug 16th, 2013,2450 MHz Aug 17th, 2013</td></tr>
<tr><td rowspan="5">Verification results</td><td rowspan="2">Frequency (MHz)</td><td colspan="2">Target value (W/kg)</td><td colspan="2">Measured value (W/kg)</td><td colspan="2">Deviation</td></tr>
<tr><td>10 g Average</td><td>1 g Average</td><td>10 g Average</td><td>1 g Average</td><td>10 g Average</td><td>1 g Average</td></tr>
<tr><td>835</td><td>1.60</td><td>2.44</td><td>1.73</td><td>2.60</td><td>8.13%</td><td>6.56%</td></tr>
<tr><td>1900</td><td>5.32</td><td>10.2</td><td>5.75</td><td>9.68</td><td>8.08%</td><td>-5.10%</td></tr>
<tr><td>2450</td><td>5.98</td><td>12.8</td><td>5.91</td><td>12.97</td><td>-1.17%</td><td>1.33%</td></tr>
</table>

## 4.10. SAR measurement procedure

### 4.10.1 Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in Picture 11.1.

Step 1: The tests described in 11.2 shall be performed at the channel that is closest to the centre of the transmit frequency band ($f_c$) for:

a). all device positions (cheek and tilt, for both left and right sides of the SAM phantom;

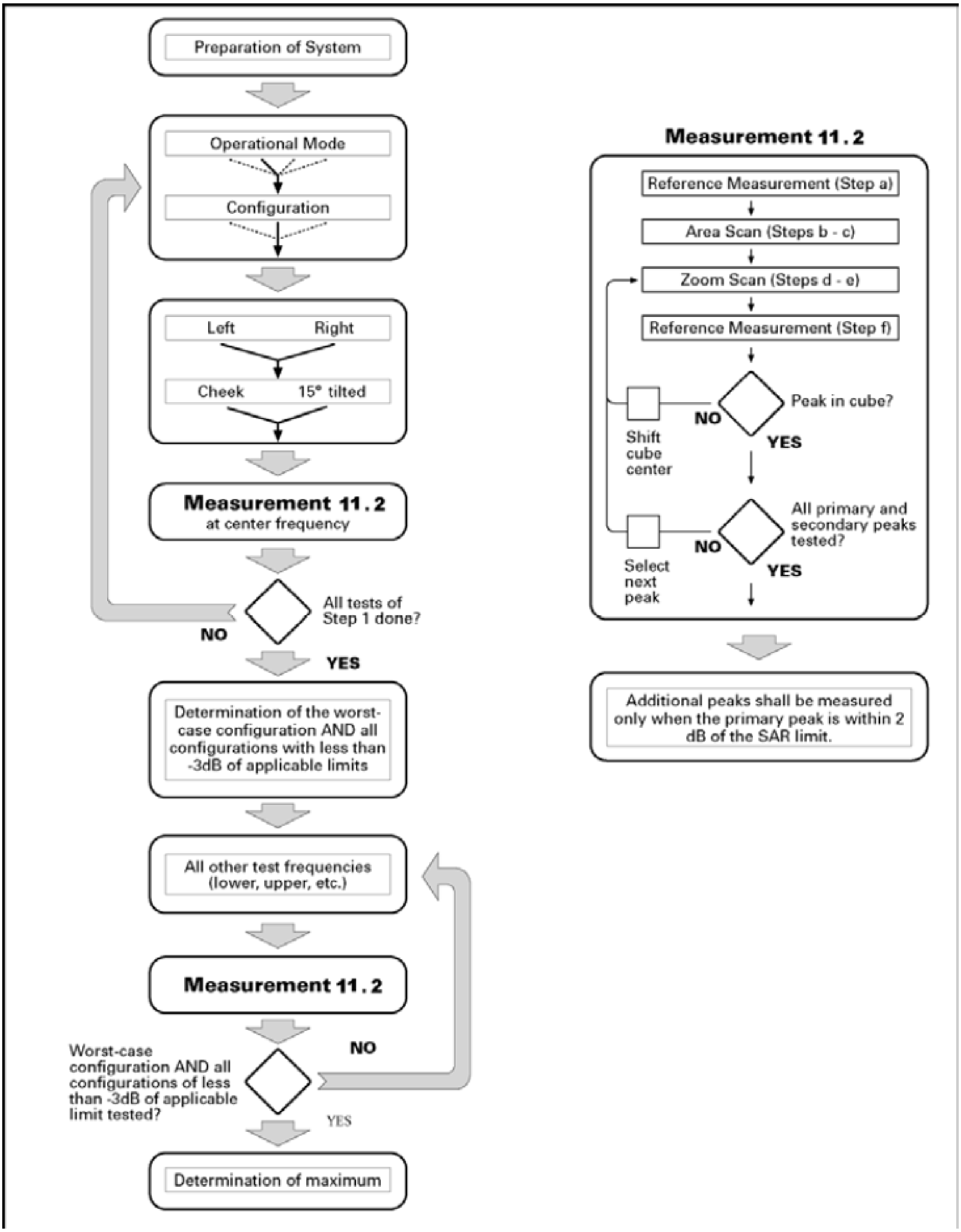
b). all configurations for each device position in a), e.g., antenna extended and retracted, and

c). all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

If more than three frequencies need to be tested according to 11.1 (i.e., $N_c > 3$), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1, perform all tests described in 11.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

Step 3: Examine all data to determine the highest value of the peak spatial-average SAR found in Steps 1 to 2.




Picture 10.1 Block diagram of the tests to be performed

### 4.10.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

| | ≤ 3 GHz | > 3 GHz |
|---|---|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 ± 1 mm | ½·δ·ln(2) ± 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | 30° ± 1° | 20° ± 1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm |
| | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | |
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$ | ≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm* | 3 – 4 GHz: ≤ 5 mm*<br>4 – 6 GHz: ≤ 4 mm* |
| Maximum zoom scan spatial resolution, normal to phantom surface — uniform grid: $\Delta z_{Zoom}(n)$ | ≤ 5 mm | 3 – 4 GHz: ≤ 4 mm<br>4 – 5 GHz: ≤ 3 mm<br>5 – 6 GHz: ≤ 2 mm |
| Maximum zoom scan spatial resolution, normal to phantom surface — graded grid: $\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface | ≤ 4 mm | 3 – 4 GHz: ≤ 3 mm<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 2 mm |
| Maximum zoom scan spatial resolution, normal to phantom surface — graded grid: $\Delta z_{Zoom}(n>1)$: between subsequent points | ≤ 1.5·$\Delta z_{Zoom}(n-1)$ | |
| Minimum zoom scan volume — x, y, z | ≥ 30 mm | 3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm |

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

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

### 4.10.3 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.
Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

### 4.10.4 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Table 14.1 to Table 14.11 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

# 5. TEST CONDITIONS AND RESULTS

## 5.1. Conducted Power Results

Max Conducted power measurement results and power drift from tune-up tolerance provide by manufacturer:

**The conducted power measurement results for GSM850/1900**

| Test Mode | Conducted Power (dBm) | | |
|---|---|---|---|
| GSM 850MHz | Channel 251(848.8MHz) | Channel 190(836.6MHz) | Channel 128(824.2MHz) |
| | 32.15 | 32.22 | 32.08 |
| GSM 1900MHz | Channel 810(1909.8MHz) | Channel 661(1880MHz) | Channel 512(1850.2MHz) |
| | 28.42 | 28.55 | 28.34 |

**The conducted power measurement results for GPRS and EGPRS**

| Test Mode | Measured Power (dBm) | | | Calculation (dB) | Averaged Power (dBm) | | |
|---|---|---|---|---|---|---|---|
| GSM 850 GPRS (GMSK) | Test Channel | | | | Test Channel | | |
| | 251 | 190 | 128 | | 251 | 190 | 128 |
| 1 Txslot | 32.11 | 32.20 | 32.00 | -9.03 | 23.08 | 23.17 | 22.97 |
| 2 Txslot | 29.31 | 29.35 | 29.20 | -6.02 | 23.29 | 23.33 | 23.18 |
| 3 Txslot | 27.36 | 27.45 | 27.23 | -4.26 | 23.10 | 23.19 | 22.97 |
| **4 Txslot** | **27.33** | **27.41** | **27.20** | **-3.01** | **24.32** | **24.40** | **24.19** |
| Test Mode | Measured Power (dBm) | | | Calculation (dB) | Averaged Power (dBm) | | |
| GSM 850 EGPRS (GMSK) | Test Channel | | | | Test Channel | | |
| | 251 | 190 | 128 | | 251 | 190 | 128 |
| 1 Txslot | 32.05 | 32.12 | 32.00 | -9.03 | 23.02 | 23.09 | 22.97 |
| 2 Txslot | 29.22 | 29.29 | 29.17 | -6.02 | 23.20 | 23.27 | 23.15 |
| 3 Txslot | 27.28 | 27.31 | 27.19 | -4.26 | 23.02 | 23.05 | 22.93 |
| **4 Txslot** | **27.30** | **27.31** | **27.15** | **-3.01** | **24.29** | **24.30** | **24.14** |
| Test Mode | Measured Power (dBm) | | | Calculation (dB) | Averaged Power (dBm) | | |
| GSM1900 GPRS (GMSK) | Test Channel | | | | Test Channel | | |
| | 810 | 661 | 512 | | 810 | 661 | 512 |
| 1 Txslot | 28.27 | 28.33 | 28.22 | -9.03 | 19.24 | 19.30 | 19.19 |
| 2 Txslot | 27.10 | 27.16 | 27.05 | -6.02 | 21.08 | 21.14 | 21.03 |
| 3 Txslot | 25.33 | 25.42 | 25.27 | -4.26 | 21.07 | 21.16 | 21.01 |
| **4 Txslot** | **24.36** | **24.40** | **24.24** | **-3.01** | **21.35** | **21.39** | **21.23** |
| Test Mode | Measured Power (dBm) | | | Calculation (dB) | Averaged Power (dBm) | | |
| GSM1900 EGPRS (GMSK) | Test Channel | | | | Test Channel | | |
| | 810 | 661 | 512 | | 810 | 661 | 512 |
| 1 Txslot | 28.25 | 28.30 | 28.19 | -9.03 | 19.22 | 19.27 | 19.16 |
| 2 Txslot | 27.10 | 27.13 | 27.02 | -6.02 | 21.08 | 21.11 | 21.00 |
| 3 Txslot | 25.31 | 25.36 | 25.22 | -4.26 | 21.05 | 21.10 | 20.96 |
| **4 Txslot** | **24.30** | **24.38** | **24.20** | **-3.01** | **21.29** | **21.37** | **21.19** |

NOTES:
1) Division Factors
To average the power, the division factor is as follows:
1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB
2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB
3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB
4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB
**According to the conducted power as above, the body measurements are performed with 4Txslots for GSM850 and GSM1900.**
**Note: According to the KDB941225 D03, "when SAR tests for EDGE or EGPRS mode is necessary, GMSK modulation should be used".**

**The conducted power measurement results for WCDMA**

| Item | band | FDDV result (dBm) | | | FDDII result (dBm) | | |
|---|---|---|---|---|---|---|---|
| | | Test Channel | | | Test Channel | | |
| | ARFCN | 4132 | 4183 | 4233 | 9262 | 9400 | 9538 |
| 5.2(WCDMA) | \ | 22.83 | 23.24 | 23.24 | 22.62 | 22.90 | 22.83 |
| 5.2AA (HSDPA) | 1 | 22.20 | 22.63 | 22.46 | 22.12 | 22.33 | 22.31 |
| | 2 | 21.37 | 21.78 | 21.52 | 21.32 | 21.41 | 21.44 |
| | 3 | 20.88 | 21.02 | 20.95 | 20.81 | 20.96 | 20.95 |
| | 4 | 20.23 | 20.46 | 20.32 | 20.19 | 20.32 | 20.28 |
| 5.2B (HSUPA) | 1 | 22.19 | 22.55 | 22.42 | 22.13 | 22.31 | 22.26 |
| | 2 | 22.16 | 22.52 | 22.48 | 22.23 | 22.33 | 22.31 |
| | 3 | 21.86 | 22.21 | 22.16 | 21.96 | 22.03 | 21.96 |
| | 4 | 21.12 | 21.53 | 21.63 | 21.52 | 21.21 | 21.33 |
| | 5 | 21.32 | 21.64 | 21.78 | 21.65 | 21.35 | 21.46 |

Note: HSUPA body SAR are not required, because maximum average output power of each RF channel with HSDPA active is not 1/4 dB higher than that measured without HSUPA and the maximum SAR for WCDMA850 and WCDMA1900 are not above 75% of the SAR limit.

***WLAN***

| Mode | Channel | Frequency (MHz) | Worst case Data rate of worst case | Conducted Output Power (dBm) | |
|---|---|---|---|---|---|
| | | | | Peak | Average |
| 802.11b | 1 | 2412 | 1Mbps | 16.52 | 14.36 |
| | 6 | 2437 | 1Mbps | 16.93 | 14.68 |
| | 11 | 2442 | 1Mbps | 16.44 | 14.20 |
| 802.11g | 1 | 2412 | 6Mbps | 18.05 | 12.22 |
| | 6 | 2437 | 6Mbps | 18.54 | 12.50 |
| | 11 | 2442 | 6Mbps | 18.33 | 12.35 |
| 802.11n(20MHz) | 1 | 2412 | 6.5 Mbps | 20.17 | 10.69 |
| | 6 | 2437 | 6.5 Mbps | 20.13 | 10.58 |
| | 11 | 2442 | 6.5 Mbps | 19.38 | 10.37 |
| 802.11n(40MHz) | 3 | 2422 | 13.5 Mbps | 21.23 | 9.05 |
| | 6 | 2437 | 13.5 Mbps | 21.17 | 8.99 |
| | 9 | 2452 | 13.5 Mbps | 21.10 | 8.90 |

**Note:** SAR is not required for 802.11g/n channels if the output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels, and for each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate. According to the above conducted power, the EUT should be tested for “802.11b, 1Mbps, channel 6”.

***Bluetooth***

| Mode | Channel | Frequency (MHz) | Conducted Peak Output Power (dBm) |
|---|---|---|---|
| GFSK-LE | 00 | 2402 | 5.56 |
| | 20 | 2440 | 5.69 |
| | 39 | 2480 | 5.44 |
| GFSK | 00 | 2402 | 5.50 |
| | 41 | 2441 | 5.63 |
| | 79 | 2480 | 5.40 |
| π/4DQPSK | 00 | 2402 | 5.02 |
| | 40 | 2441 | 5.18 |
| | 79 | 2480 | 5.13 |
| 8DPSK | 00 | 2402 | 5.10 |
| | 40 | 2441 | 5.24 |
| | 79 | 2480 | 5.07 |

**Manufacturing tolerance**

**GSM Speech**

| GSM 850 | | | |
|---|---|---|---|
| Channel | Channel 251 | Channel 190 | Channel 190 |
| Target (dBm) | 31.5 | 31.5 | 31.5 |
| Tolerance ±(dB) | 1 | 1 | 1 |
| **GSM 1900** | | | |
| Channel | Channel 810 | Channel 661 | Channel 512 |
| Target (dBm) | 28 | 28 | 28 |
| Tolerance ±(dB) | 1 | 1 | 1 |

**GPRS (GMSK Modulation)**

| GSM 850 GPRS | | | | |
|---|---|---|---|---|
| Channel | | 251 | 190 | 128 |
| 1 Txslot | Target (dBm) | 31.5 | 31.5 | 31.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 2 Txslot | Target (dBm) | 29.5 | 29.5 | 29.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 3 Txslot | Target (dBm) | 27.5 | 27.5 | 27.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 4 Txslot | Target (dBm) | 26.5 | 26.5 | 26.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| **GSM 850 EGPRS** | | | | |
| Channel | | 251 | 190 | 128 |
| 1 Txslot | Target (dBm) | 31.5 | 31.5 | 31.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 2 Txslot | Target (dBm) | 29.5 | 29.5 | 29.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 3 Txslot | Target (dBm) | 27.5 | 27.5 | 27.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 4 Txslot | Target (dBm) | 26.5 | 26.5 | 26.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| **GSM 1900 GPRS** | | | | |
| Channel | | 810 | 661 | 512 |
| 1 Txslot | Target (dBm) | 28 | 28 | 28 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 2 Txslot | Target (dBm) | 26.5 | 26.5 | 26.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 3 Txslot | Target (dBm) | 24.5 | 24.5 | 24.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 4 Txslot | Target (dBm) | 23.5 | 23.5 | 23.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| **GSM 1900 EGPRS** | | | | |
| Channel | | 810 | 661 | 512 |
| 1 Txslot | Target (dBm) | 28 | 28 | 28 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 2 Txslot | Target (dBm) | 26.5 | 26.5 | 26.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 3 Txslot | Target (dBm) | 24.5 | 24.5 | 24.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |
| 4 Txslot | Target (dBm) | 23.5 | 23.5 | 23.5 |
| | Tolerance ±(dB) | 1 | 1 | 1 |

**WCDMA**

| WCDMA 850 | | | |
|---|---|---|---|
| Channel | Channel 4132 | Channel 4182 | Channel 4233 |
| Target (dBm) | 22.5 | 22.5 | 22.5 |
| Tolerance ±(dB) | 1 | 1 | 1 |
| **WCDMA 1900** | | | |
| Channel | Channel 810 | Channel 661 | Channel 512 |
| Target (dBm) | 22.5 | 22.5 | 22.5 |
| Tolerance ±(dB) | 1 | 1 | 1 |

**WiFi**

| 802.11b | | | |
|---|---|---|---|
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 14.50 | 14.50 | 14.50 |
| Tolerance ±(dB) | 1 | 1 | 1 |
| **802.11g** | | | |
| Channel | Channel 810 | Channel 661 | Channel 512 |
| Target (dBm) | 12.50 | 12.50 | 12.50 |
| Tolerance ±(dB) | 1 | 1 | 1 |
| **802.11n(20MHz)** | | | |
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 10.50 | 10.50 | 10.50 |
| Tolerance ±(dB) | 1 | 1 | 1 |
| **802.11n(40MHz)** | | | |
| Channel | Channel 3 | Channel 6 | Channel 9 |
| Target (dBm) | 8.50 | 8.50 | 8.50 |
| Tolerance ±(dB) | 1 | 1 | 1 |

**Bluetooth**

| GFSK-LE | | | |
|---|---|---|---|
| Channel | Channel 00 | Channel 20 | Channel 39 |
| Target (dBm) | 5.5 | 5.5 | 5.5 |
| Tolerance ±(dB) | 0.2 | 0.2 | 0.2 |
| **GFSK** | | | |
| Channel | Channel 00 | Channel 41 | Channel 79 |
| Target (dBm) | 5.5 | 5.5 | 5.5 |
| Tolerance ±(dB) | 0.2 | 0.2 | 0.2 |
| **8DPSK** | | | |
| Channel | Channel 00 | Channel 41 | Channel 79 |
| Target (dBm) | 5.0 | 5.0 | 5.0 |
| Tolerance ±(dB) | 0.2 | 0.2 | 0.2 |
| **π/4DQPSK** | | | |
| Channel | Channel 00 | Channel 41 | Channel 79 |
| Target (dBm) | 5.0 | 5.0 | 5.0 |
| Tolerance ±(dB) | 0.2 | 0.2 | 0.2 |

## 5.2. Simultaneous TX SAR Considerations

### 5.2.1 Introduction

Simultaneous multi-band transmision means that the device can transmit multiple transmission modes at the same time. The time-averaged output power of a secondary transmitter may be much lower than that of the primary transmitter.In some cases,the secondary transmitter can be exclused from SAR testing when used alone.However ,when the primary and secondary transmitters are used together,the SAR limits may still be exceed.A means of determing the threshold power for the secondary transmitter allows it to be exclused from SAR testing is needed.
For the DUT,the WiFi and BT modules sharing a single antenna,and so these two modules can’t transmit signal simultaneously.WCDMA and GSM modules sharing a single antenna,so these two modules can’t transmit signal simultaneous.
So we can get following combination that can transmit signal simultaneously.
GSM and BT
GSM and WiFi
WCDMA and BT

WCDMA and WiFi

**5.2.2 Standalone SAR Test Exclusion Considerations**

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied. The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by: [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] • [ √f(GHz)] ≤ 3.0 for 1-g SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

According to the KDB447498 appendix A, the SAR test exclusion threshold for 2450MHz at 10m test separation distances is 19mW.

**Appendix A**

**SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm**

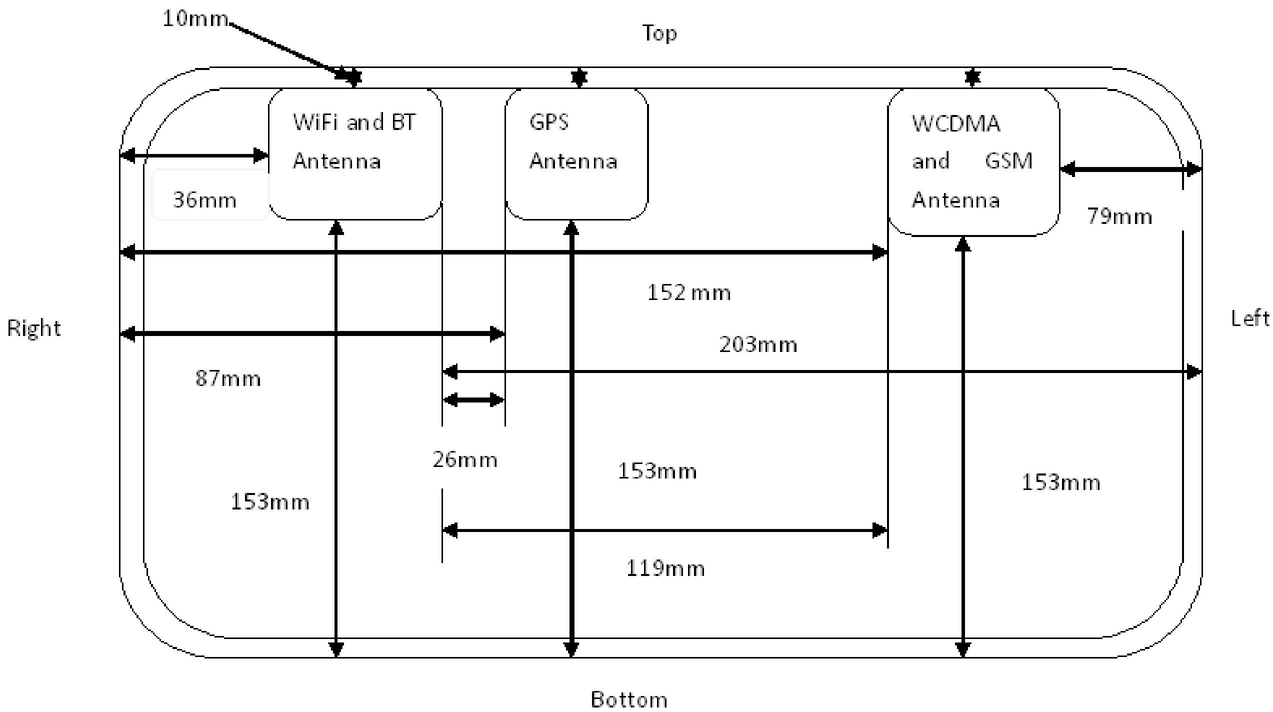
Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

| MHz | 5 | 10 | 15 | 20 | 25 | mm |
|---|---|---|---|---|---|---|
| 150 | 39 | 77 | 116 | 155 | 194 | SAR Test Exclusion Threshold (mW) |
| 300 | 27 | 55 | 82 | 110 | 137 | |
| 450 | 22 | 45 | 67 | 89 | 112 | |
| 835 | 16 | 33 | 49 | 66 | 82 | |
| 900 | 16 | 32 | 47 | 63 | 79 | |
| 1500 | 12 | 24 | 37 | 49 | 61 | |
| 1900 | 11 | 22 | 33 | 44 | 54 | |
| 2450 | 10 | 19 | 29 | 38 | 48 | |
| 3600 | 8 | 16 | 24 | 32 | 40 | |
| 5200 | 7 | 13 | 20 | 26 | 33 | |
| 5400 | 6 | 13 | 19 | 26 | 32 | |
| 5800 | 6 | 12 | 19 | 25 | 31 | |

**5.2.3 Transmitting antenna information**

The following pictures showed the diagonal dimension (29.0cm>20cm) of the EUT and position of the antenna:

Diagonal dimension of the display



Position of the antennas

***WCDMA850/WCDMA1900/GSM850/GSM1900(GPRS) Test Configuration***

SAR test for GSM 850/1900 and WCDMA850/1900, a communication link is set up with a system simulator by air link. Using CMU200 the power level is set to “5” in SAR of GSM850，set to “0” in SAR of GSM 1900,and WCDMA850/1900 for class 3, The tests in the band of GSM850/1900 are performed in the mode of voice and data transfer function,and WCDMA850/1900 for RMC mode.

The EUT should be tested under the following positions according to KDB 941225 and KDB447498:
(1) Back side: the back side of the EUT towards and contacted to the phantom.
(2) Bottom side: SAR test was not required. Beacuse the distance between GSM antenna and Bottom side was 153mm,maximum avager output power (including tune-up tolerance) 24.99dBm<30.40dBm(1096mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(3) Left side: SAR test was not required. Beacuse the distance between GSM antenna and Left side was 79mm,maximum average output power (including tune-up tolerance) 24.99dBm<25.91dBm(390mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(4) Top side:SAR test was required. Beacuse the distance between GSM antenna and Top side was 10mm,maximum average output power (including tune-up tolerance) 24.99 dBm>10dBm(10mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(5) Right Side: SAR test was not required. Beacuse the distance between GSM antenna and Right side was 152mm,maximum average output power (including tune-up tolerance)24.99dBm<30.40dBm(1096mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(6). Front Side: SAR test was not required.
(7). The 2/3/5/6 positions are not the most conservative antenna - to – user distance at edge mode. According to KDB 447498 4) ii) (2) –SAR is required only the edge with the most conservative exposure conditions, No SAR)

***WLAN Test Configuration***

The EUT should be tested under the following positions according to KDB 616217 and KDB447498:
(8).Back side: the back side of the EUT towards and contacted to the phantom.
(9).Bottom side: SAR test was not required. Beacuse the distance between WLAN antenna and Bottom side was 153mm,maximum average output power (including tune-up tolerance)16dBm<30.40dBm(1096mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(10).Left side: SAR test was not required. Beacuse the distance between WLAN antenna and Left side was 115mm,maximum output power (including tune-up tolerance) 16dBm<30.40dBm(1096mW),according KDB447498 Appendix B SAR test exclusion power thresholds.

(11).Top side:SAR test was required. Beacuse the distance between WLAN antenna and Top side was 10mm,maximum output power (including tune-up tolerance) 16dBm>10dBm(10mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(12).Right Side: SAR test was not required. Beacuse the distance between WLAN antenna and Right side was 36mm,maximum output power (including tune-up tolerance)16dBm<18.26dBm(67mW),according KDB447498 Appendix B SAR test exclusion power thresholds.
(13).Front Side: SAR test was not required.
(14).The 9/10/12 positions are not the most conservative antenna - to – user distance at edge mode. According to KDB 447498 4) ii) (2) –SAR is required only the edge with the most conservative exposure conditions, No SAR)
(15).According to KDB248227 SAR is not required for 802.11g channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

***Bluetooth Test Configuration***
SAR test was not required beacuse the maximum output power (including tune-up tolerance) 5.7dBm<10dBm(10mw), according KDB447498 Appendix B SAR test exclusion power thresholds.

## 5.3. SAR Measurement Results

**Duty Cycle**

| Test Mode | Duty Cycle |
|---|---|
| Speech for GSM850/1900 | 1:8.3 |
| GPRS for GSM850/1900 | 1:2 |
| WCDMA 850/1900 | 1:1 |
| WiFi 2450 | 1:1 |

***SAR Values (GSM 900 MHz Band-Body)***

| Test Frequency | | Mode/Band | Test Configuration | Average SAR over1g(W/kg) (Including power drift) | Scaling Factor | Average SAR over1g(W/kg) (Including Power Drift and Scaling factor) | SAR limit 1g (W/kg) | Ref. Plot # |
|---|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | | |
| 190 | 824.20 | GPRS 4TS | Back | 1.182 | 1.04 | 1.229 | 1.60 | 1 |
| 128 | 836.60 | GPRS 4TS | Back | 1.201 | 1.03 | 1.237 | 1.60 | 2 |
| 251 | 848.80 | GPRS 4TS | Back | 1.070 | 1.08 | 1.156 | 1.60 | 3 |
| 190 | 824.20 | GPRS 4TS | Top | 0.957 | 1.04 | 0.995 | 1.60 | 4 |
| 128 | 836.60 | GPRS 4TS | Top | 0.946 | 1.03 | 0.974 | 1.60 | 5 |
| 251 | 848.80 | GPRS 4TS | Top | 0.940 | 1.08 | 1.015 | 1.60 | 6 |
| 190 | 836.60 | EGPRS 4TS | Back | **1.217** | 1.05 | **1.278** | 1.60 | 7 |

**SAR Values (GSM 1900 MHz Band-Body)**

| Test Frequency | | Mode/Band | Test Configuration | Average SAR over1g(W/kg) (Including power drift) | Scaling Factor | Average SAR over1g(W/kg) (Including Power Drift and Scaling factor) | SAR limit 1g (W/kg) | Ref. Plot # |
|---|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | | |
| 512 | 1850.20 | GPRS 4TS | Back | 1.081 | 1.04 | 1.124 | 1.60 | 8 |
| 661 | 1880.00 | GPRS 4TS | Back | 1.100 | 1.03 | 1.133 | 1.60 | 9 |
| 810 | 1909.80 | GPRS 4TS | Back | 0.994 | 1.07 | 1.064 | 1.60 | 10 |
| 512 | 1850.20 | GPRS 4TS | Top | 0.865 | 1.04 | 0.900 | 1.60 | 11 |
| 661 | 1880.00 | GPRS 4TS | Top | 0.877 | 1.03 | 0.903 | 1.60 | 12 |
| 810 | 1909.80 | GPRS 4TS | Top | 0.851 | 1.07 | 0.911 | 1.60 | 13 |
| 512 | 1850.20 | EGPRS 4TS | Back | **1.130** | 1.03 | **1.164** | 1.60 | 14 |

*SAR Values (WCDMA 850 MHz Band-Body)*

| Test Frequency | | Mode/Band | Test Configuration | Average SAR over1g(W/kg) (Including power drift) | Scaling Factor | Average SAR over1g(W/kg) (Including Power Drift and Scaling factor) | SAR limit 1g (W/kg) | Ref. Plot # |
|---|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | | |
| 4132 | 826.40 | RMC | Back | **0.924** | 1.17 | **1.081** | 1.60 | 15 |
| 4183 | 836.60 | RMC | Back | 0.937 | 1.07 | 1.002 | 1.60 | 16 |
| 4233 | 846.60 | RMC | Back | 0.920 | 1.07 | 0.984 | 1.60 | 17 |
| 4132 | 826.40 | RMC | Top | 0.712 | 1.17 | 0.833 | 1.60 | 18 |
| 4183 | 836.60 | RMC | Top | 0.729 | 1.07 | 0.780 | 1.60 | 19 |
| 4233 | 846.60 | RMC | Top | 0.704 | 1.07 | 0.753 | 1.60 | 20 |

*SAR Values (WCDMA 1900 MHz Band-Body)*

| Test Frequency | | Mode/Band | Test Configuration | Average SAR over1g(W/kg) (Including power drift) | Scaling Factor | Average SAR over1g(W/kg) (Including Power Drift and Scaling factor) | SAR limit 1g (W/kg) | Ref. Plot # |
|---|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | | |
| 9262 | 1952.4 | RMC | Back | **0.874** | 1.23 | **1.075** | 1.60 | 21 |
| 9400 | 1880.0 | RMC | Back | 0.892 | 1.15 | 1.025 | 1.60 | 22 |
| 9538 | 1908.0 | RMC | Back | 0.868 | 1.17 | 1.016 | 1.60 | 23 |
| 9262 | 1952.4 | RMC | Top | 0.667 | 1.23 | 0.820 | 1.60 | 24 |
| 9400 | 1880.0 | RMC | Top | 0.679 | 1.15 | 0.781 | 1.60 | 25 |
| 9538 | 1908.0 | RMC | Top | 0.671 | 1.17 | 0.785 | 1.60 | 26 |

**SAR Values (WLAN2450 Band-Body)**

| Test Frequency | | Mode/Band | Test Configuration | Average SAR over1g(W/kg) (Including power drift) | Scaling Factor | Average SAR over1g(W/kg) (Including Power Drift and Scaling factor) | SAR limit 1g (W/kg) | Ref. Plot # |
|---|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | | |
| 1 | 2412 | Body- worn | Back | 0.216 | 1.30 | 0.281 | 1.60 | 27 |
| 6 | 2437 | Body- worn | Back | **0.252** | 1.21 | **0.305** | 1.60 | 28 |
| 11 | 2462 | Body- worn | Back | 0.219 | 1.35 | 0.296 | 1.60 | 29 |
| 1 | 2412 | Body- worn | Top | 0.204 | 1.30 | 0.265 | 1.60 | 30 |
| 6 | 2437 | Body- worn | Top | 0.213 | 1.21 | 0.258 | 1.60 | 31 |
| 11 | 2462 | Body- worn | Top | 0.198 | 1.35 | 0.267 | 1.60 | 32 |

**Evaluation for Simultaneous SAR**

| Test Mode | WLAN | | Main Mode SAR(1g) (W/kg) (Including Power Drift and Scaling factor) | Wi-Fi SAR(1g) (W/kg) (Including Power Drift and Scaling factor) | Summation SAR(1g) (W/kg) (Including Power Drift and Scaling factor) | SAR –to-peak-location Separation Ratio | Simultaneous Measurement Required? |
|---|---|---|---|---|---|---|---|
| GSM850 | 802.11b | Body | 1.278 | 0.305 | 1.583＜1.6 | / | No |
| GSM1900 | 802.11b | Body | 1.164 | 0.305 | 1.469＜1.6 | / | No |
| WCDMA850 | 802.11b | Body | 1.081 | 0.305 | 1.386＜1.6 | / | No |
| WCDMA2100 | 802.11b | Body | 1.075 | 0.305 | 1.380＜1.6 | / | No |

## 5.4. SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. The following procedures are applied to determine if repeated measurements are required.

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

**SAR Measurement Variability for Body GSM 850 (1g)**

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 190 | 824.20 | GPRS 4TS | Back | 1.182 | 1.168 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 190 | 836.60 | GPRS 4TS | Back | 1.201 | 1.190 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 251 | 848.80 | GPRS 4TS | Back | 1.070 | 1.055 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 190 | 824.20 | GPRS 4TS | Top | 0.957 | 0.946 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 190 | 836.60 | GPRS 4TS | Top | 0.946 | 0.933 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 251 | 848.80 | GPRS 4TS | Top | 0.940 | 0.930 | 0.98 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 190 | 836.60 | EGPRS 4TS | Back | 1.217 | 1.198 | 0.98 | / |

**SAR Measurement Variability for Body GSM 1900 (1g)**

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 512 | 1850.20 | GPRS 4TS | Back | 1.081 | 1.073 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 661 | 1880.00 | GPRS 4TS | Back | 1.100 | 1.058 | 0.96 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 810 | 1909.80 | GPRS 4TS | Back | 0.994 | 0.980 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 512 | 1850.20 | GPRS 4TS | Top | 0.865 | 0.860 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 661 | 1880.00 | GPRS 4TS | Top | 0.877 | 0.858 | 0.98 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 810 | 1909.80 | GPRS 4TS | Top | 0.851 | 0.844 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 512 | 1850.20 | EGPRS 4TS | Back | 1.130 | 1.110 | 0.98 | / |

**SAR Measurement Variability for Body WCDMA 850 (1g)**

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 4132 | 826.40 | RMC | Back | 0.924 | 0.920 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 4183 | 836.60 | RMC | Back | 0.937 | 0.933 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 4233 | 846.60 | RMC | Back | 0.920 | 0.908 | 0.99 | / |

**SAR Measurement Variability for Body WCDMA 1900 (1g)**

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 9262 | 1952.4 | RMC | Back | 0.874 | 0.869 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 9400 | 1880.0 | RMC | Back | 0.892 | 0.880 | 0.99 | / |

| Test Frequency | | Mode/Band | Test Configuration | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| Channel | MHz | | | | | | |
| 9538 | 1908.0 | RMC | Back | 0.868 | 0.856 | 0.99 | / |

## 5.5. Measurement Uncertainty

| Uncertainty Component | Tol. (%) | Prob Dist. | Div | ci (10g) | ci.ui(%) (10g) | vi |
|---|---|---|---|---|---|---|
| Measurement System | | | | | | |
| Probe Calibration | 5.9 | N | 1 | 1 | 5.9 | ∞ |
| Axial Isotropy | 4.7 | R | $\sqrt{3}$ | 0.7 | 1.9 | ∞ |
| Hemispherical Isotropy | 9.6 | R | $\sqrt{3}$ | 0.7 | 3.9 | ∞ |
| Boundary Effect | 1.0 | R | $\sqrt{3}$ | 1 | 0.6 | ∞ |
| Linearity | 4.7 | R | $\sqrt{3}$ | 1 | 2.7 | ∞ |
| System Detection Limits | 1.0 | R | $\sqrt{3}$ | 1 | 0.6 | ∞ |
| Readout Electronics | 0.3 | N | 1 | 1 | 0.3 | ∞ |
| Response Time | 0.8 | R | $\sqrt{3}$ | 1 | 0.5 | ∞ |
| Integration Time | 2.6 | R | $\sqrt{3}$ | 1 | 1.5 | ∞ |
| RF Ambient Conditions - Noise | 3.0 | R | $\sqrt{3}$ | 1 | 1.7 | ∞ |
| RF Ambient Conditions - Reflections | 3.0 | R | $\sqrt{3}$ | 1 | 1.7 | ∞ |
| Probe Positioner Mechanical Tolerance | 0.4 | R | $\sqrt{3}$ | 1 | 0.2 | ∞ |
| Probe Positioning with respect to Phantom Shell | 2.9 | R | $\sqrt{3}$ | 1 | 1.7 | ∞ |
| Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation | 1.0 | R | $\sqrt{3}$ | 1 | 0.6 | ∞ |
| **Test Sample Related** | | | | | | |
| Test Sample Positioning | 2.9 | N | 1 | 1 | 2.9 | 145 |
| Device Holder Uncertainty | 3.6 | N | 1 | 1 | 3.6 | 5 |
| Output Power Variation - SAR drift measurement | 5.0 | R | $\sqrt{3}$ | 1 | 2.9 | ∞ |
| **Phantom and Tissue Parameters** | | | | | | |
| Phantom Uncertainty (shape and thickness tolerances) | 4.0 | R | $\sqrt{3}$ | 1 | 2.3 | ∞ |
| Conductivity Target - tolerance | 5.0 | R | $\sqrt{3}$ | 0.43 | 1.2 | ∞ |
| Conductivity - measurement uncertainty | 2.5 | N | 1 | 0.43 | 1.1 | ∞ |
| Permittivity Target - tolerance | 5.0 | R | $\sqrt{3}$ | 0.49 | 1.4 | ∞ |
| Permittivity - measurement uncertainty | 2.5 | N | 1 | 0.49 | 1.2 | 5 |
| **Combined Standard Uncertainty** | | **R** | **2** | | **10.7** | **387** |
| **Expanded STD Uncertainty** | | | | | **21.4** | |

## 5.6. System Check Results

**System Performance Check at 835 MHz**

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d134

Date/Time: 08/15/2013 AM

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

Medium parameters used (interpolated): f = 835 MHz; σ = 0.98 S/m; $\varepsilon_r$ = 55.80; ρ = 1000 kg/$m^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x91x1):** Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 3.48 W/kg

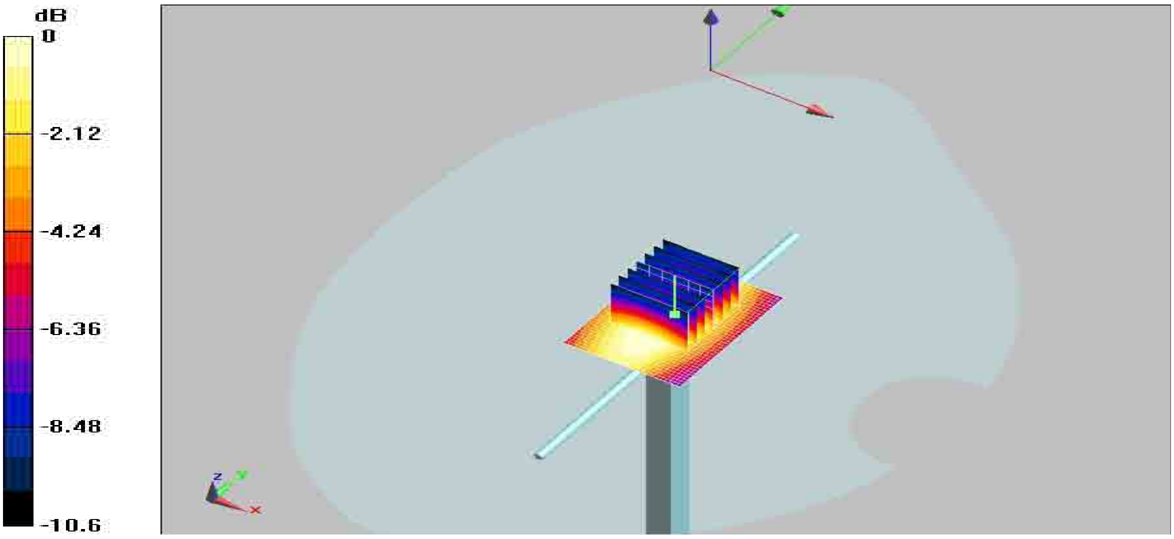
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 62.1 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 4.06 mW/g

**SAR(1 g) = 2.60 mW/g; SAR(10 g) = 1.73 mW/g**

Maximum value of SAR (measured) = 3.16 W/kg




0 dB = 3.16mW/g=9.99dB mW/g

System Performance Check 835MHz 250mW

**System Performance Check at 1900 MHz**

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d150

Date/Time: 08/16/2013 AM

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

Medium parameters used (interpolated): f = 1900 MHz; σ = 1.42 S/m; εr = 53.10; ρ = 1000 kg/$m^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x91x1):** Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 2.01 W/kg

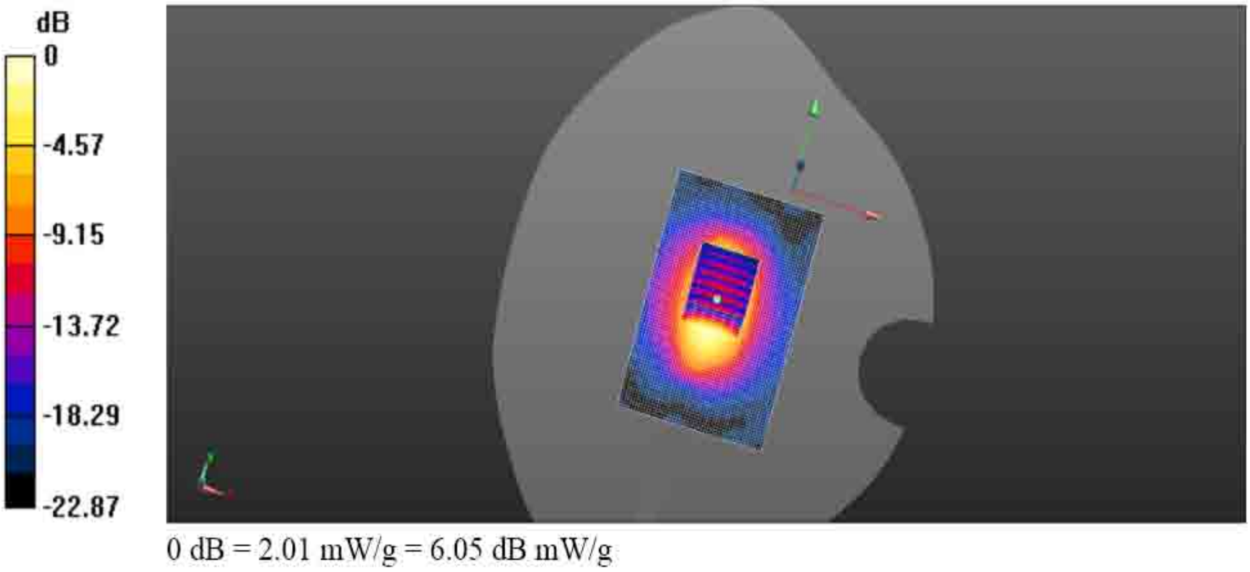
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 35.069 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 2.872 mW/g

**SAR(1 g) = 9.68 mW/g; SAR(10 g) = 5.75 mW/g**

Maximum value of SAR (measured) = 1.87 W/kg




System Performance Check 1900MHz 250mW

**System Performance Check at 2450 MHz**

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 884

Date/Time: 08/17/2013 AM

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

Medium parameters used (interpolated): f = 2450 MHz; σ = 1.99 S/m; $\varepsilon_r$ = 51.4; ρ = 1000 kg/m$^3$

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3292; ConvF(4.47, 4.47, 4.47); Calibrated: 24/02/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)

**Area Scan (61x91x1):** Measurement grid: dx=15.00 mm, dy=15.00 mm

Maximum value of SAR (interpolated) = 14.08 W/kg

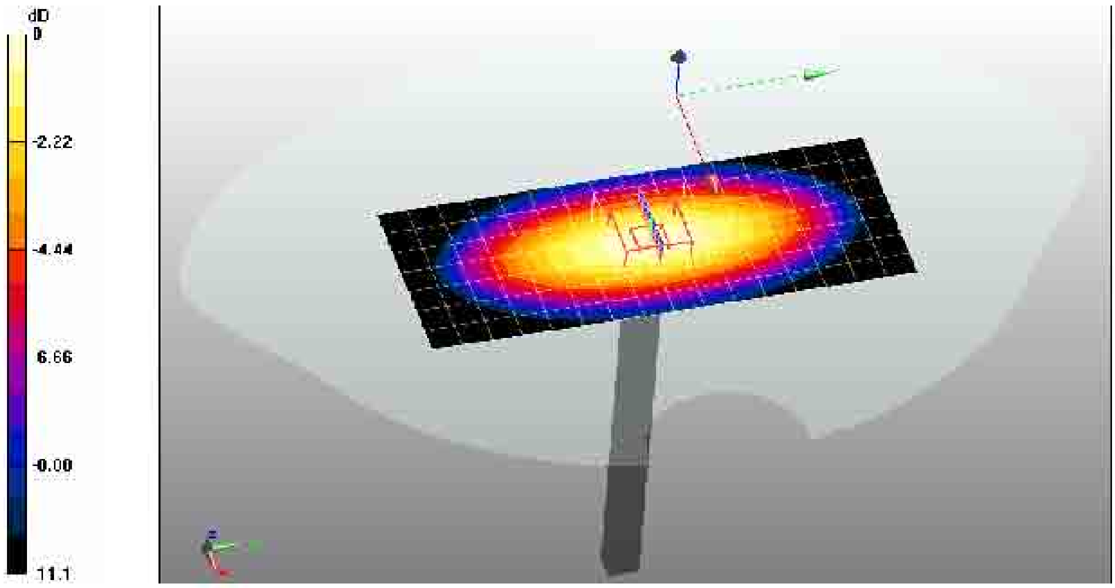
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.60 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 15.73 mW/g

**SAR(1 g) = 12.97 mW/g; SAR(10 g) = 5.91 mW/g**

Maximum value of SAR (measured) = 13.76 W/kg




0 dB = 13.76mW/g=22.77dB mW/g

System Performance Check 2450MHz 250mW

## 5.7. SAR Test Graph Results

**GSM850 GPRS 4TS Body Toward Back Side Low Channel**

Communication System: Customer System; Frequency: 826.4 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 826.4 MHz; σ = 0.97 S/m; $\varepsilon_r$ = 54.90; ρ = 1000 kg/m$^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.894 W/kg

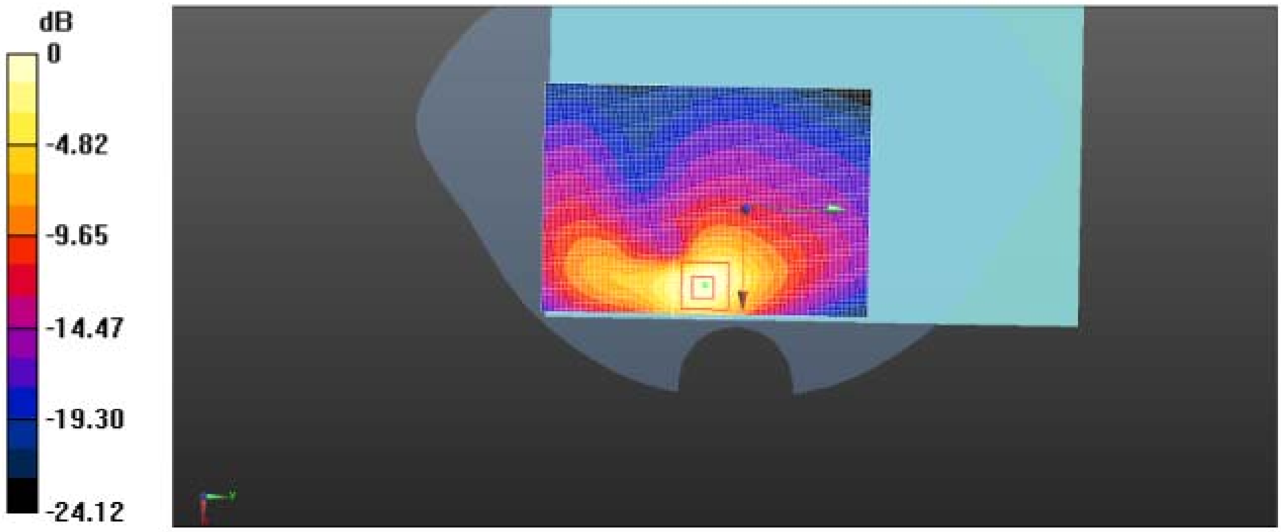
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.358 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.34 W/Kg

**SAR(1 g) = 1.182 W/Kg; SAR(10 g) = 0.861 W/Kg**

Maximum value of SAR (measured) = 0.996 W/kg




0dB = 0.996 W/kg = 1.32 dBW/kg

Plot 1: Body Toward Back (GSM850 GPRS 4TS Low Channel)

**GSM850 GPRS 4TS Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.98 S/m; $\varepsilon_r$ = 55.80; ρ = 1000 kg/m$^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.931 W/kg

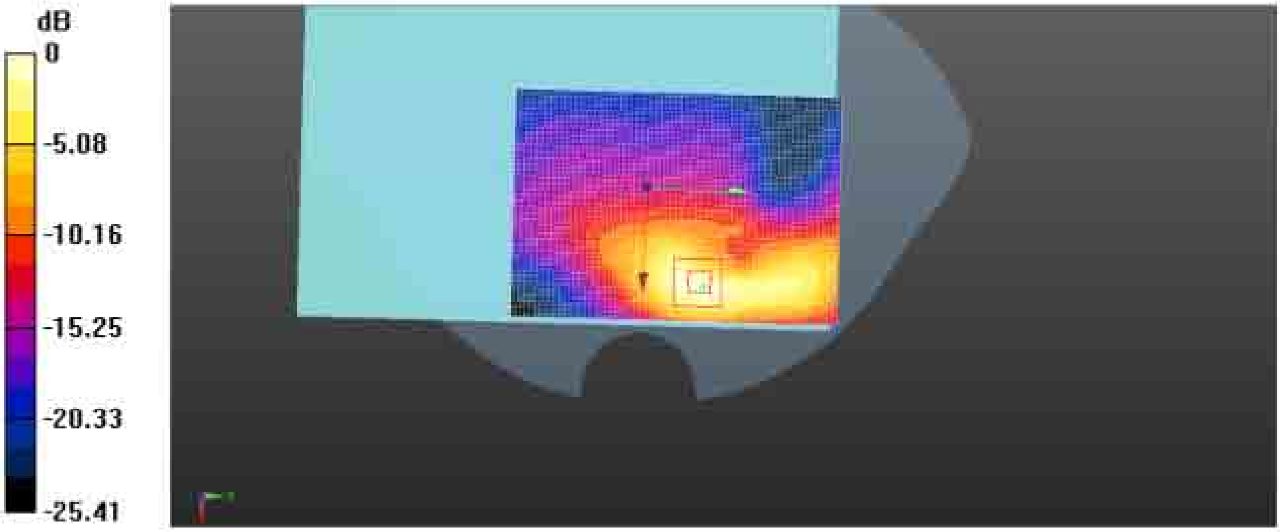
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.106 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 1.26 W/Kg

**SAR(1 g) = 1.201 W/Kg; SAR(10 g) = 0.876 W/Kg**

Maximum value of SAR (measured) = 1.06 W/kg




0dB = 1.06 W/kg = 1.58 dBW/kg

Plot 2: Body Toward Back (GSM850 GPRS 4TS Middle Channel)

**GSM850 GPRS 4TS Body Toward Back Side High Channel**

Communication System: Customer System; Frequency: 846.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.95 S/m; $\varepsilon_r$ = 55.30; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.854 W/kg

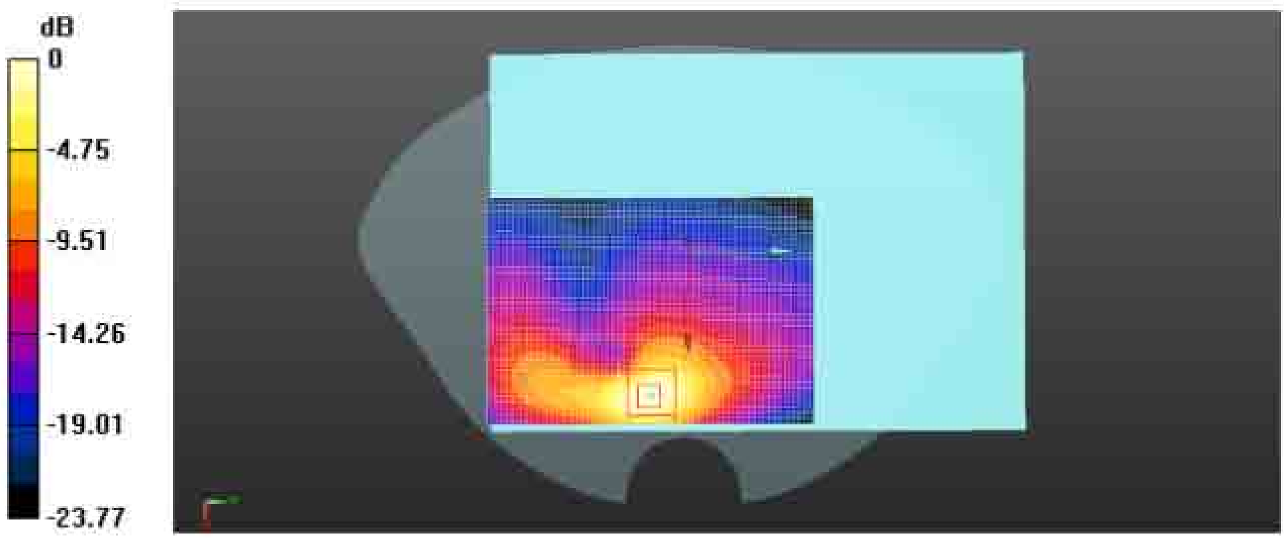
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.654 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 1.18 W/Kg

**SAR(1 g) = 1.070 W/Kg; SAR(10 g) = 0.847 W/Kg**

Maximum value of SAR (measured) = 0.893 W/kg




0dB = 0.893 W/kg = -0.05 dBW/kg

Plot 3: Body Toward Back (GSM850 GPRS 4TS High Channel)

**GSM850 GPRS 4TS Body Toward Top Side Low Channel**

Communication System: Customer System; Frequency: 826.4MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 826.4 MHz; σ = 0.97 S/m; $\varepsilon_r$ = 54.90; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.861 W/kg

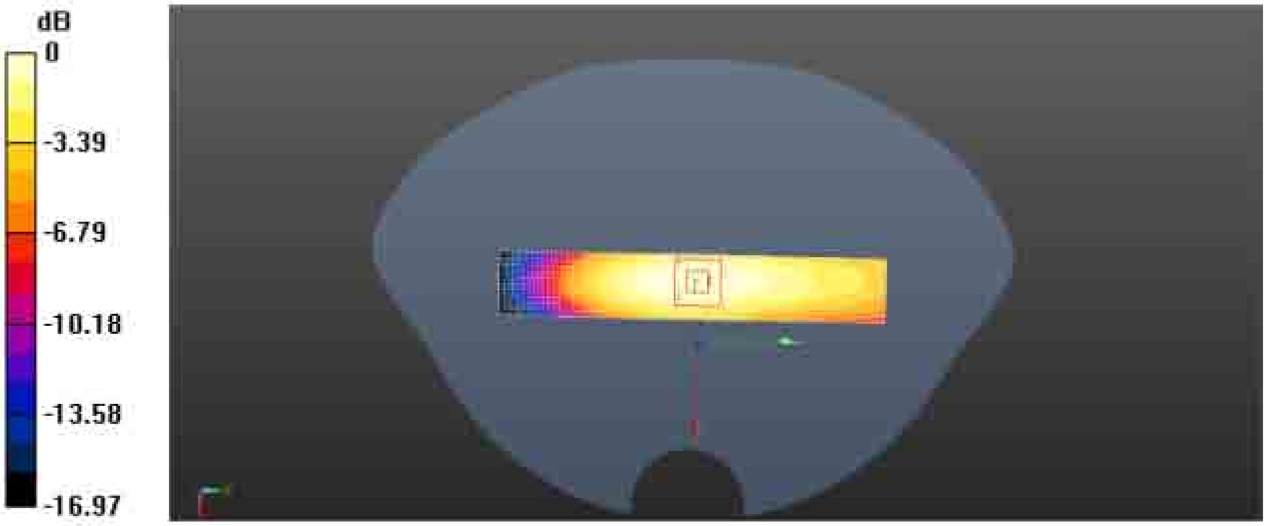
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.964 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.26 W/Kg

**SAR(1 g) = 0.957 W/Kg; SAR(10 g) = 0.683 W/Kg**

Maximum value of SAR (measured) = 0.995 W/kg




0dB = 0.995 W/kg = 0.18 dBW/kg

Plot 4: Body Toward Top (GSM850 GPRS 4TS Low Channel)

**GSM850 GPRS 4TS Body Toward Top Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.98 S/m; $\varepsilon_r$ = 55.80; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.872 W/kg

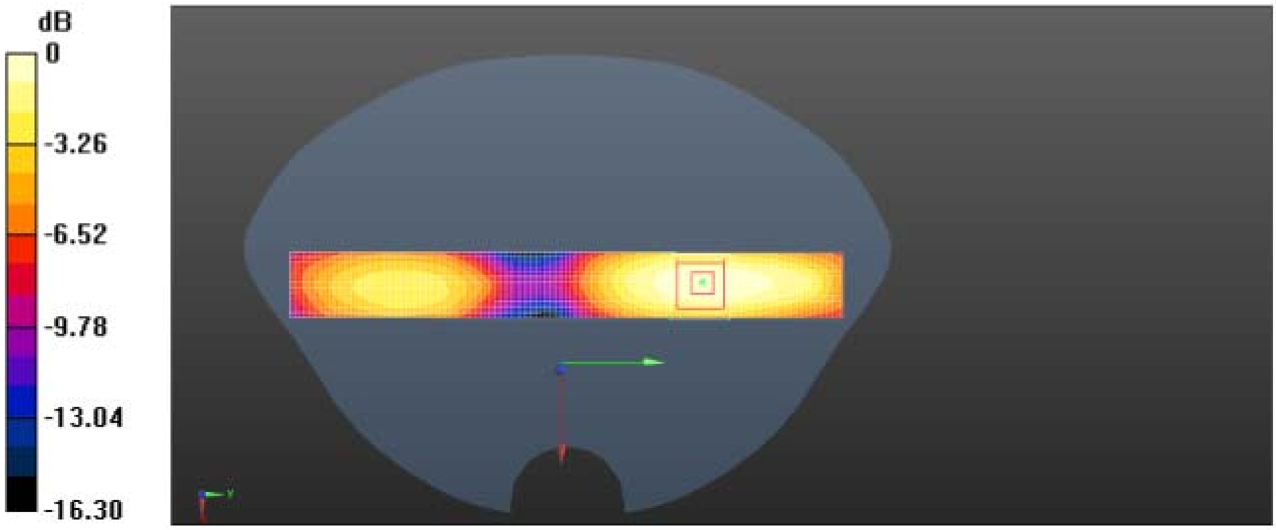
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.348 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 1.28 W/Kg

**SAR(1 g) = 0.964 W/Kg; SAR(10 g) = 0.690 W/Kg**

Maximum value of SAR (measured) = 0.872 W/kg




0dB = 0.872 W/kg = -0.51 dBW/kg

Plot 5: Body Toward Top (GSM850 GPRS 4TS Middle Channel)

**GSM850 GPRS 4TS Body TowardTop Side High Channel**

Communication System: Customer System; Frequency: 848.8 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 848.8 MHz; $\sigma$ = 0.95 S/m; $\varepsilon_r$ = 55.30; $\rho$ = 1000 kg/m$^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.931 W/kg

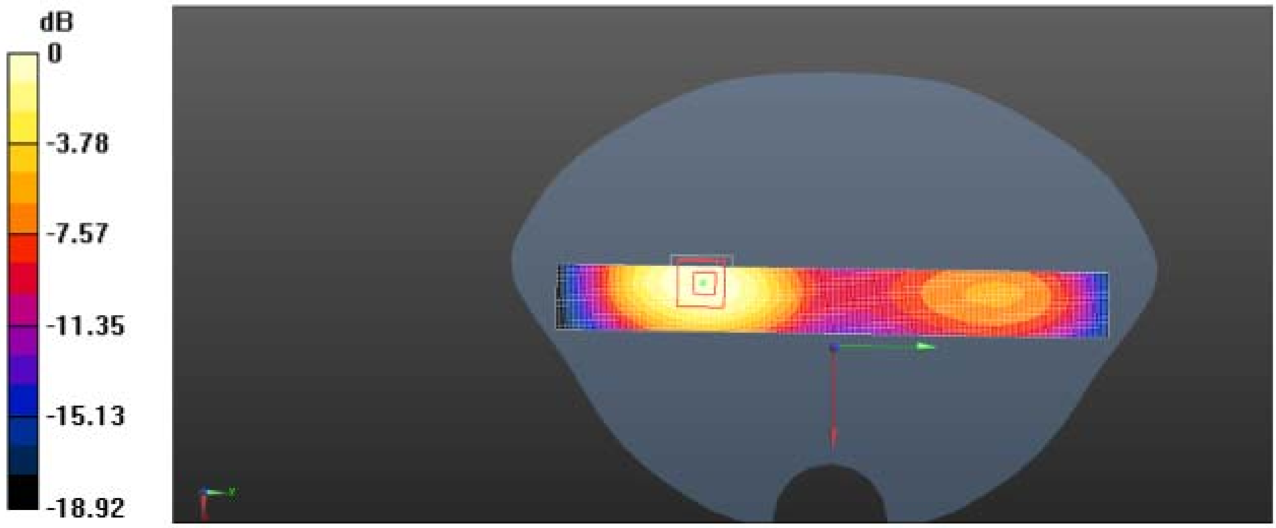
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.532 V/m; Power Drift = -0.20 dB

Peak SAR (extrapolated) = 1.13 W/Kg

**SAR(1 g) = 0.940 W/Kg; SAR(10 g) = 0.671 W/Kg**

Maximum value of SAR (measured) = 0.894 W/kg




0dB = 0.894 W/kg = -0.43 dBW/kg

Plot 6: Body Toward Top (GSM850 GPRS 4TS High Channel)

**GSM850 EGPRS 4TS Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 836.6 MHz; $\sigma$ = 0.98 S/m; $\varepsilon_r$ = 55.80; $\rho$ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.942 W/kg

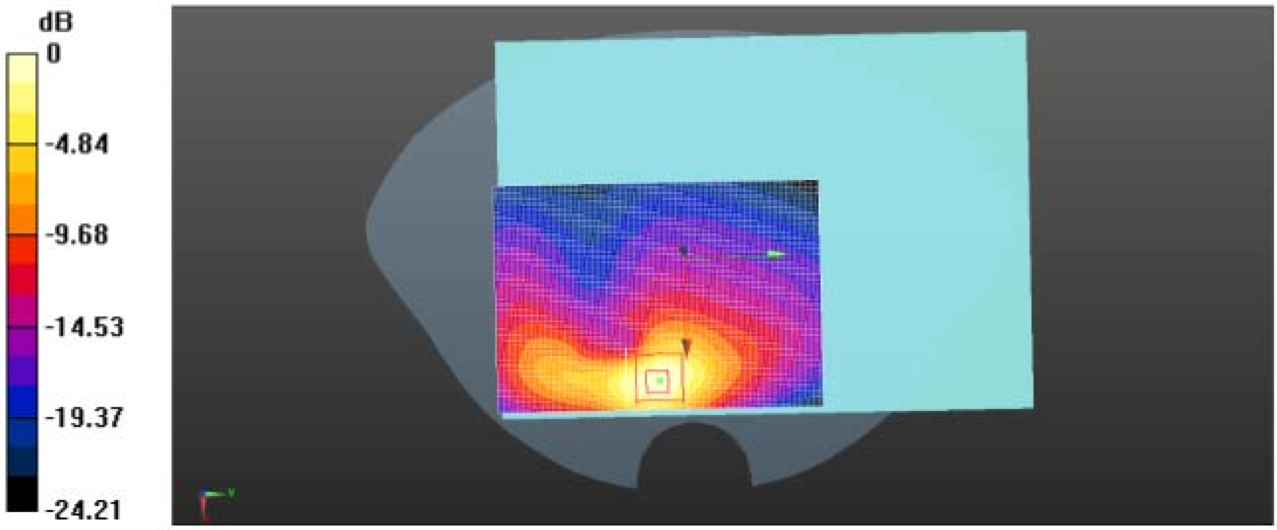
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.535 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.01 W/Kg

**SAR(1 g) = 1.217 W/Kg; SAR(10 g) = 0.853 W/Kg**

Maximum value of SAR (measured) = 1.08 W/kg




0dB = 1.08 W/kg = 1.50 dBW/kg

Plot 7: Body Toward Back (GSM850 EGPRS 4TS Middle Channel)

**GSM1900 GPRS 4TS Body Toward Back Side Low Channel**

Communication System: Customer System; Frequency: 1850.20 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1850.20 MHz; σ =1.43 S/m; $\varepsilon_r$ = 52.90; ρ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.957 W/kg

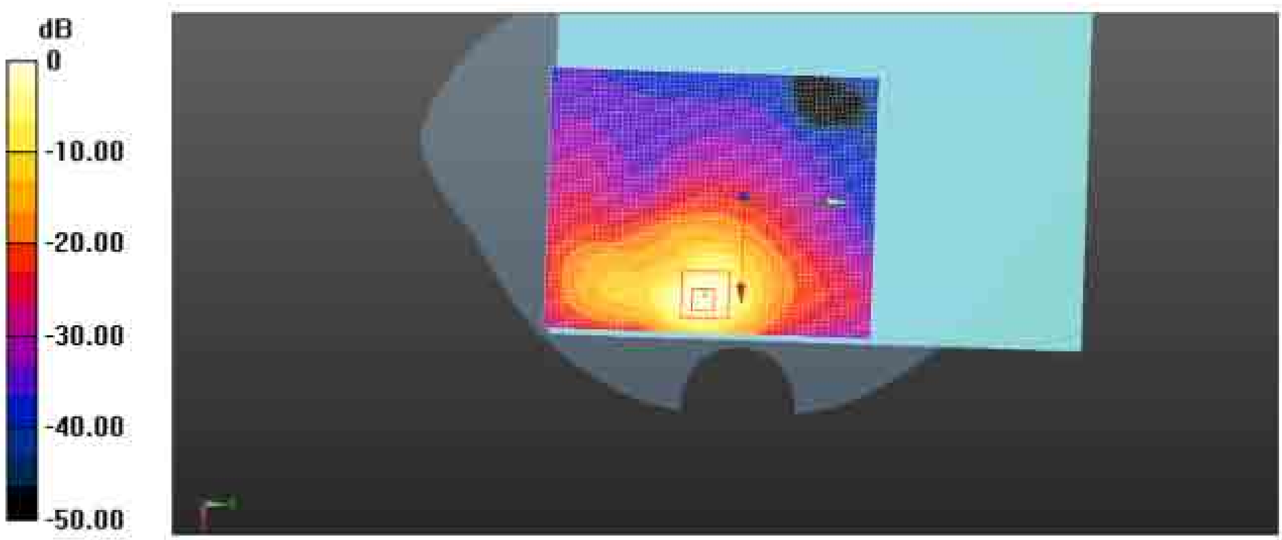
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.127 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.81 W/Kg

**SAR(1 g) = 1.081 W/Kg; SAR(10 g) = 0.735 W/Kg**

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




0dB = 0.954 W/kg = 0.07 dBW/kg

Plot 8: Body Toward Back (GSM1900 GPRS 4TS Low Channel)

**GSM1900 GPRS 4TS Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1880.00 MHz; σ = 1.45 S/m; $\varepsilon_r$ = 53.10; ρ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.943 W/kg

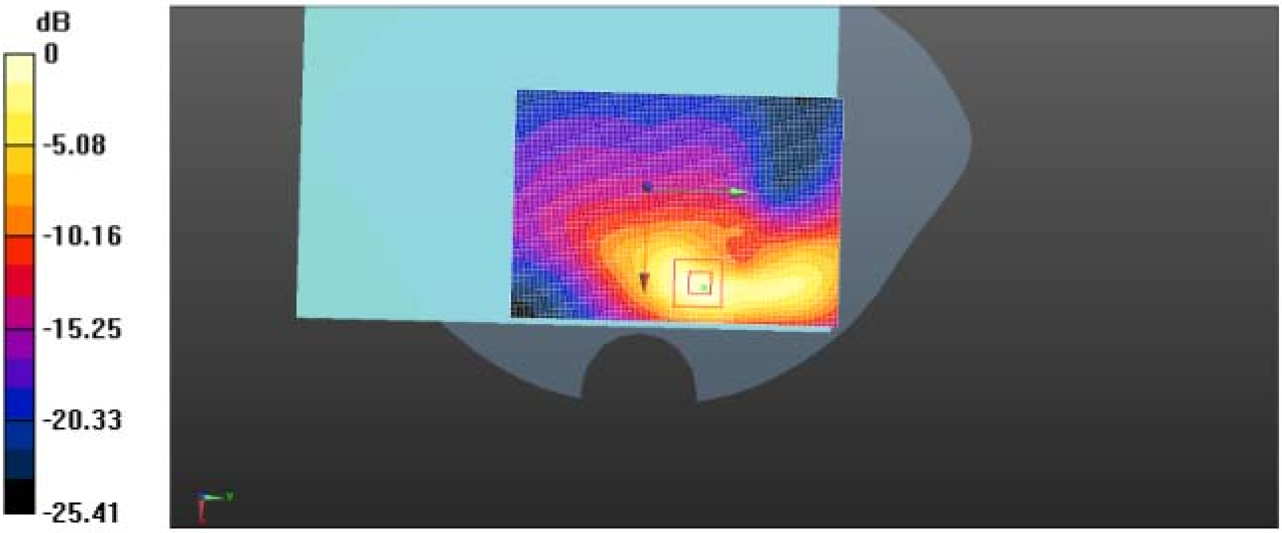
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.247 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.91 W/Kg

**SAR(1 g) = 1.10 W/Kg; SAR(10 g) = 0.743 W/Kg**

Maximum value of SAR (measured) = 0.908 W/kg




0dB = 0.908 W/kg = -0.61 dBW/kg

Plot 9: Body Toward Back (GSM1900 GPRS 4TS Middle Channel)

**GSM1900 GPRS 4TS Body Toward Back Side High Channel**

Communication System: Customer System; Frequency: 1909.80 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1909.80 MHz; σ =1.503 S/m; $\varepsilon_r$ = 52.33; ρ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.914 W/kg

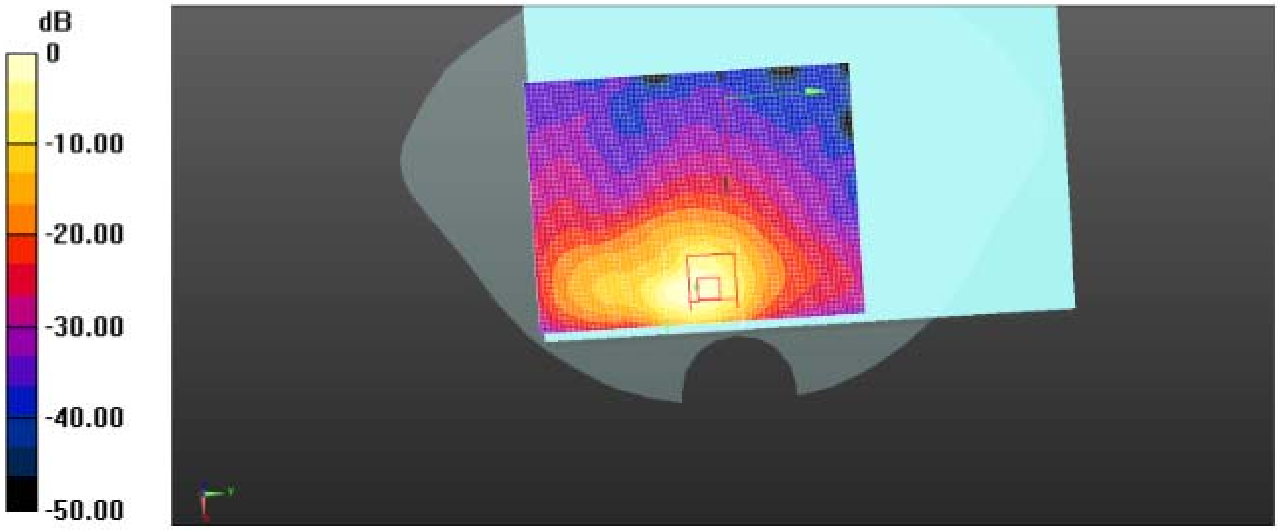
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.547 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.846 W/Kg

**SAR(1 g) = 0.994 W/Kg; SAR(10 g) = 0.726 W/Kg**

Maximum value of SAR (measured) = 0.991 W/kg




0dB = 0.991 W/kg = 2.04 dBW/kg

Plot 10: Body Toward Back (GSM1900 GPRS 4TS High Channel)

**GSM1900 GPRS 4TS Body Toward Top Side Low Channel**

Communication System: Customer System; Frequency: 1850.20 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1850.20 MHz; σ =1.43 S/m; $\varepsilon_r$ = 52.90; ρ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.712 W/kg

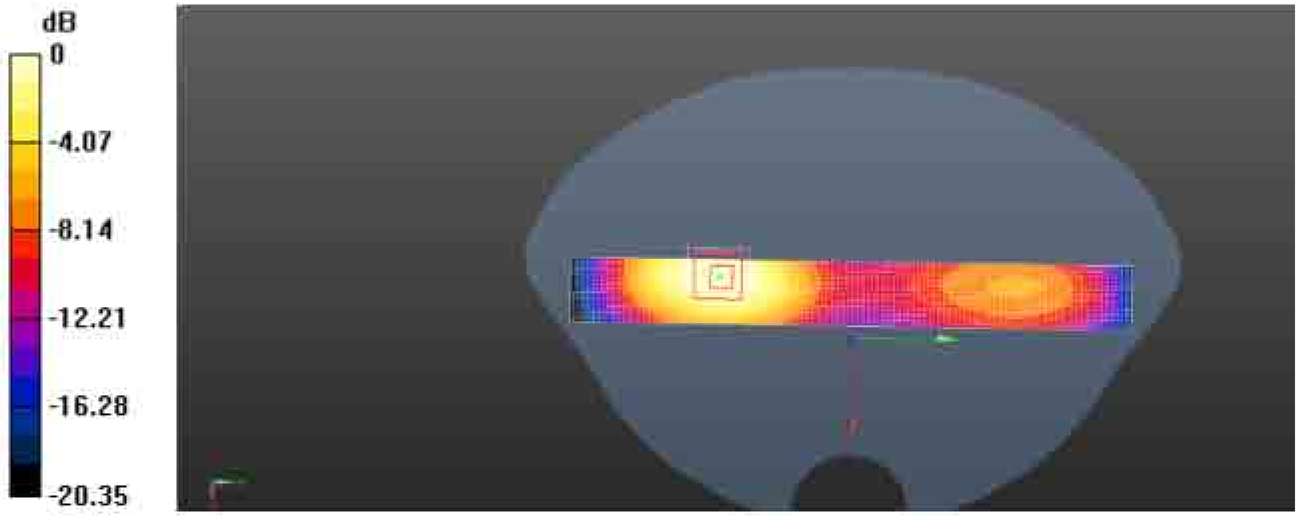
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.215 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 0.923 W/Kg

**SAR(1 g) = 0.865 W/Kg; SAR(10 g) = 0.568 W/Kg**

Maximum value of SAR (measured) = 0.852 W/kg




0dB = 0.852 W/kg = -1.64 dBW/kg

Plot 11: Body Toward Top (GSM1900 GPRS 4TS Low Channel)

**GSM1900 GPRS 4TS Body Toward Top Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1880.00 MHz; $\sigma$ = 1.45 S/m; $\varepsilon_r$ = 53.10; $\rho$ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.765 W/kg

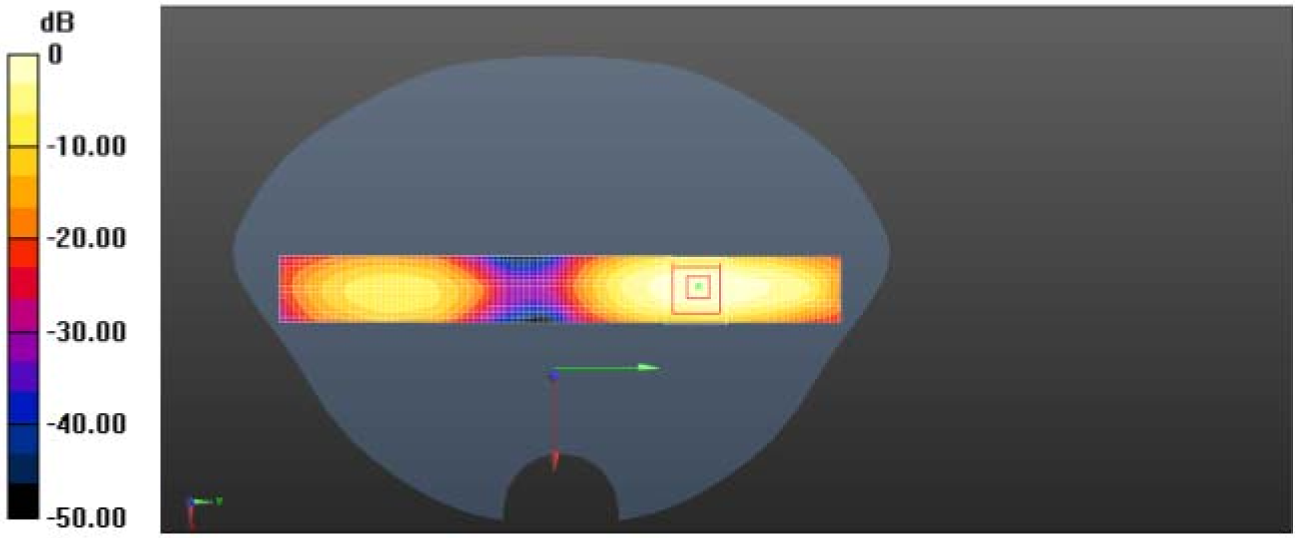
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.546 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.865 W/Kg

**SAR(1 g) = 0.877 W/Kg; SAR(10 g) = 0.572 W/Kg**

Maximum value of SAR (measured) = 0.965 W/kg




0dB = 0.965 W/kg = -0.24 dBW/kg

Plot 12: Body Toward Top (GSM1900 GPRS 4TS Middle Channel)

**GSM1900 GPRS 4TS Body Toward Top Side High Channel**

Communication System: Customer System; Frequency: 1909.80 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1909.80 MHz; σ =1.503 S/m; $\varepsilon_r$ = 52.33; ρ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.725 W/kg

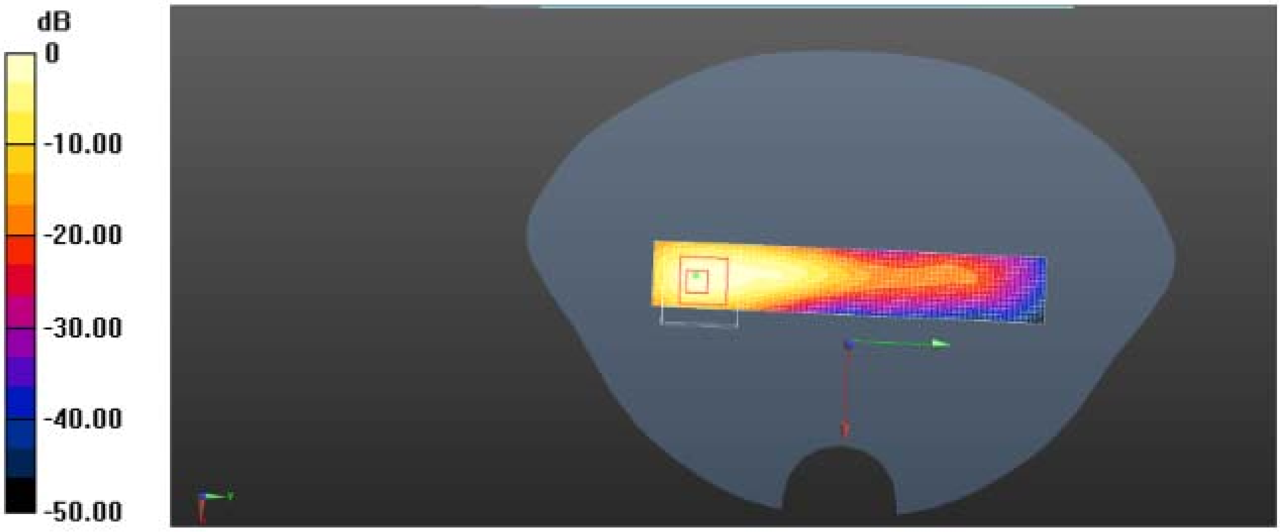
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.416 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.851 W/Kg

**SAR(1 g) = 0.851 W/Kg; SAR(10 g) = 0.555 W/Kg**

Maximum value of SAR (measured) = 0.883 W/kg




0dB = 0.883 W/kg = -0.85 dBW/kg

Plot 13: Body Toward Right (GSM1900 GPRS 4TS High Channel)

**GSM1900 EGPRS 4TS Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1880.00 MHz; σ = 1.45 S/m; $\varepsilon_r$ = 53.10; ρ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.956 W/kg

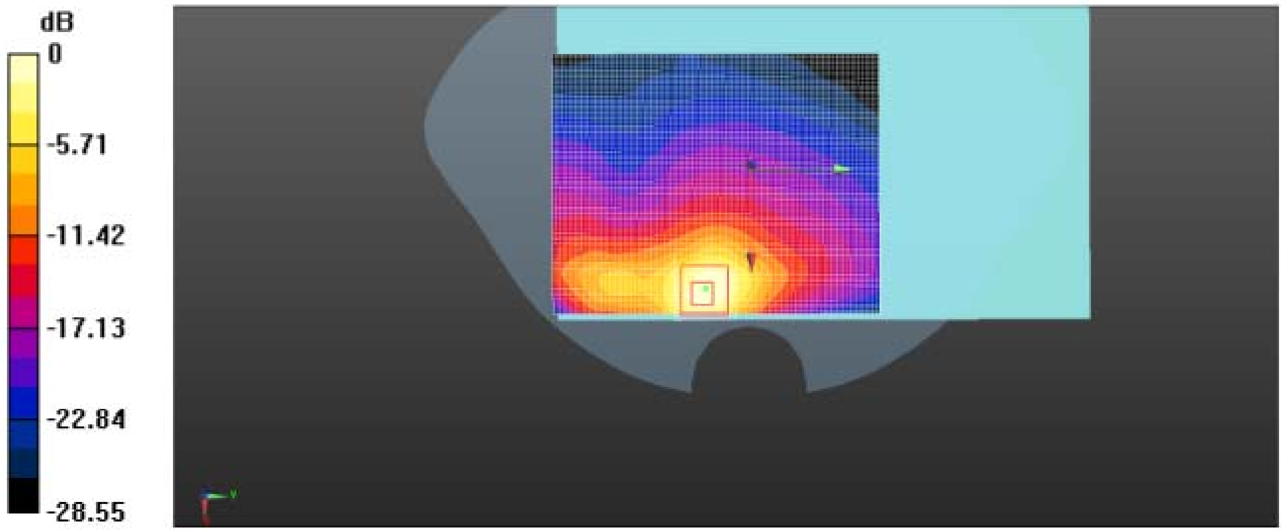
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.152 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.81 W/Kg

**SAR(1 g) = 1.13 W/Kg; SAR(10 g) = 0.750 W/Kg**

Maximum value of SAR (measured) = 0.980 W/kg




0dB = 0.980 W/kg = 0.25 dBW/kg

Plot 14: Body Toward Back (GSM1900 EGPRS 4TS Middle Channel)

**WCDMA850 RMC Body Toward Back Side Low Channel**

Communication System: Customer System; Frequency: 826.4MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 826.4 MHz; σ = 0.96 S/m; $\varepsilon_r$ = 54.95; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.783 W/kg

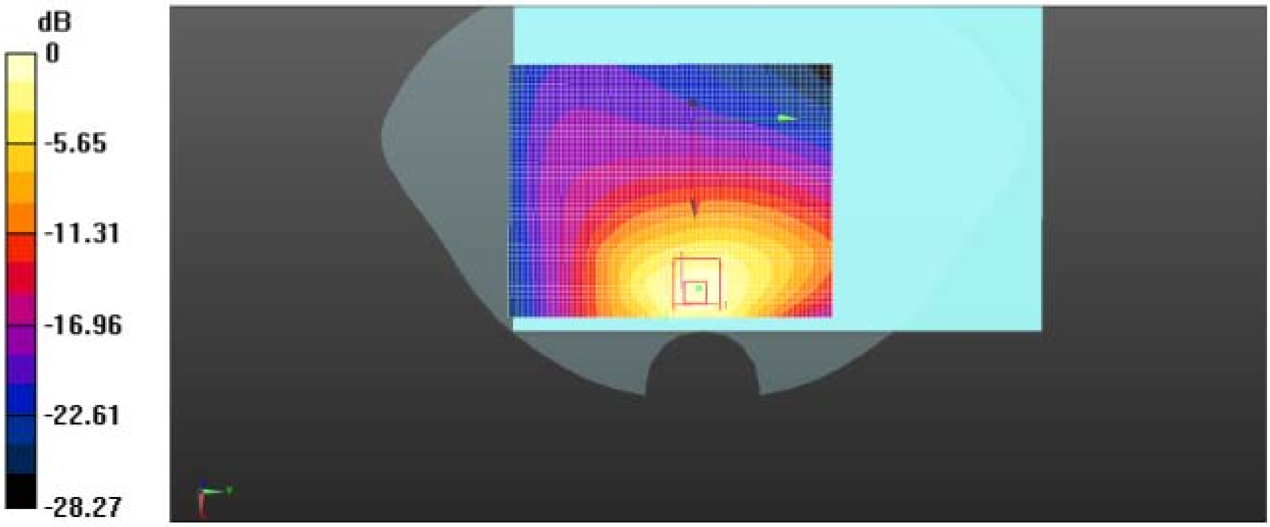
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.297 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 1.25 W/Kg

**SAR(1 g) = 0.924 W/Kg; SAR(10 g) = 0.671 W/Kg**

Maximum value of SAR (measured) = 0.860 W/kg




0dB = 0.860 W/kg = -0.66 dBW/kg

Plot 15: Body Toward Back (WCDMA850 RMC Low Channel)

**WCDMA850 RMC Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.99 S/m; $\varepsilon_r$ = 55.82; ρ = 1000 kg/m$^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.797 W/kg

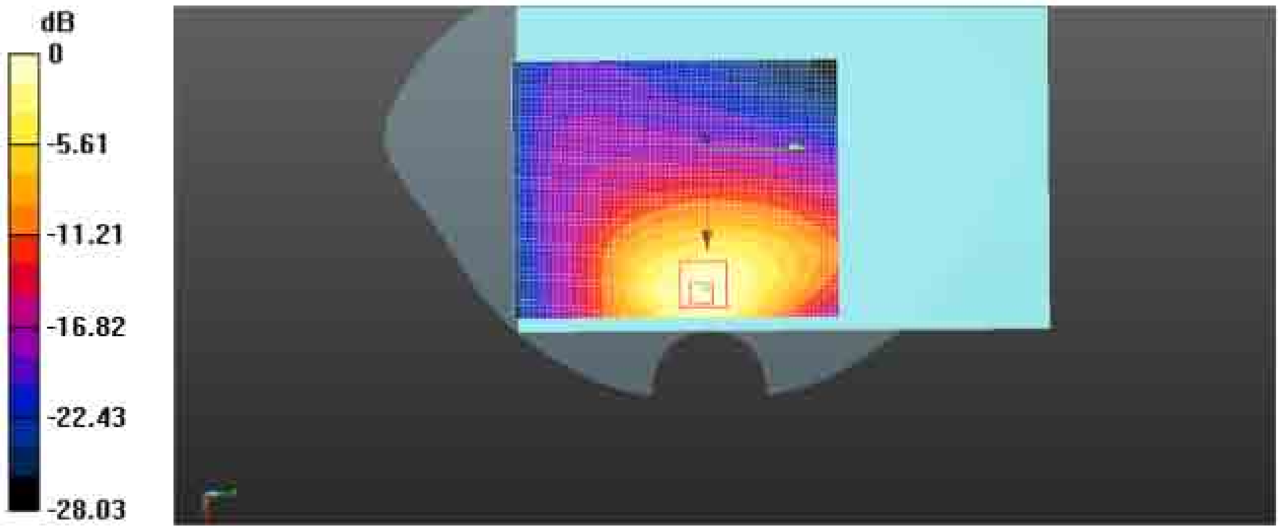
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.514 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.28 W/Kg

**SAR(1 g) = 0.937 W/Kg; SAR(10 g) = 0.684 W/Kg**

Maximum value of SAR (measured) = 0.873 W/kg




0dB = 0.873 W/kg = -0.58 dBW/kg

Plot 16: Body Toward Back (WCDMA850 RMC Middle Channel)

**WCDMA850 RMC Body Toward Back Side High Channel**

Communication System: Customer System; Frequency: 846.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.98 S/m; $\varepsilon_r$ = 55.31; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.792 W/kg

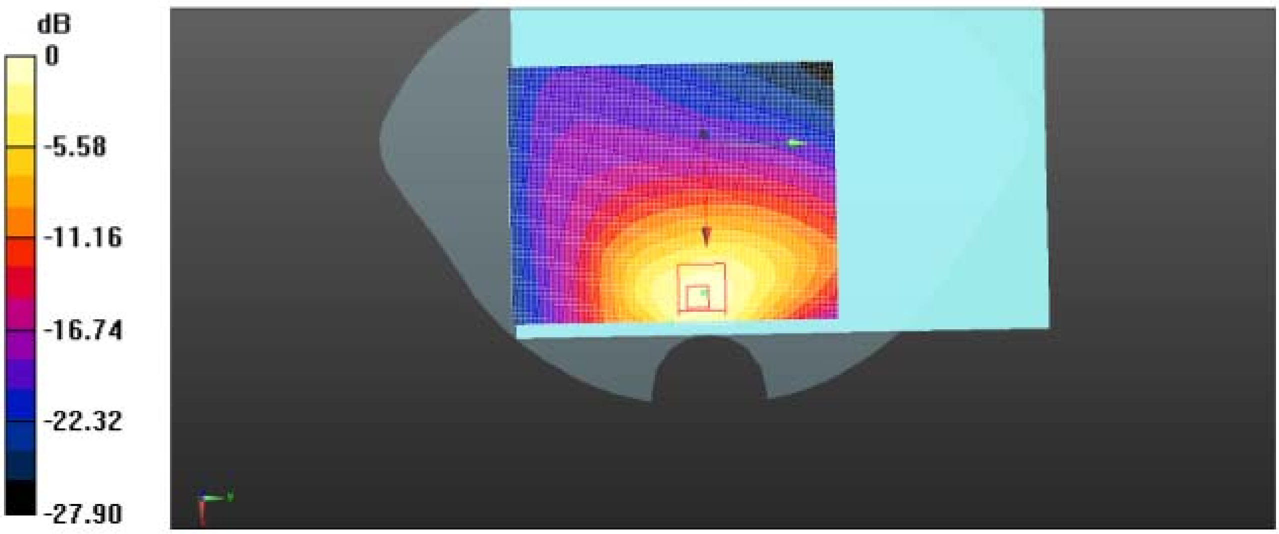
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.214 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.24 W/Kg

**SAR(1 g) = 0.920 W/Kg; SAR(10 g) = 0.667 W/Kg**

Maximum value of SAR (measured) = 0.855 W/kg




0dB = 0.855 W/kg = -0.69 dBW/kg

Plot 17: Body Toward Back (WCDMA850 RMC High Channel)

**WCDMA850 RMC Body Toward Top Side Low Channel**

Communication System: Customer System; Frequency: 826.4MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 826.4 MHz; σ = 0.94 S/m; $\varepsilon_r$ = 54.95; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.779 W/kg

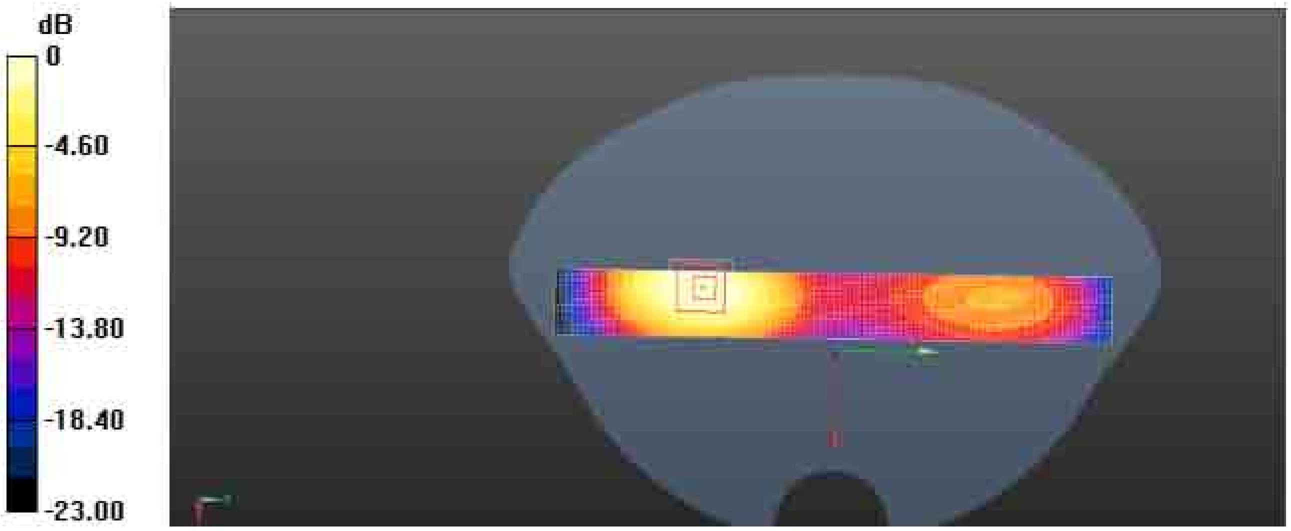
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.251 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.10 W/Kg

**SAR(1 g) = 0.712 W/Kg; SAR(10 g) = 0.443 W/Kg**

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




0dB = 0.779 W/kg = -1.08 dBW/kg

Plot 18: Body Toward Top (WCDMA850 RMC Low Channel)

**WCDMA850 RMC Body Toward Top Side Middle Channel**

Communication System: Customer System; Frequency: 836.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.99 S/m; $\varepsilon_r$ = 55.89; ρ = 1000 kg/m$^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.813 W/kg

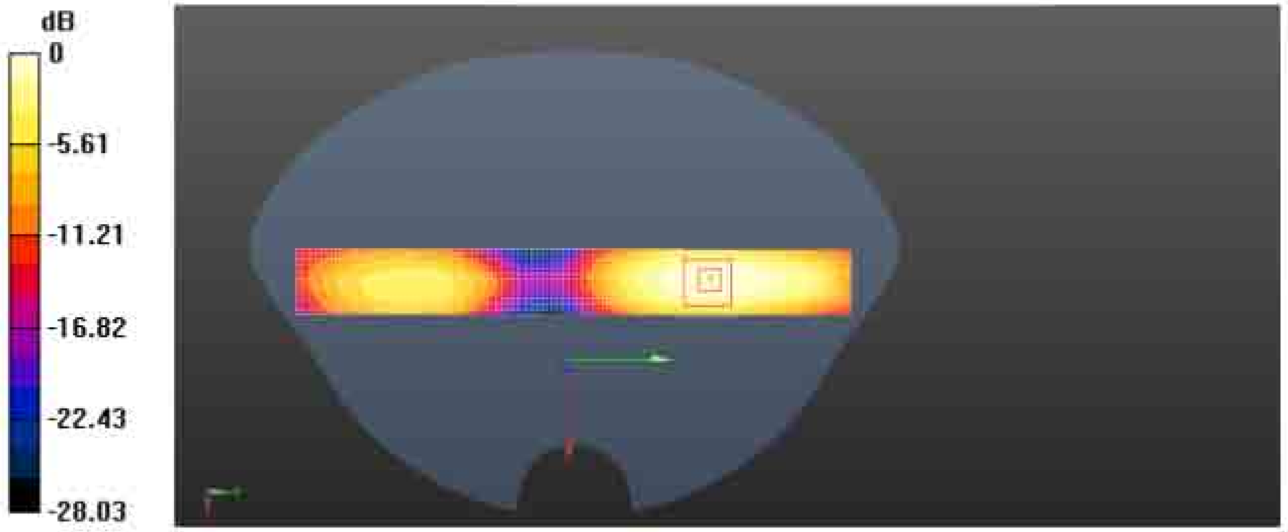
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.327 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 1.13 W/Kg

**SAR(1 g) = 0.729 W/Kg; SAR(10 g) = 0.458 W/Kg**

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




0dB = 0.780 W/kg = -1.08 dBW/kg

Plot 19: Body Toward Top (WCDMA850 RMC Middle Channel)

**WCDMA850 RMC Body Toward Top Side High Channel**

Communication System: Customer System; Frequency: 846.6 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 846.6 MHz; σ = 0.96 S/m; $\varepsilon_r$ = 55.34; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(6.14, 6.14, 6.14); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.758 W/kg

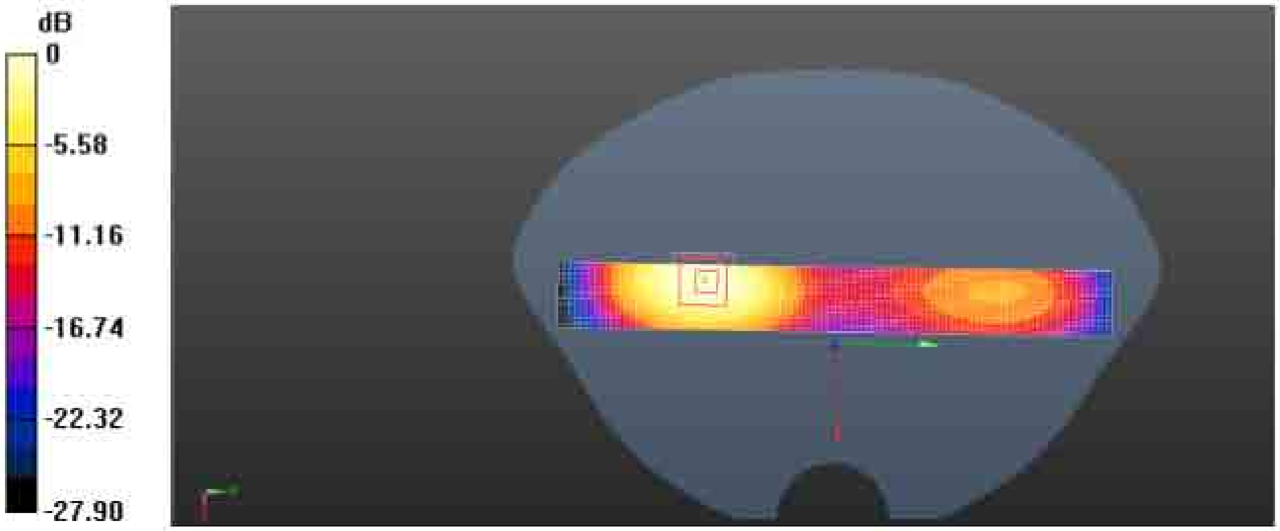
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.356 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 1.01 W/Kg

**SAR(1 g) = 0.704 W/Kg; SAR(10 g) = 0.431 W/Kg**

Maximum value of SAR (measured) = 0.758 W/kg




0dB = 0.758 W/kg = -1.33 dBW/kg

Plot 20: Body Toward Top (WCDMA850 RMC High Channel)

**WCDMA1900 RMC Body Toward Back Side Low Channel**

Communication System: Customer System; Frequency: 1852.4 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1852.4 MHz; $\sigma$ =1.46 S/m; $\varepsilon_r$ = 52.92; $\rho$ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.873 W/kg

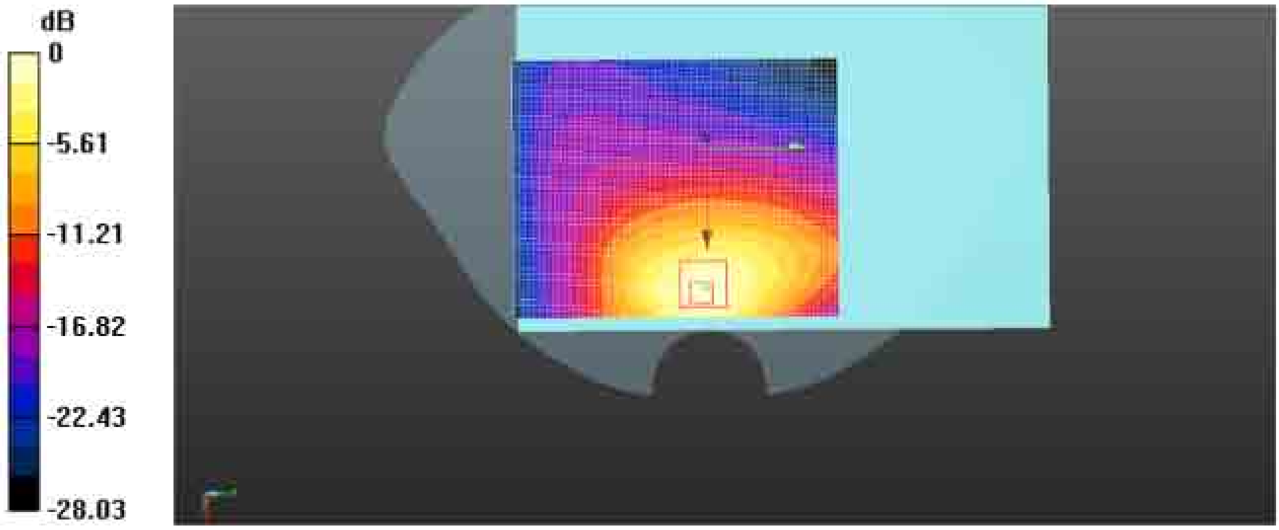
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.347 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.83 W/Kg

**SAR(1 g) = 0.874 W/Kg; SAR(10 g) = 0.587 W/Kg**

Maximum value of SAR (measured) = 0.892 W/kg




0dB = 0.892 W/kg = -0.56 dBW/kg

Plot 21: Body Toward Back (WCDMA1900 RMC Low Channel)

**WCDMA1900 RMC Body Toward Back Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1880.00 MHz; σ = 1.48 S/m; $\varepsilon_r$ = 53.14; ρ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.889 W/kg

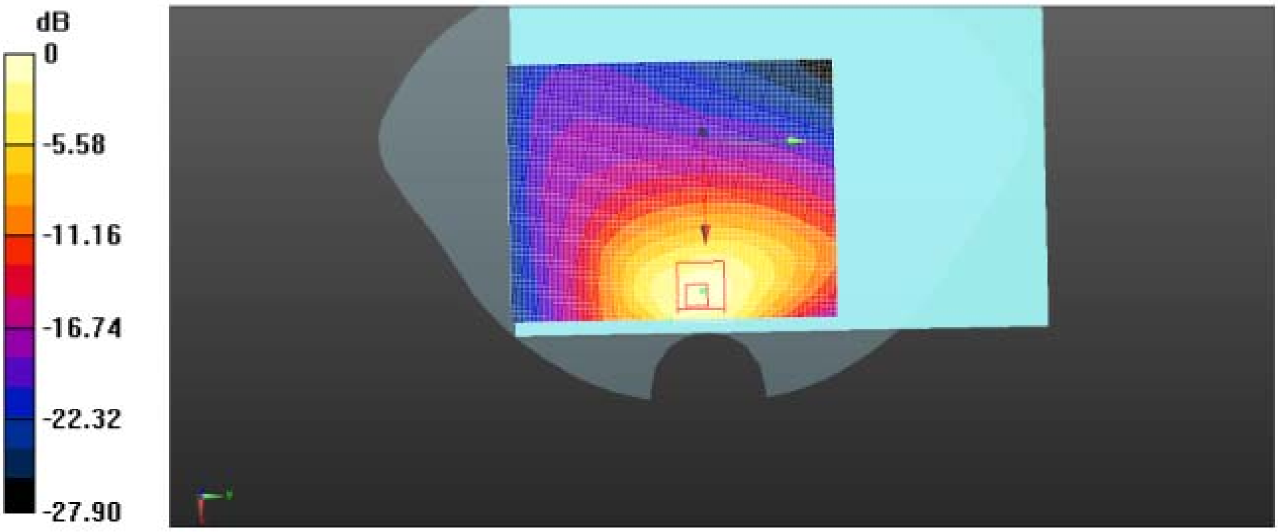
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.345 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.83 W/Kg

**SAR(1 g) = 0.892 W/Kg; SAR(10 g) = 0.587 W/Kg**

Maximum value of SAR (measured) = 0.910 W/kg




0dB = 0.910 W/kg = -0.51 dBW/kg

Plot 22: Body Toward Back (WCDMA1900 RMC Middle Channel)

**WCDMA1900RMC Body Toward Back Side High Channel**

Communication System: Customer System; Frequency: 1908.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1908.0 MHz; $\sigma$ =1.54 S/m; $\varepsilon_r$ = 52.34; $\rho$ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.877 W/kg

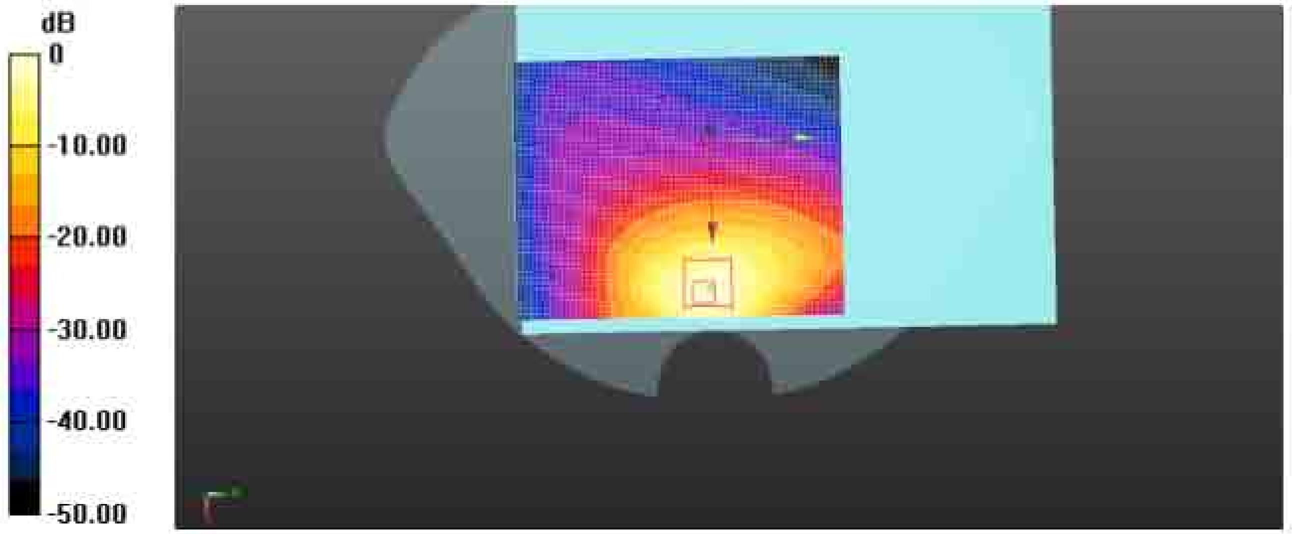
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.725 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.73 W/Kg

**SAR(1 g) = 0.868 W/Kg; SAR(10 g) = 0.571 W/Kg**

Maximum value of SAR (measured) = 0.825 W/kg




0dB = 0.825 W/kg = -0.64 dBW/kg

Plot 23: Body Toward Back (WCDMA1900 RMC High Channel)

**WCDMA1900 RMC Body Toward Top Side Low Channel**

Communication System: Customer System; Frequency: 1852.4 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1852.4 MHz; σ =1.48 S/m; $\varepsilon_r$ = 52.95; ρ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.832 W/kg

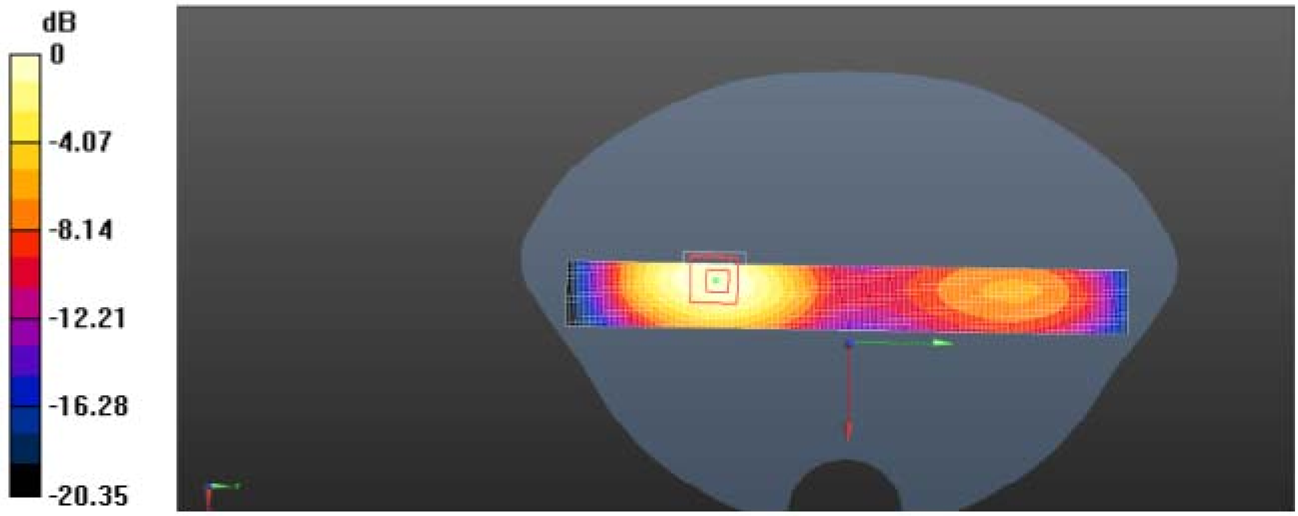
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.368 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 0.867 W/Kg

**SAR(1 g) = 0.667 W/Kg; SAR(10 g) = 0.358 W/Kg**

Maximum value of SAR (measured) = 0.867 W/kg




0dB = 0.867 W/kg = -0.94 dBW/kg

Plot 24: Body Toward Top (WCDMA1900 RMC Low Channel)

**WCDMA1900 RMC Body Toward Top Side Middle Channel**

Communication System: Customer System; Frequency: 1880.00 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1880.00 MHz; $\sigma$ = 1.48 S/m; $\varepsilon_r$ = 53.17; $\rho$ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.884 W/kg

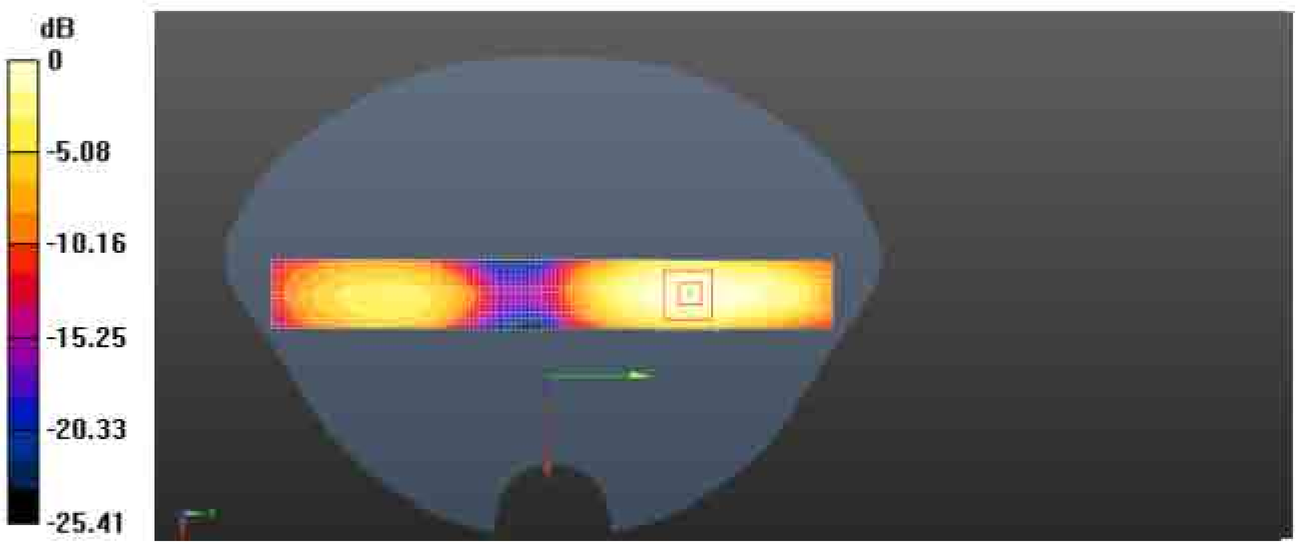
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.685 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.874 W/Kg

**SAR(1 g) = 0.679 W/Kg; SAR(10 g) = 0.368 W/Kg**

Maximum value of SAR (measured) = 0.874 W/kg




0dB = 0.874 W/kg = -0.83 dBW/kg

Plot 25: Body Toward Top (WCDMA1900 RMC Middle Channel)

**WCDMA1900 RMC Body Toward Top Side High Channel**

Communication System: Customer System; Frequency: 1908.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 1908.0 MHz; σ =1.58 S/m; $\varepsilon_r$ = 52.37; ρ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.66, 4.66, 4.66); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.816 W/kg

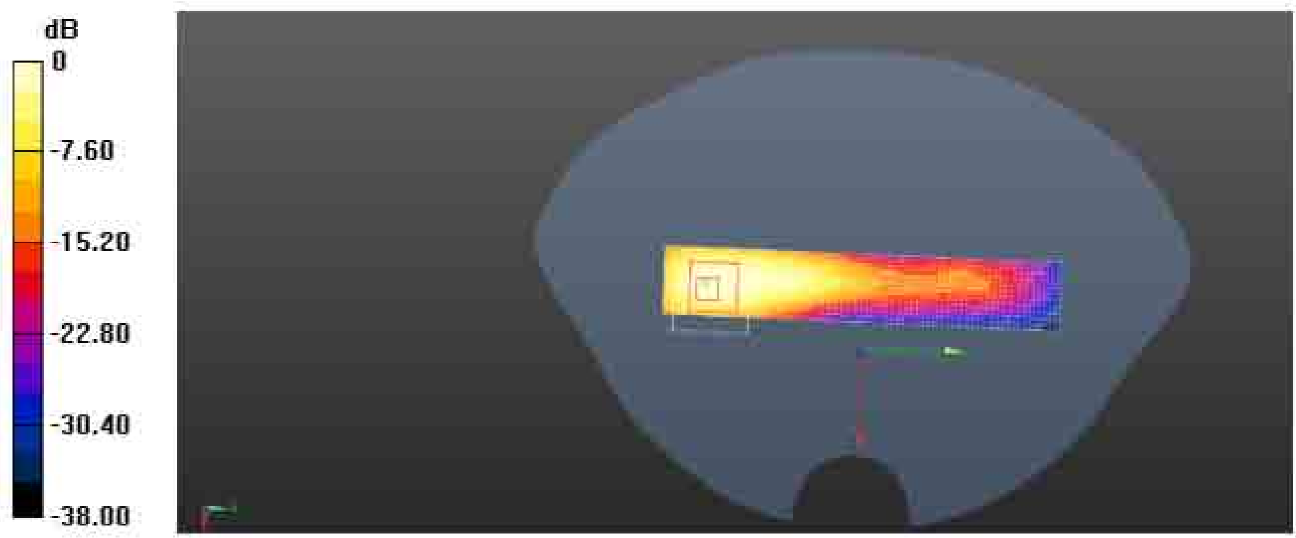
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.630 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.887 W/Kg

**SAR(1 g) = 0.671 W/Kg; SAR(10 g) = 0.364 W/Kg**

Maximum value of SAR (measured) = 0.887 W/kg




0dB = 0.887 W/kg = -0.79 dBW/kg

Plot 26: Body Toward Right (WCDMA1900 RMC High Channel)

**Body- worn Back side-802.11b-Channel 1-2412MHz(1Mbps)**

Communication System: Customer System; Frequency: 2412.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 2412.0 MHz; σ = 1.95 S/m; $\varepsilon_r$ = 52.76; ρ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

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

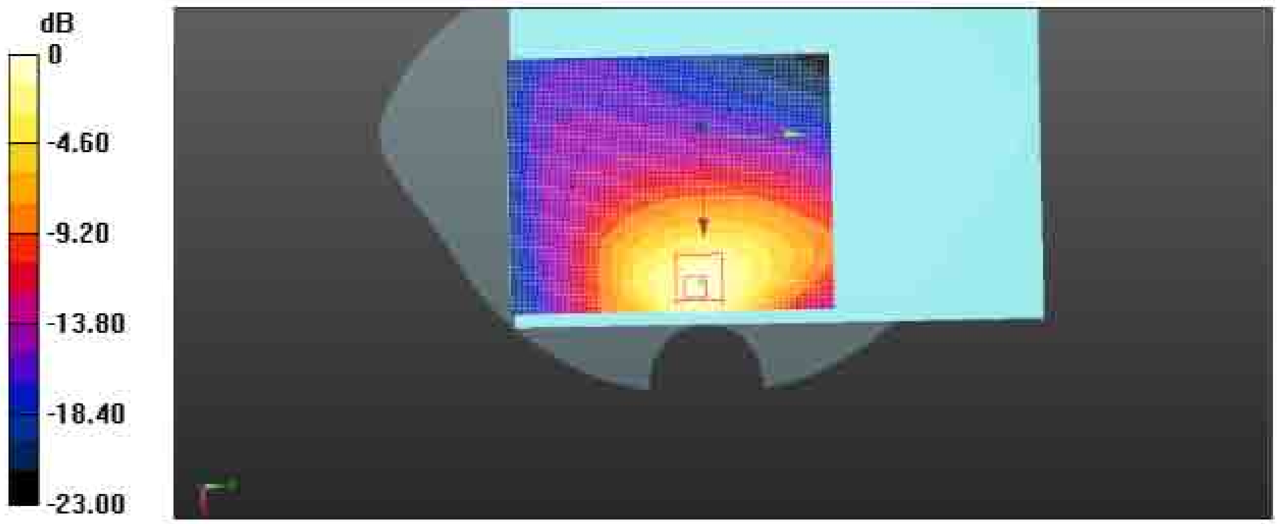
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.857 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.217 W/Kg

**SAR(1 g) = 0.216 W/Kg; SAR(10 g) = 0.135 W/Kg**

Maximum value of SAR (measured) = 0.251 W/kg




0dB = 0.251 W/kg = -5.38 dBW/kg

Plot 27: Body- worn Back-802.11b -Channel 1-2412MHz(1Mbps)

**Body- worn Back side-802.11b-Channel 6-2437MHz(1Mbps)**

Communication System: Customer System; Frequency: 2437.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 2437.0 MHz; σ = 1.98 S/m; $\varepsilon_r$ = 52.83; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.276 W/kg

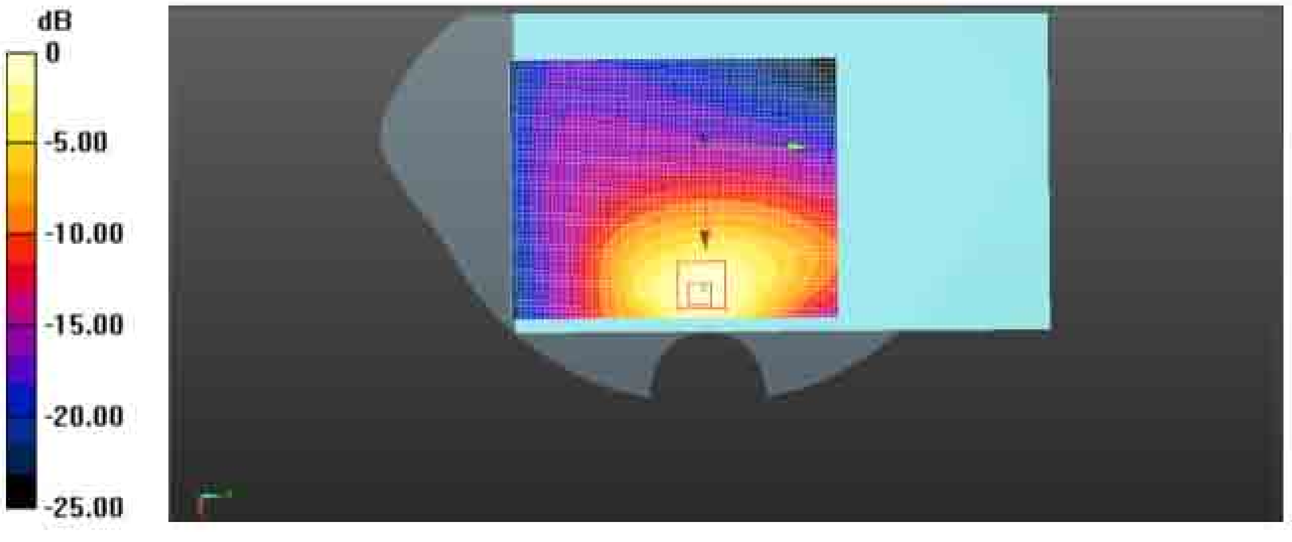
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.357 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.640 W/Kg

**SAR(1 g) = 0.252 W/Kg; SAR(10 g) = 0.137 W/Kg**

Maximum value of SAR (measured) = 0.352 W/kg




0dB = 0.267 W/kg = -5.59 dBW/kg

Plot 28: Body- worn Back-802.11b-Channel 6-2437MHz(1Mbps)

**Body- worn Back side-802.11b-Channel 11-2462MHz(1Mbps)**

Communication System: Customer System; Frequency: 2462.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 2462.0 MHz; σ = 1.95 S/m; $\varepsilon_r$ = 53.4; ρ = 1000 kg/$m^3$

Phantom section : Body- worn

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Electronics: DAE4 Sn1315; Calibrated: 02/27/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.213 W/kg

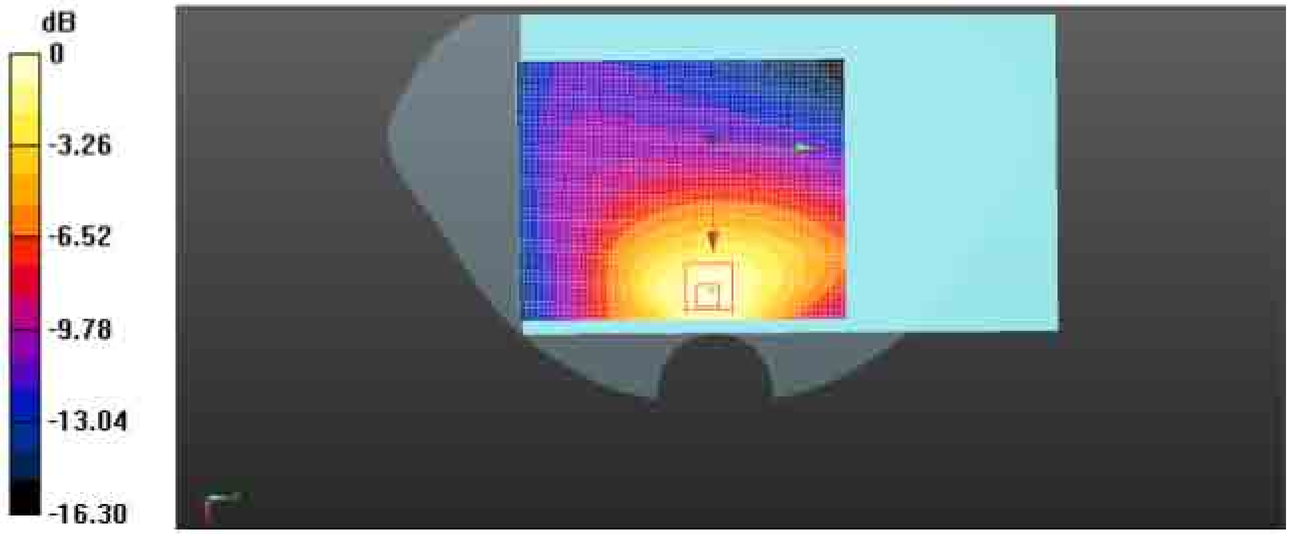
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.214 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.527 W/Kg

**SAR(1 g) = 0.219 W/Kg; SAR(10 g) = 0.103 W/Kg**

Maximum value of SAR (measured) = 0.277 W/kg




0dB = 0.153 W/kg = -3.66 dBW/kg

Plot 29: Body- worn Back-802.11b-Channel 11-2462MHz(1Mbps)

**Body- worn Top side-802.11b-Channel 1-2412MHz(1Mbps)**

Communication System: Customer System; Frequency: 2412.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 2412.0 MHz; σ =1.94 S/m; $\varepsilon_r$ = 52.90; ρ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.183 W/kg

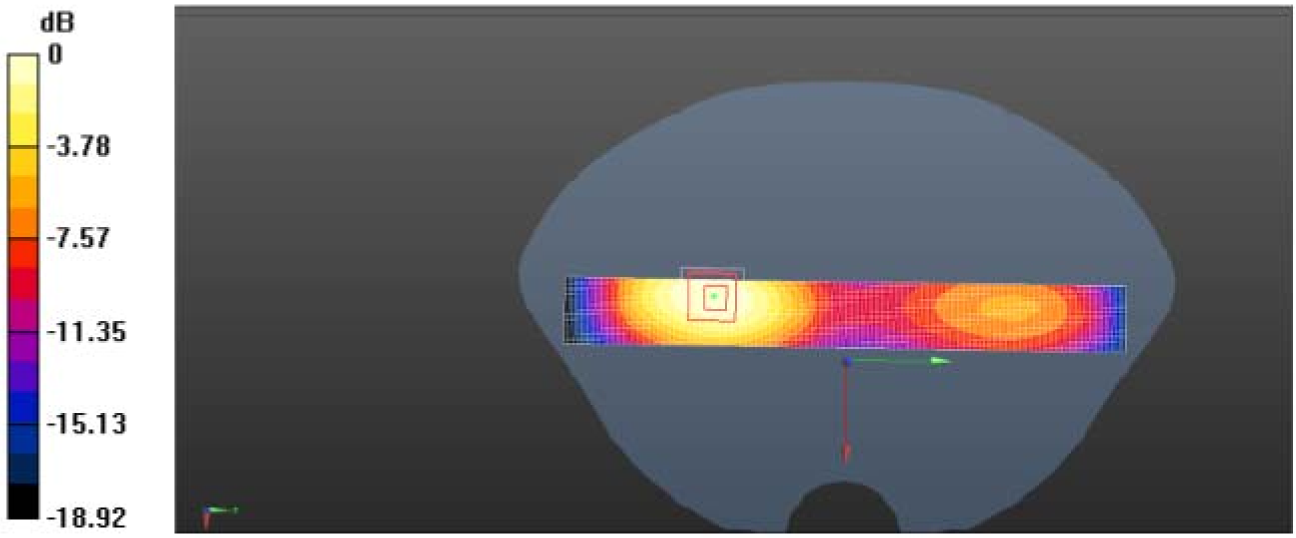
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.247 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.145 W/Kg

**SAR(1 g) = 0.204 W/Kg; SAR(10 g) = 0.115 W/Kg**

Maximum value of SAR (measured) = 0.190 W/kg




0dB = 0.190 W/kg = -14.15 dBW/kg

Plot 30: Body- worn Top-802.11b -Channel 1-2412MHz(1Mbps)

**Body- worn Right side-802.11b-Channel 6-2437MHz(1Mbps)**

Communication System: Customer System; Frequency: 2437.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 2437.0 MHz; $\sigma$ = 1.99 S/m; $\varepsilon_r$ = 53.40; $\rho$ = 1000 kg/m$^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.195 W/kg

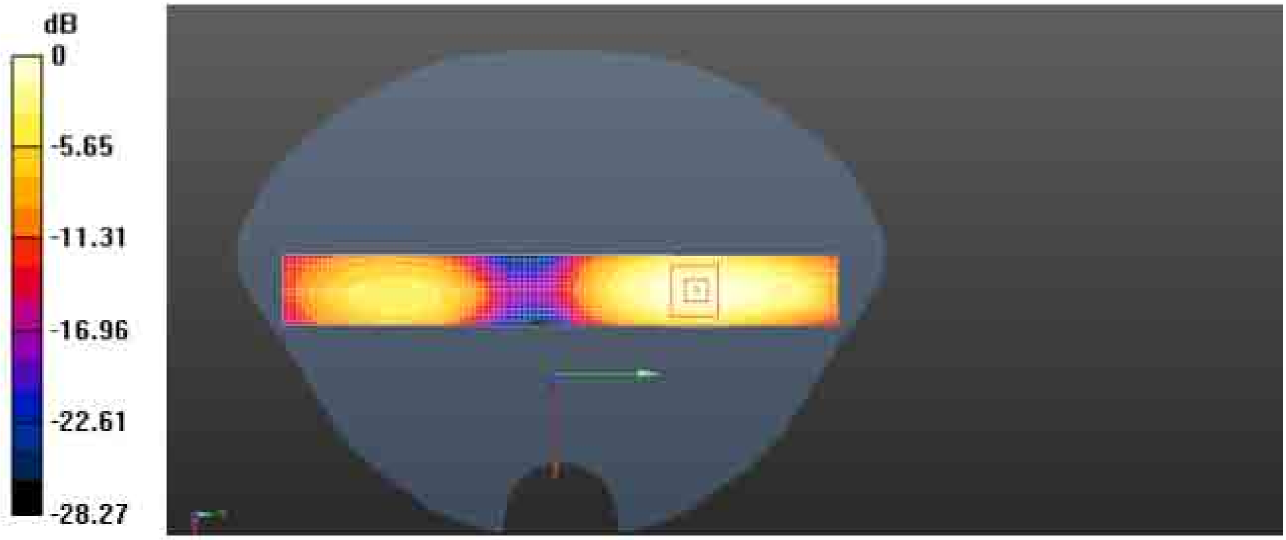
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.451 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.151 W/Kg

**SAR(1 g) = 0.213 W/Kg; SAR(10 g) = 0.126 W/Kg**

Maximum value of SAR (measured) = 0.189 W/kg




0dB = 0.189 W/kg = -14.28 dBW/kg

Plot 31: Body- worn Top-802.11b-Channel 6-2437MHz(1Mbps)

**Body- worn Top side-802.11b-Channel 11-2462MHz(1Mbps)**

Communication System: Customer System; Frequency: 2462.0 MHz;Duty Cycle:1:2

Medium parameters used (interpolated): f = 2462.0 MHz; σ =1.92 S/m; $\varepsilon_r$ = 52.82; ρ = 1000 kg/$m^3$

Phantom section : Flat Section

Probe: ES3DV3 - SN3292; ConvF(4.25, 4.25, 4.25); Calibrated: 24/02/2013;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1315; Calibrated: 27/02/2013

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

**Area Scan (81x101x1):** Measurement grid: dx=1.50 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 0.153 W/kg

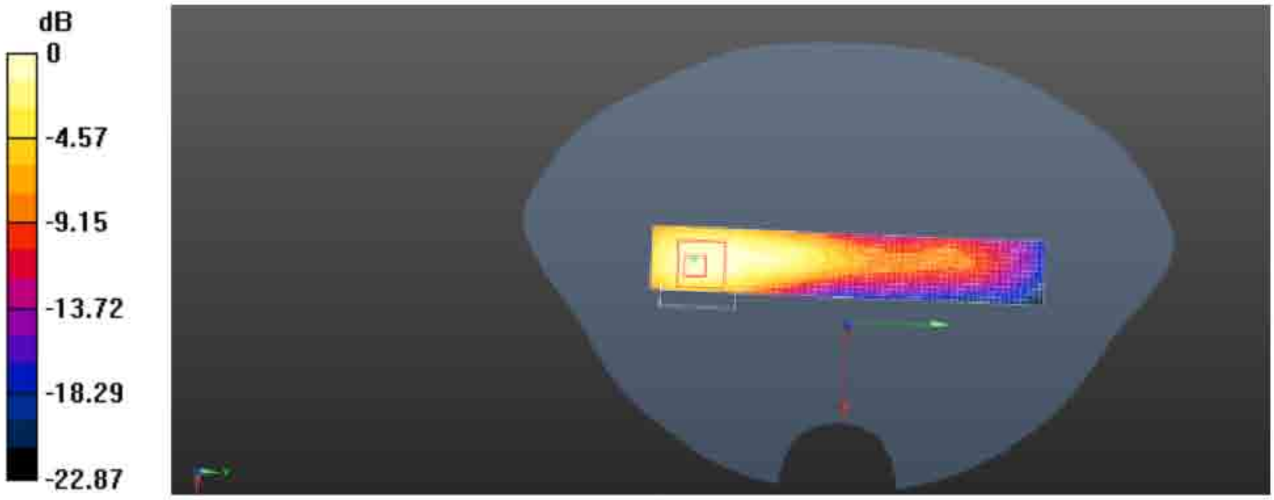
**Zoom Scan (5x5x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.354 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.180 W/Kg

**SAR(1 g) = 0.198 W/Kg; SAR(10 g) = 0.101 W/Kg**

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




0dB = 0.158 W/kg = -18.24 dBW/kg

Plot 32: Body- worn Top-802.11b-Channel 11-2462MHz(1Mbps)

# 6. Calibration Certificate

## 6.1. Probe Calibration Ceriticate

**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
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 **CIQ SZ (Auden)**

Certificate No: **ES3-3292_Feb13**

# CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3292

Calibration procedure(s): QA CAL-01.v8, QA CAL-14.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: February 24, 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 (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter E4419B | GB41293874 | 31-Mar-12 (No. 217-01372) | Apr-13 |
| Power sensor E4412A | MY41498087 | 31-Mar-12 (No. 217-01372) | Apr-13 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 29-Mar-12 (No. 217-01369) | Apr-13 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-12 (No. 217-01367) | Apr-13 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 29-Mar-12 (No. 217-01370) | Apr-13 |
| Reference Probe ES3DV2 | SN: 3013 | 29-Dec-12 (No. ES3-3013_Dec12) | Dec-13 |
| DAE4 | SN: 654 | 3-May-12 (No. DAE4-654_May12) | May-13 |
| | | | |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-12) | In house check: Apr-13 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Jeton Kastrati | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: February 27, 2013

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Accreditation No.: **SCS 108**

## Glossary:

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

## Calibration is Performed According to the Following Standards:

a) 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

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

## Methods Applied and Interpretation of Parameters:

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

# Probe ES3DV3

## SN:3292

Manufactured: July 6, 2010
Calibrated: February 24, 2013

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

# DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|---|---|---|---|
| Norm ($\mu V/(V/m)^2$)[A] | 0.81 | 0.90 | 1.18 | ± 10.1 % |
| DCP (mV)[B] | 105.9 | 104.7 | 102.0 | |

## Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|
| 10000 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 117.3 | ±2.2 % |
| | | | Y | 0.00 | 0.00 | 1.00 | 94.2 | |
| | | | Z | 0.00 | 0.00 | 1.00 | 108.2 | |

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

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

# DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

## Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 450 | 43.5 | 0.87 | 6.71 | 6.71 | 6.71 | 0.15 | 1.80 | ± 13.4 % |
| 835 | 41.5 | 0.90 | 6.06 | 6.06 | 6.06 | 0.26 | 2.19 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 6.03 | 6.03 | 6.03 | 0.29 | 2.00 | ± 12.0 % |
| 1810 | 40.0 | 1.40 | 5.25 | 5.25 | 5.25 | 0.80 | 1.17 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 5.21 | 5.21 | 5.21 | 0.63 | 1.38 | ± 12.0 % |
| 2100 | 39.8 | 1.49 | 5.15 | 5.15 | 5.15 | 0.80 | 1.20 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 4.47 | 4.47 | 4.47 | 0.63 | 1.50 | ± 12.0 % |

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

# DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

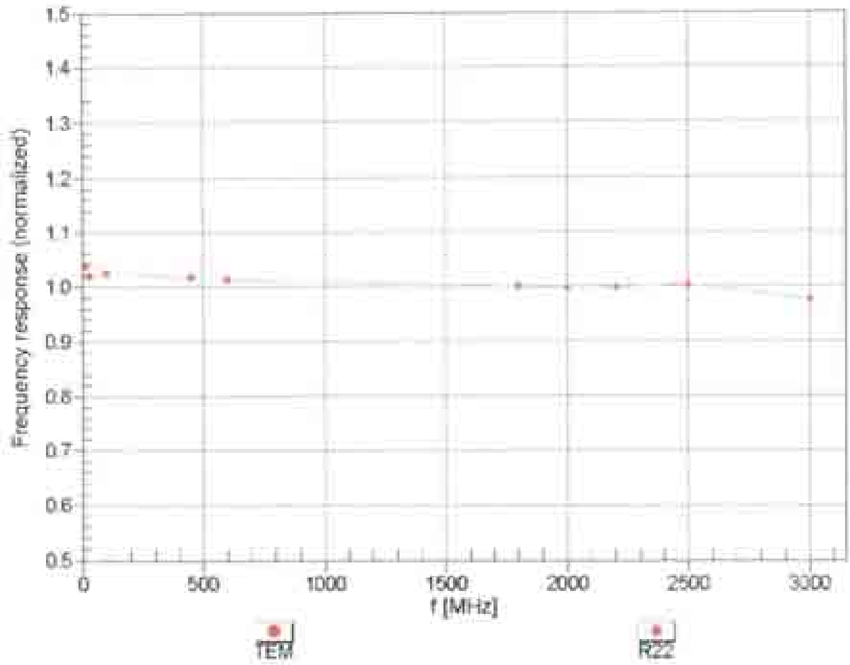
## Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 450 | 56.7 | 0.94 | 7.10 | 7.10 | 7.10 | 0.09 | 1.00 | ± 13.4 % |
| 835 | 55.2 | 0.97 | 6.14 | 6.14 | 6.14 | 0.42 | 1.57 | ± 12.0 % |
| 900 | 55.0 | 1.05 | 6.07 | 6.07 | 6.07 | 0.48 | 1.49 | ± 12.0 % |
| 1810 | 53.3 | 1.52 | 4.86 | 4.86 | 4.86 | 0.62 | 1.42 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 4.66 | 4.66 | 4.66 | 0.47 | 1.75 | ± 12.0 % |
| 2100 | 53.2 | 1.62 | 4.76 | 4.76 | 4.76 | 0.70 | 1.39 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 4.25 | 4.25 | 4.25 | 0.80 | 1.03 | ± 12.0 % |

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

# Frequency Response of E-Field

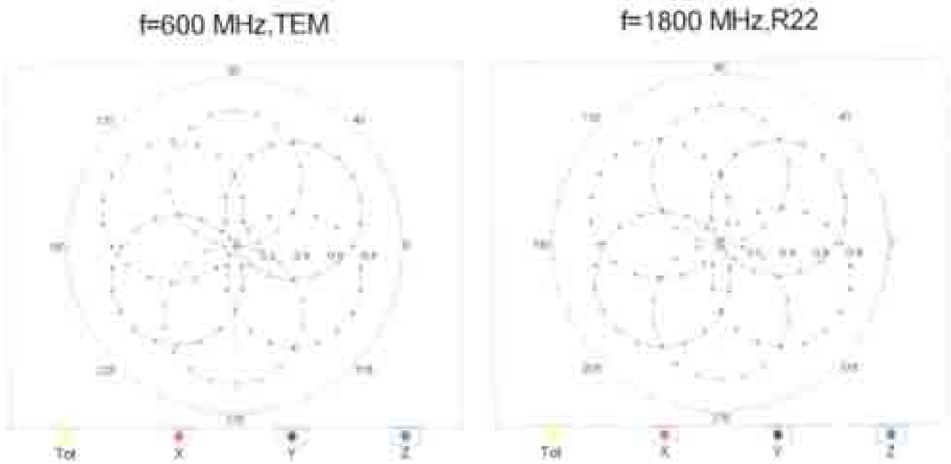
(TEM-Cell:ifi110 EXX, Waveguide: R22)

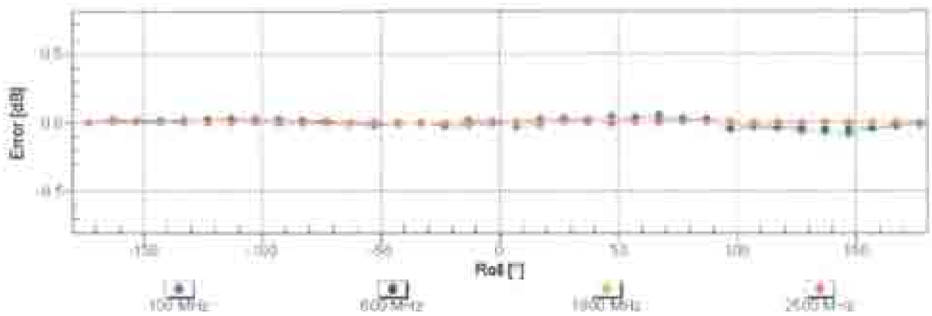



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

ES3DV3- SN:3292 February 24, 2013

## Receiving Pattern (ϕ), ϑ = 0°

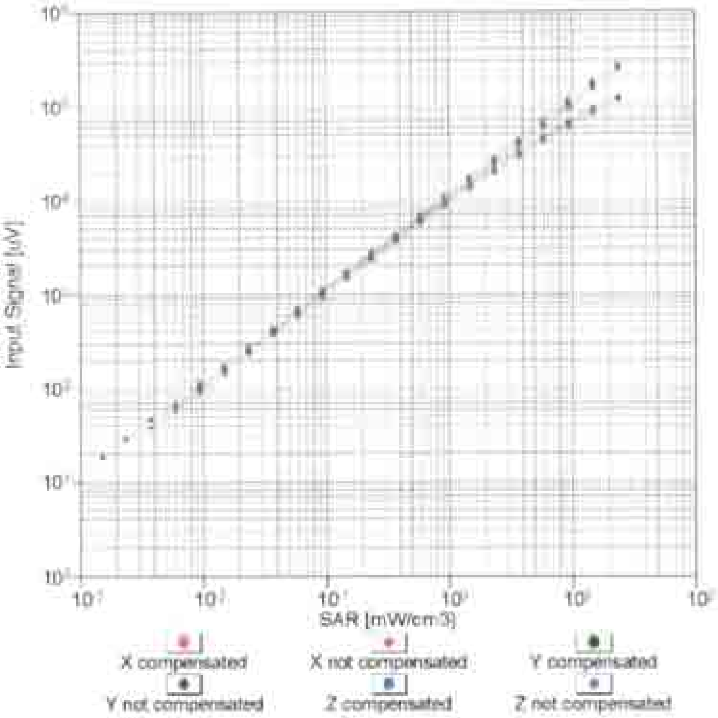


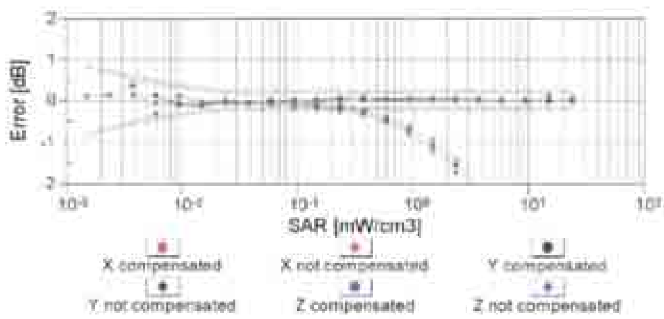




**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

# Dynamic Range f(SAR$_{head}$)

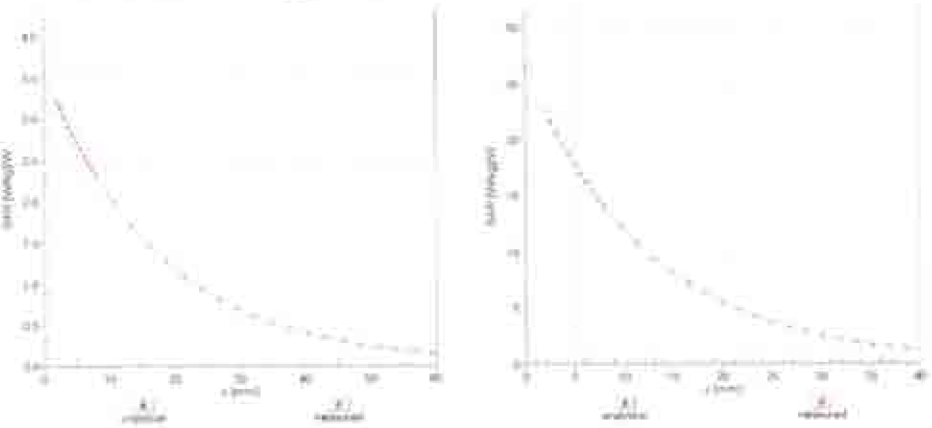
(TEM cell , f = 900 MHz)



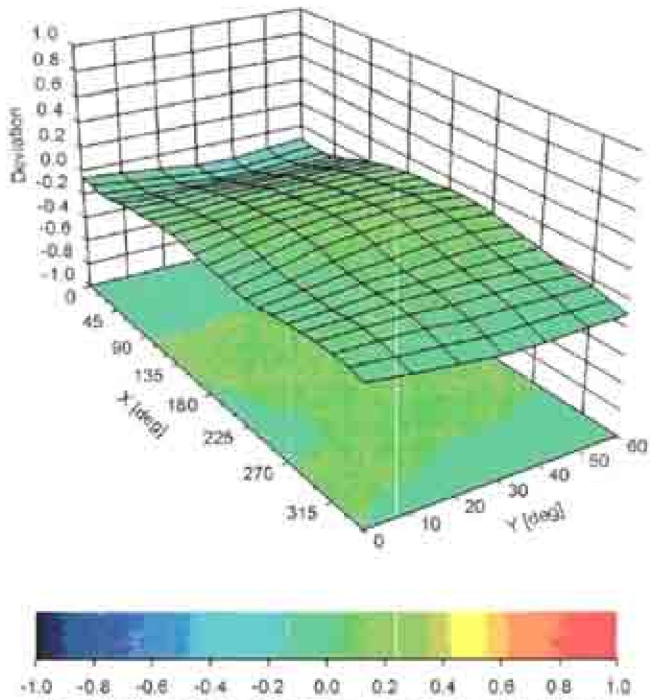

**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

## Conversion Factor Assessment




## Deviation from Isotropy in Liquid

**Error (ϕ, ϑ), f = 900 MHz**




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

# DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | Not applicable |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 10 mm |
| Tip Diameter | 4 mm |
| Probe Tip to Sensor X Calibration Point | 2 mm |
| Probe Tip to Sensor Y Calibration Point | 2 mm |
| Probe Tip to Sensor Z Calibration Point | 2 mm |
| Recommended Measurement Distance from Surface | 3 mm |

## 6.2. D835V2 Dipole Calibration Ceriticate

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Accreditation No.: **SCS 108**

Client **CIQ SZ (Auden)**

Certificate No: **D835V2-4d134_Feb13**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D835V2 - SN: 4d134 |
| Calibration procedure(s) | QA CAL-05.v8<br>Calibration procedure for dipole validation kits above 700 MHz |
| Calibration date: | February 27, 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 (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter EPM-442A | GB37480704 | 05-Oct-12 (No. 217-01451) | Oct-13 |
| Power sensor HP 8481A | US37292783 | 05-Oct-12 (No. 217-01451) | Oct-13 |
| Reference 20 dB Attenuator | SN: 5086 (20g) | 29-Mar-12 (No. 217-01368) | Apr-13 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-12 (No. 217-01371) | Apr-13 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-12 (No. ES3-3205_Dec11) | Dec-13 |
| DAE4 | SN: 601 | 04-Jul-12 (No. DAE4-601_Jul11) | Jul-13 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-13 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Israe El-Naouq | Laboratory Technician | Israe El-Naouq |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: February 27, 2013

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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:**

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:**

d) 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.

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.8.0 |
| **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 ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 41.5 | 0.90 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 41.0 ± 6 % | 0.89 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 2.33 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **9.37 mW /g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (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 ± 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 ± 0.2) °C | 55.7 ± 6 % | 1.01 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 2.44 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **9.49 mW / g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | concition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.60 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **6.26 mW / g ± 16.5 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 52.7 Ω - 2.1 jΩ |
| Return Loss | - 29.6 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 47.1 Ω - 4.6 jΩ |
| Return Loss | - 25.0 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.398 ns |

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

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

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |
| Manufactured on | July 22, 2011 |

**DASY5 Validation Report for Head TSL**

Date: 27.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

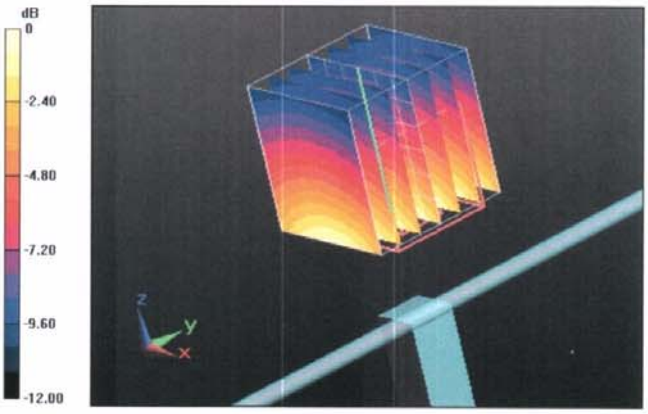
**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d134**

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma$ = 0.89 mho/m; $\varepsilon_r$ = 41; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

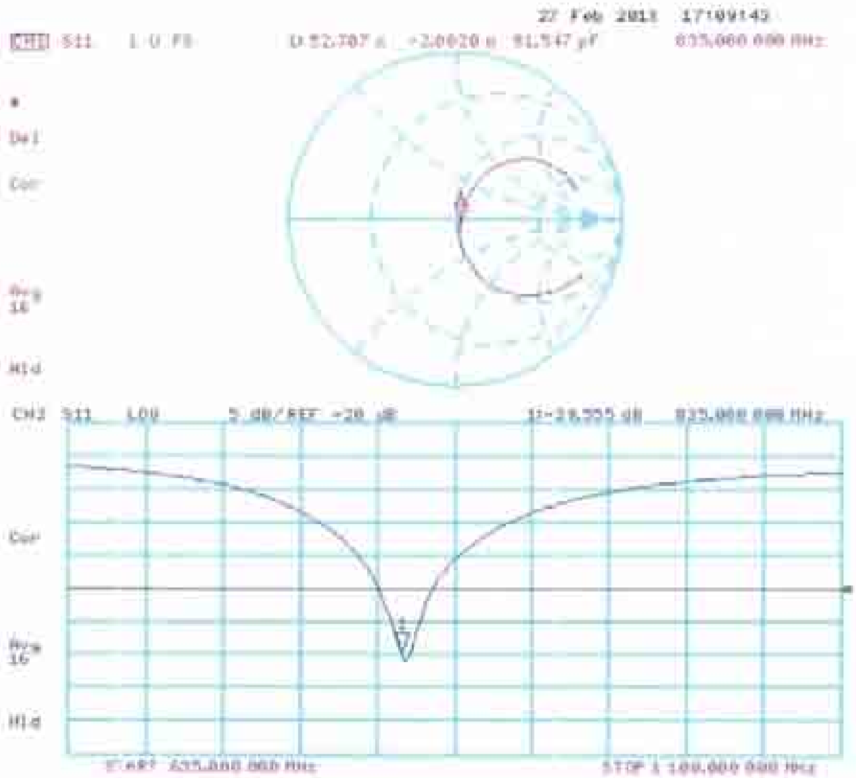
- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**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 = 57.043 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.4280
**SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.52 mW/g**
Maximum value of SAR (measured) = 2.725 mW/g




0 dB = 2.730mW/g = 8.72 dB mW/g

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 27.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

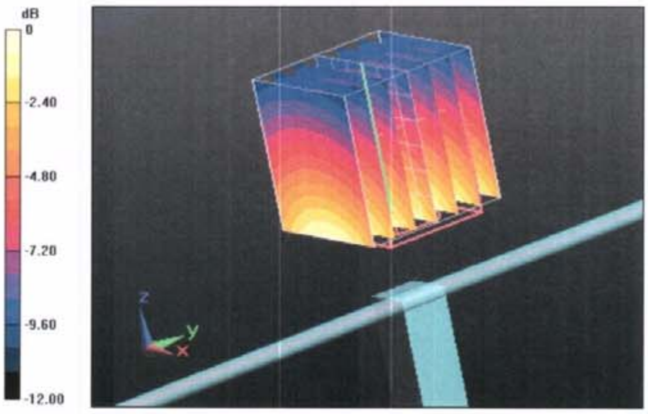
**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d134**

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma$ = 1.01 mho/m; $\varepsilon_r$ = 55.7; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

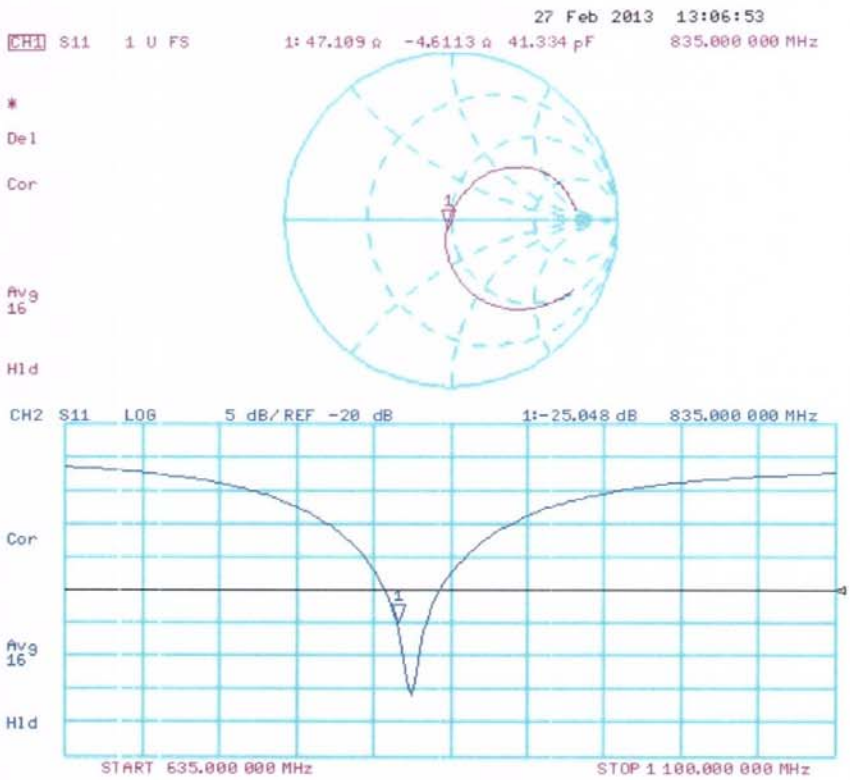
- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**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 = 54.902 V/m; Power Drift = 0.0055 dB
Peak SAR (extrapolated) = 3.5280
**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**
Maximum value of SAR (measured) = 2.838 mW/g




0 dB = 2.840mW/g = 9.07 dB mW/g

## Impedance Measurement Plot for Body TSL



## 6.3. D1900V2 Dipole Calibration Ceriticate

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Accreditation No.: **SCS 108**

Client **CIQ SZ (Auden)**

Certificate No: **D1900V2-5d150_Feb13**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D1900V2 - SN: 5d150 |
| Calibration procedure(s) | QA CAL-05.v8<br>Calibration procedure for dipole validation kits above 700 MHz |
| Calibration date: | February 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 (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter EPM-442A | GB37480704 | 05-Oct-12 (No. 217-01451) | Oct-13 |
| Power sensor HP 8481A | US37292783 | 05-Oct-12 (No. 217-01451) | Oct-13 |
| Reference 20 dB Attenuator | SN: 5086 (20g) | 29-Mar-12 (No. 217-01368) | Apr-13 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-12 (No. 217-01371) | Apr-13 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-12 (No. ES3-3205_Dec11) | Dec-13 |
| DAE4 | SN: 601 | 04-Jul-12 (No. DAE4-601_Jul11) | Jul-13 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-11) | In house check: Oct-13 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Claudio Leubler | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: February 28, 2013

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



**Glossary:**

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

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

a) IEEE Std 1528-2003, "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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:**

d) 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.

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.8.0 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | Modular Flat Phantom | |
| **Distance Dipole Center - TSL** | 10 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 1900 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 40.0 | 1.40 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 40.4 ± 6 % | 1.40 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 9.94 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **39.8 mW /g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.24 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **21.0 mW /g ± 16.5 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 53.3 | 1.52 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 53.0 ± 6 % | 1.56 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 10.2 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **40.1 mW / g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.32 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **21.1 mW / g ± 16.5 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 52.9 Ω + 6.8 jΩ |
| Return Loss | - 22.9 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 48.5 Ω + 7.4 jΩ |
| Return Loss | - 22.3 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.195 ns |

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

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

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |
| Manufactured on | March 11, 2011 |

## DASY5 Validation Report for Head TSL

Date: 28.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

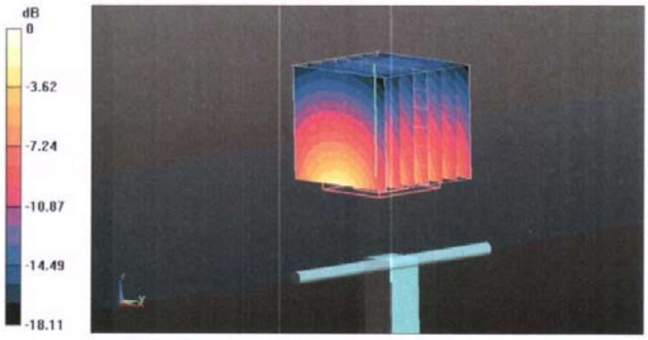
**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d150**

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.4 mho/m; $\varepsilon_r$ = 40.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

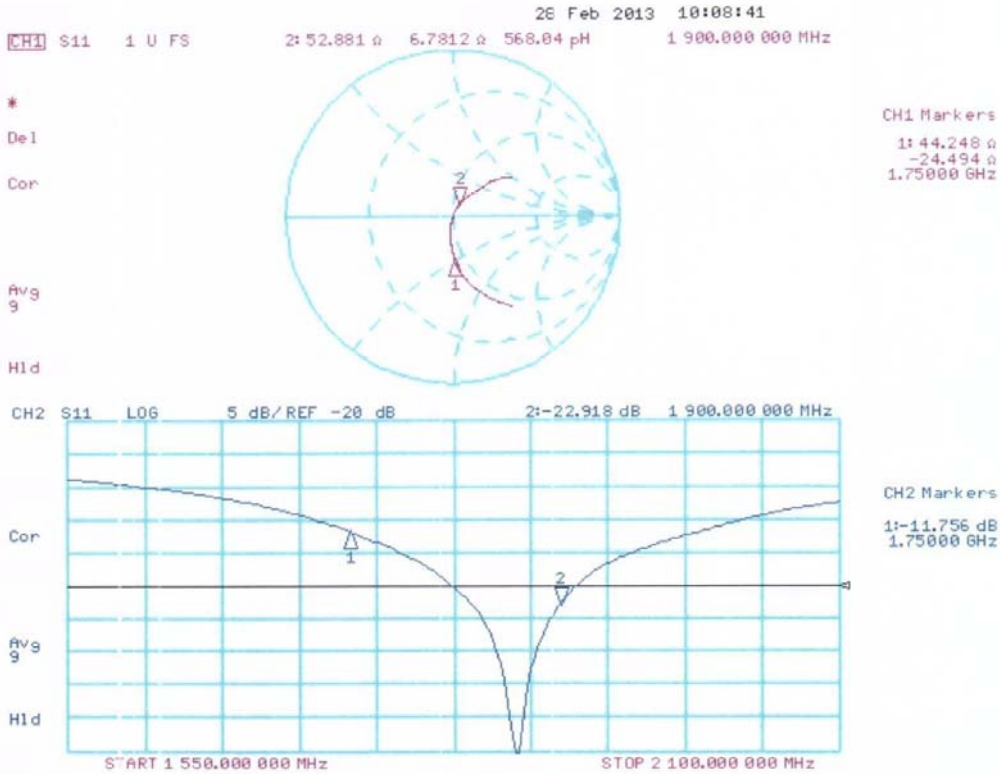
- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (8x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.182 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 17.6990
**SAR(1 g) = 9.94 mW/g; SAR(10 g) = 5.24 mW/g**
Maximum value of SAR (measured) = 12.584 mW/g




0 dB = 12.580mW/g = 21.99 dB mW/g

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 28.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

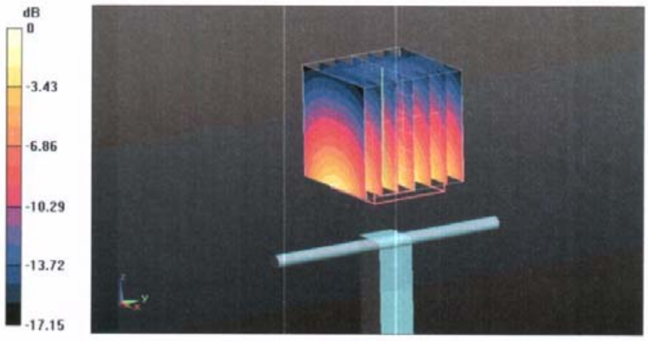
**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d150**

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.56 mho/m; $\varepsilon_r$ = 53; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

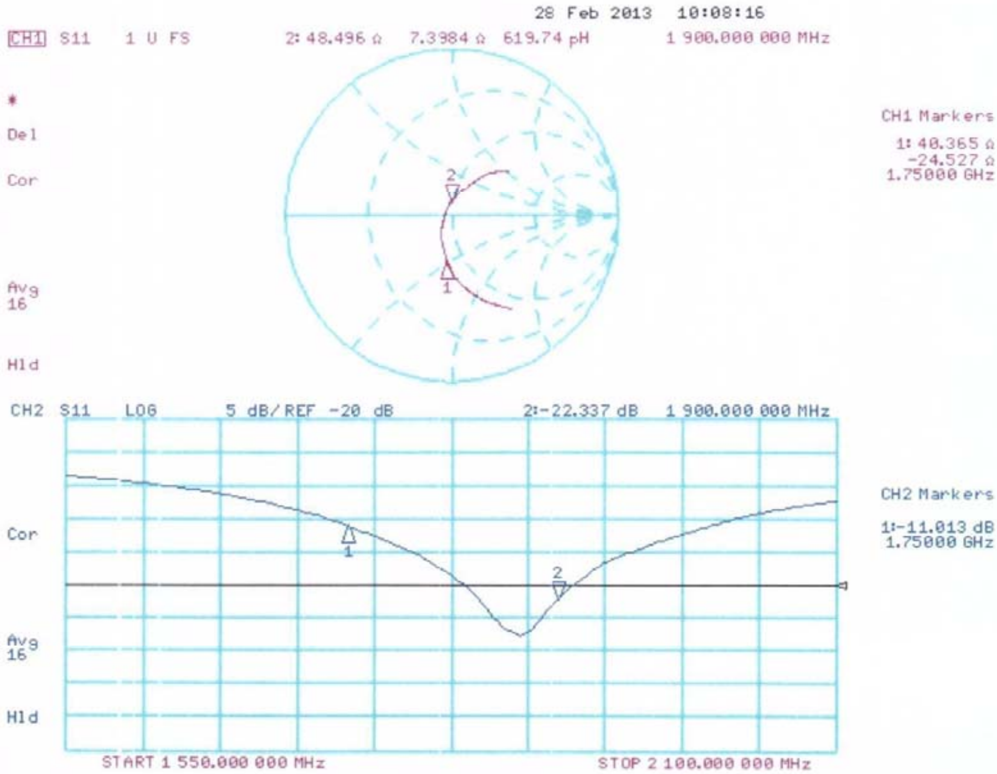
- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**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 = 94.968 V/m; Power Drift = 0.0033 dB
Peak SAR (extrapolated) = 18.0350
**SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.32 mW/g**
Maximum value of SAR (measured) = 12.901 mW/g




0 dB = 12.900mW/g = 22.21 dB mW/g

### Impedance Measurement Plot for Body TSL



## 6.4. D2450V2 Dipole Calibration Ceriticate

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

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S Servizio svizzero di taratura
Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Client **CIQ SZ (Auden)**

Certificate No: **D2450V2-884_Feb13**

# CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 884

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

Calibration date: February 29, 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 (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter EPM-442A | GB37480704 | 05-Oct-12 (No. 217-01451) | Oct-13 |
| Power sensor HP 8481A | US37292783 | 05-Oct-12 (No. 217-01451) | Oct-13 |
| Reference 20 dB Attenuator | SN: 5086 (20g) | 29-Mar-12 (No. 217-01368) | Apr-13 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 29-Mar-12 (No. 217-01371) | Apr-13 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-12 (No. ES3-3205_Dec12) | Dec-13 |
| DAE4 | SN: 601 | 04-Jul-12 (No. DAE4-601_Jul12) | Jul-13 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-12) | In house check: Oct-13 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-12) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Israe El-Naouq | Laboratory Technician | Israe El-Naouq |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: February 29, 2013

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

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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:**

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:**

d) 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.

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.8.0 |
| **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 ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 39.2 | 1.80 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 38.9 ± 6 % | 1.86 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 cm³ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 13.7 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **53.9 mW /g ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 6.36 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **25.2 mW /g ± 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 ± 0.2) °C | 52.3 ± 6 % | 2.02 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 cm³ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 12.8 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **50.3 mW / g ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.98 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **23.7 mW / g ± 16.5 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 53.7 Ω + 2.1 jΩ |
| Return Loss | - 27.7 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 50.7 Ω + 3.7 jΩ |
| Return Loss | - 28.6 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.159 ns |

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

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

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |
| Manufactured on | October 06, 2011 |

**DASY5 Validation Report for Head TSL**

Date: 29.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884**

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 mho/m; $\varepsilon_r$ = 38.9; ρ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

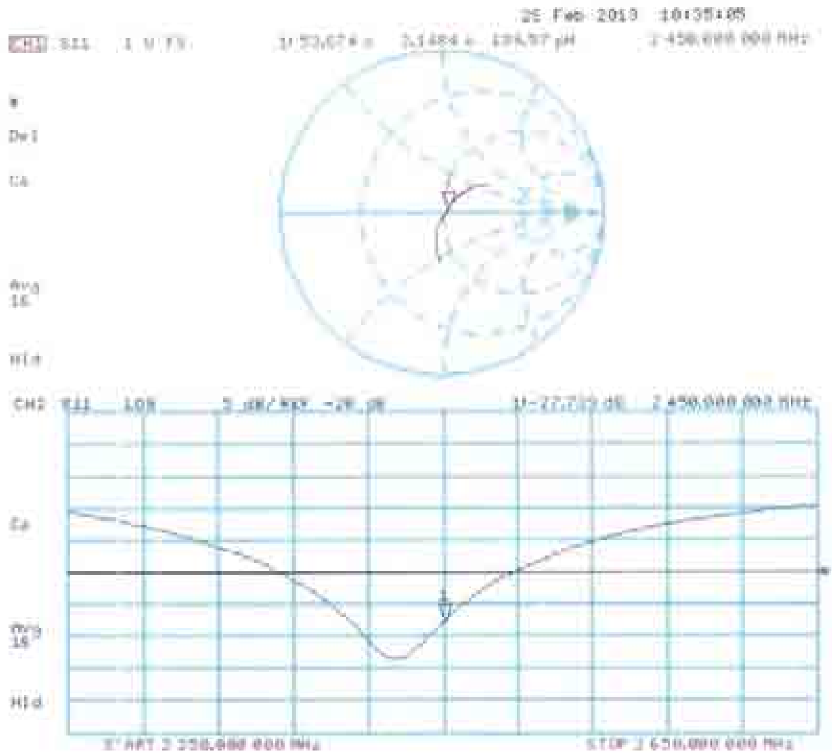
DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**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 = 100.8 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 28.4450
**SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.36 mW/g**
Maximum value of SAR (measured) = 17.648 mW/g


0 dB = 17.650mW/g = 24.93 dB mW/g

Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 29.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

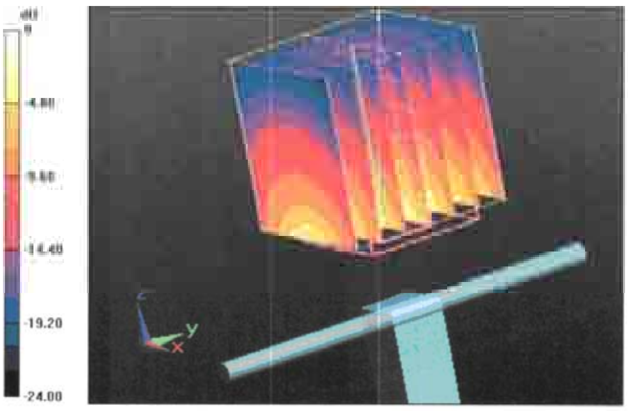
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 884**

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma$ = 2.02 mho/m; $\varepsilon_r$ = 52.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

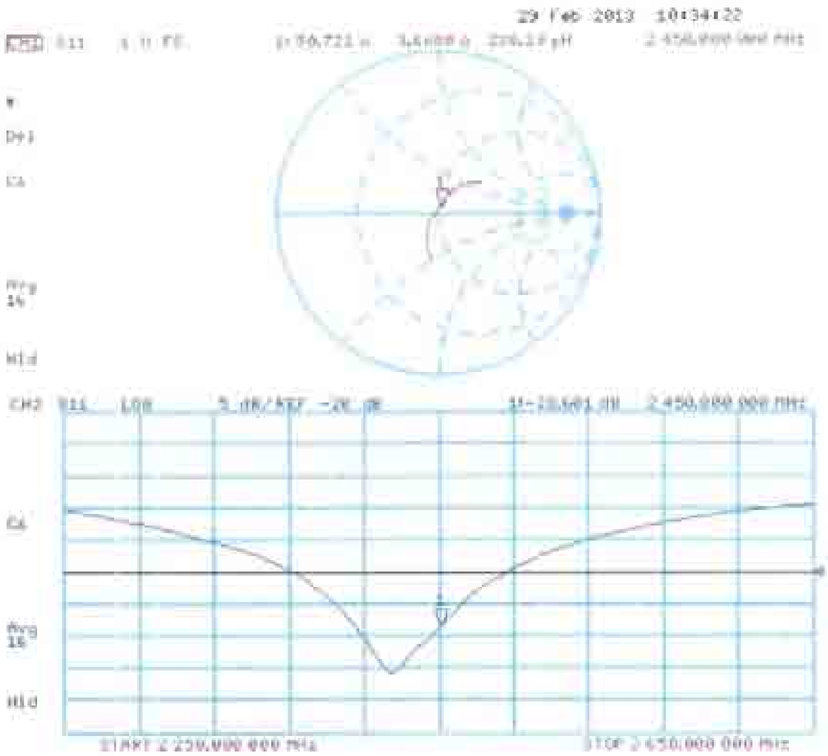
- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2012
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**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 = 94.956 V/m; Power Drift = 0.0027 dB
Peak SAR (extrapolated) = 26.2360
**SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.98 mW/g**
Maximum value of SAR (measured) = 16.972 mW/g




0 dB = 16.970mW/g = 24.59 dB mW/g

**Impedance Measurement Plot for Body TSL**



## 6.5. DAE4 Calibration Ceriticate

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

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C Service suisse d'étalonnage
S Servizio svizzero di taratura
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 **CIQ SZ (Auden)**

Certificate No: **DAE4-1315_Feb13**

# CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BJ - SN: 1315

Calibration procedure(s): QA CAL-06.v24
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: February 27, 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 (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Keithley Multimeter Type 2001 | SN: 0810278 | 28-Sep-12 (No:11450) | Sep-13 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Calibrator Box V2.1 | SE UWS 053 AA 1001 | 05-Jan-12 (in house check) | In house check: Jan-13 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Andrea Guntli | Technician | |
| Approved by: | Fin Bomholt | R&D Director | i.V. |

Issued: February 27, 2013

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

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

S Schweizerischer Kalibrierdienst
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

## 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 following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

## 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** | 405.194 ± 0.1% (k=2) | 405.031 ± 0.1% (k=2) | 405.006 ± 0.1% (k=2) |
| **Low Range** | 4.00179 ± 0.7% (k=2) | 3.99504 ± 0.7% (k=2) | 4.00535 ± 0.7% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 20.0 ° ± 1 ° |

## Appendix

### 1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 199993.07 | -0.46 | -0.00 |
| Channel X | + Input | 19998.21 | 0.29 | 0.00 |
| Channel X | - Input | -19997.04 | 5.94 | -0.03 |
| Channel Y | + Input | 199992.78 | -1.05 | -0.00 |
| Channel Y | + Input | 19995.99 | -1.88 | -0.01 |
| Channel Y | - Input | -20001.41 | 1.50 | -0.01 |
| Channel Z | + Input | 199996.23 | 3.02 | 0.00 |
| Channel Z | + Input | 19996.75 | -0.72 | -0.00 |
| Channel Z | - Input | -20003.50 | -0.24 | 0.00 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 1999.32 | -1.73 | -0.09 |
| Channel X | + Input | 200.22 | -1.03 | -0.51 |
| Channel X | - Input | -198.55 | 0.32 | -0.16 |
| Channel Y | + Input | 1997.53 | -3.28 | -0.16 |
| Channel Y | + Input | 199.64 | -1.21 | -0.60 |
| Channel Y | - Input | -199.77 | -0.78 | 0.39 |
| Channel Z | + Input | 1997.90 | -2.04 | -0.10 |
| Channel Z | + Input | 199.23 | -1.21 | -0.61 |
| Channel Z | - Input | -200.63 | -1.12 | 0.56 |

### 2. Common mode sensitivity

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

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|---|---|---|---|
| Channel X | 200 | -1.10 | -3.09 |
| | - 200 | 4.35 | 3.23 |
| Channel Y | 200 | -22.09 | -22.46 |
| | - 200 | 21.74 | 22.31 |
| Channel Z | 200 | -4.46 | -4.92 |
| | - 200 | 3.65 | 2.86 |

### 3. Channel separation

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

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|---|---|---|---|---|
| Channel X | 200 | - | -2.62 | -3.29 |
| Channel Y | 200 | 6.73 | - | -2.17 |
| Channel Z | 200 | 8.11 | 5.38 | - |

## 4. AD-Converter Values with inputs shorted

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

| | High Range (LSB) | Low Range (LSB) |
|---|---|---|
| Channel X | 16132 | 15682 |
| Channel Y | 16251 | 15151 |
| Channel Z | 15551 | 15659 |

## 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

| | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|---|---|---|---|---|
| Channel X | 1.32 | 0.22 | 2.38 | 0.46 |
| Channel Y | -1.23 | -2.04 | -0.58 | 0.36 |
| Channel Z | -1.89 | -3.56 | -1.12 | 0.39 |

## 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

## 7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|---|---|---|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

## 8. Low Battery Alarm Voltage (Typical values for information)

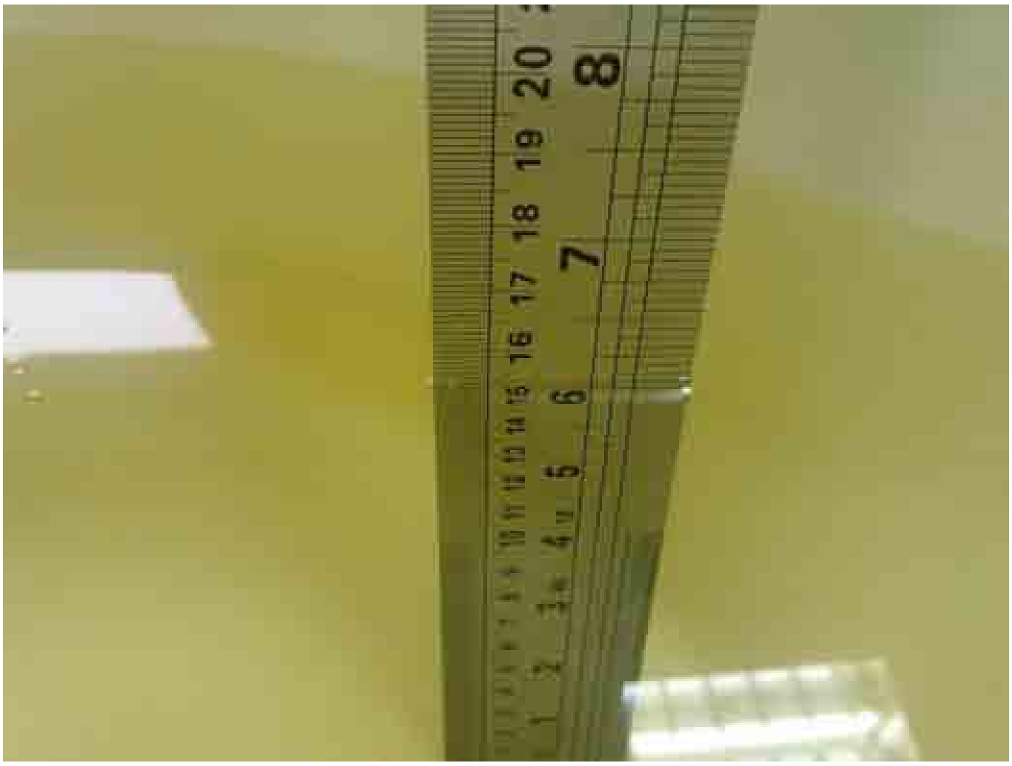
| Typical values | Alarm Level (VDC) |
|---|---|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

## 9. Power Consumption (Typical values for information)

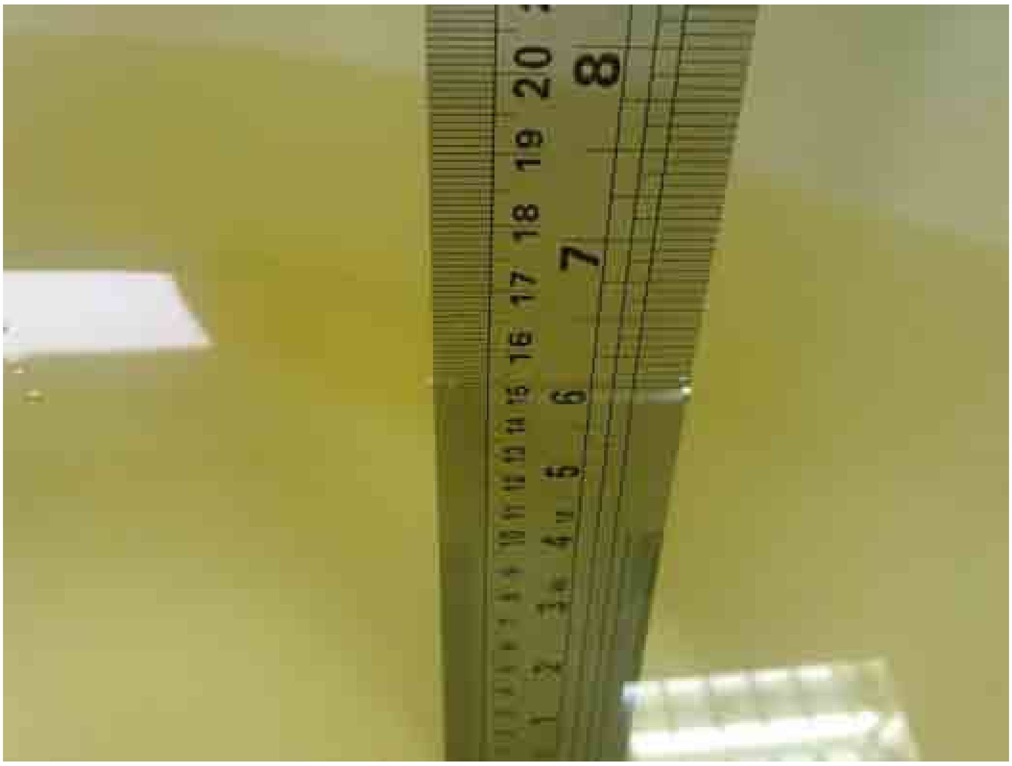
| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|---|---|---|---|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |

# 7. Test Setup Photos

Liquid depth in the Flat Phantom (835MHz)

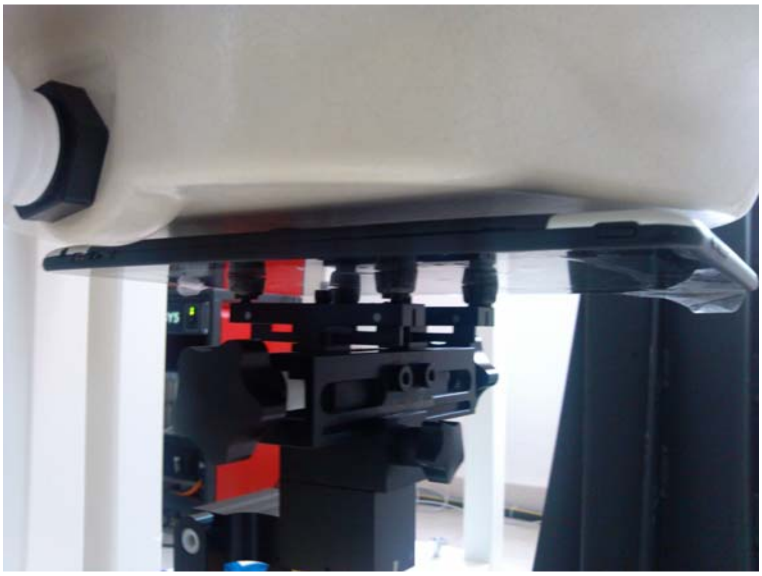


Liquid depth in the Flat Phantom (1900MHz)



Liquid depth in the Flat Phantom (2450MHz)

Top Side Setup Photo(The distance between phantom was 0mm)



Back Side Setup Photo(The distance between phantom was 0mm)

# 8. External and Internal Photos of the EUT

## External Photos


....................End of Report.........................