



SAR TEST REPORT

| | |
|----------------------|--------------------|
| Product Name | Tablet |
| Model | P1640 |
| FCC ID | VOB-P1640 |
| Client | NVIDIA CORPORATION |
| Manufacturer | NVIDIA CORPORATION |
| Date of issue | August 29, 2013 |

TA Technology (Shanghai) Co., Ltd.

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GENERAL SUMMARY

| | |
|------------------------------|---|
| Reference Standard(s) | <p>FCC 47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices</p> <p>ANSI C95.1, 1992: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1991)</p> <p>KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r01: SAR Measurement Requirements for 100 MHz to 6 GHz</p> <p>KDB 447498 D01 General RF Exposure Guidance v05r01: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies</p> <p>KDB 616217 D04 SAR for laptop and tablets v01r01: SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers</p> <p>KDB 248227 D01 SAR meas for 802 11 a b g v01r02: SAR Measurement Procedures for 802.11a/b/g Transmitters.</p> |
| Conclusion | <p>This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 7 of this test report are below limits specified in the relevant standards for the tested bands only.</p> <p>General Judgment: Pass</p> |
| Comment | <p>The test result only responds to the measured sample.</p> |

Approved by
Director

Revised by
SAR Manager

Performed by
SAR Engineer

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1. General Information

1.1. Notes of the Test Report

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

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

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

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

1.2. Testing Laboratory

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1.3. Applicant Information

Company: NVIDIA CORPORATION
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City: SANTA CLARA
Postal Code: 95050
Country: USA

1.4. Manufacturer Information

Company: NVIDIA CORPORATION
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City: SANTA CLARA
Postal Code: 95050
Country: USA

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1.5. Information of EUT

General Information

| | | |
|--|--|----------------|
| Device Type: | Portable Device | |
| Exposure Category: | Uncontrolled Environment /General Population | |
| State of Sample: | Prototype Unit | |
| IMEI: | / | |
| Hardware Version: | A03 | |
| Software Version: | / | |
| Antenna Type: | Internal Antenna | |
| Device Operating Configurations: | | |
| Supporting Mode(s): | 802.11b/g/nHT20; (tested) | |
| | 802.11nHT40; (untested) | |
| | Bluetooth; (untested) | |
| Test Frequency Range(s): | Mode | Tx (MHz) |
| | 802.11b/g/nHT20 | 2412 ~ 2462MHz |
| Test Channel: (Low - Middle - High) | 1-6-11 (802.11b/g/nHT20) | |

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Auxiliary Equipment Details

AE1: Battery

Model: 32102102
Manufacturer: YOKU ENERGY LIMITED
S/N: /

Equipment under Test (EUT) has an internal antenna for BT/WiFi antenna that can be used for Tx/Rx and a GPS antenna that can be used for Rx. The detail about EUT is in chapter 1.5 in this report. During SAR test of the EUT, SAR is tested for 802.11b/g/n channels.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

1.6. The Maximum Reported SAR_{1g} Values

Body SAR Configuration

| Mode | Test Position | Channel /Frequency(MHz) | Limit SAR _{1g} 1.6 W/kg | |
|---------|-------------------------------|-------------------------|-----------------------------------|-----------------------------------|
| | | | Measured SAR _{1g} (W/kg) | Reported SAR _{1g} (W/kg) |
| 802.11b | Back Side/ Test Position 1 | 1/2412 | 1.010 | 1.356 |

1.7. Test Date

The test performed on August 22, 2013.

2. SAR Measurements System Configuration

2.1. SAR Measurement Set-up

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

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

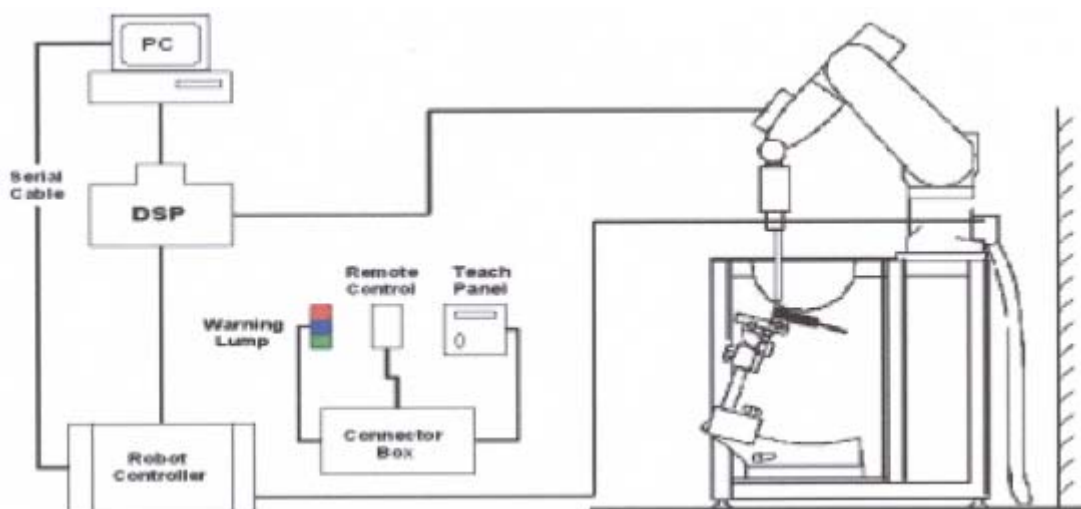


Figure 1. SAR Lab Test Measurement Set-up

2.2. DASY5 E-field Probe System

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

2.2.1. EX3DV4 Probe Specification

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



Figure 2. EX3DV4 E-field Probe



Figure 3. EX3DV4 E-field probe

2.2.2. E-field Probe Calibration

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

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

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

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

Where: Δt = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
 ΔT = Temperature increase due to RF exposure.
Or

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

Where:
 σ = Simulated tissue conductivity,
 ρ = Tissue density (kg/m³).

2.3. Other Test Equipment

2.3.1. Device Holder for Transmitters

Construction: Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

Material: POM, Acrylic glass, Foam

2.3.2. Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue-simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

| | |
|-----------------|--------------------------|
| Shell Thickness | 2±0.2 mm |
| Filling Volume | Approx. 30 liters |
| Dimensions | 190×600×0 mm (H x L x W) |



Figure 4. ELI4 Phantom

2.4. Scanning Procedure

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

- The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 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

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

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

- **Zoom Scan**

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

- **Spatial Peak Detection**

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

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

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

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

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

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

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

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

2.5. Data Storage and Evaluation

2.5.1. Data Storage

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

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

2.5.2. Data Evaluation by SEMCAD

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

| | | |
|--------------------|---------------------------|--|
| Probe parameters: | - Sensitivity | Normi, a _{i0} , a _{i1} , a _{i2} |
| | - Conversion factor | ConvF _i |
| | - Diode compression point | Dcp _i |
| Device parameters: | - Frequency | f |
| | - Crest factor | cf |
| Media parameters: | - Conductivity | |
| | - Density | |

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

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

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for

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peak power. The formula for each channel can be given as:

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

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

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

cf = crest factor of exciting field (DASY parameter)

dcp_i = diode compression point (DASY parameter)

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

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

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

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

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

$ConvF$ = sensitivity enhancement in solution

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

f = carrier frequency [GHz]

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

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

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

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

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

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

with SAR = local specific absorption rate in mW/g

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

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. The power flow density is calculated assuming the excitation field to be a free space field.

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm²

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

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

3. Laboratory Environment

Table 2: The Requirements of the Ambient Conditions

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

4. Tissue-equivalent Liquid

4.1. Tissue-equivalent Liquid Ingredients

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

Table 3: Composition of the Body Tissue Equivalent Matter

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

4.2. Tissue-equivalent Liquid Properties

Table 4: Dielectric Performance of Tissue Simulating Liquid

| Frequency | Test Date | Temp °C | Measured Dielectric Parameters | | Target Dielectric Parameters | | Limit (Within $\pm 5\%$) | |
|-------------------|-----------|------------|--------------------------------|----------------|------------------------------|----------------|------------------------------|---------------------|
| | | | ϵ_r | σ (s/m) | ϵ_r | σ (s/m) | Dev ϵ_r (%) | Dev σ (%) |
| 2450MHz (body) | 2013-8-22 | 21.5 | 52.14 | 1.99 | 52.70 | 1.95 | -1.06 | 2.05 |

5. System Check

5.1. Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 5.

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

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

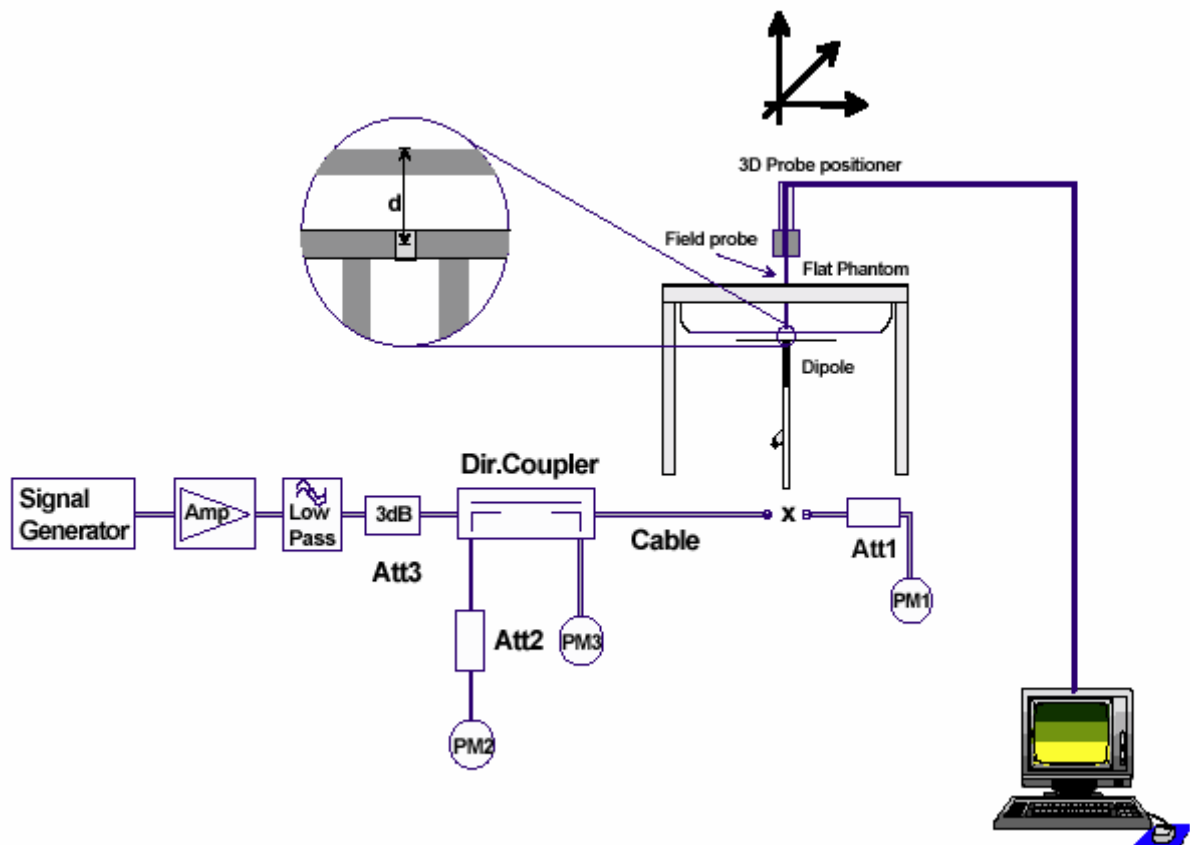


Figure 5. System Check Set-up

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Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

| | | | | |
|------------------------|-----------------|------------|------------------------|----------------|
| Dipole D2450V2 SN: 786 | | | | |
| Body Liquid | | | | |
| Date of Measurement | Return Loss(dB) | Δ % | Impedance (Ω) | $\Delta\Omega$ |
| 8/29/2011 | -29.0 | / | 50.4 | / |
| 8/28/2012 | -29.9 | 3.1% | 52.1 | 1.7 Ω |

5.2. System Check Results

Table 5: System Check for Body Tissue Simulating Liquid

| Frequency | Test Date | Dielectric Parameters | | Temp | 250mW Measured SAR _{1g} | 1W Normalized SAR _{1g} | 1W Target SAR _{1g} | Limit ($\pm 10\%$ Deviation) |
|-----------|-----------|-----------------------|----------------|-----------------|----------------------------------|---------------------------------|-----------------------------|-------------------------------|
| | | ϵ_r | σ (s/m) | ($^{\circ}$ C) | (W/kg) | | | |
| 2450MHz | 2013-8-22 | 52.14 | 1.99 | 21.5 | 13.20 | 52.80 | 51.70 | 2.13 |

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

6. Operational Conditions during Test

6.1. General Description of Test Procedures

For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal. The Tx power is set to 18 for 802.11 b/g/n mode by software. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.

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

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

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

6.2. Measurement Variability

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

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

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

6.3. Test Position

6.3.1. Test Positions Requirements

The overall diagonal dimension of the display section of a tablet is 22.5 cm > 20 cm, Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. SAR evaluation for the front surface of tablet display screens are generally not necessary. The SAR Exclusion Threshold in KDB 447498 D01 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

6.3.2. SAR test reduction and exclusion guidance

(1) The SAR exclusion threshold for distances <50mm is defined by the following equation:

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

(2) The SAR exclusion threshold for distances >50mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:

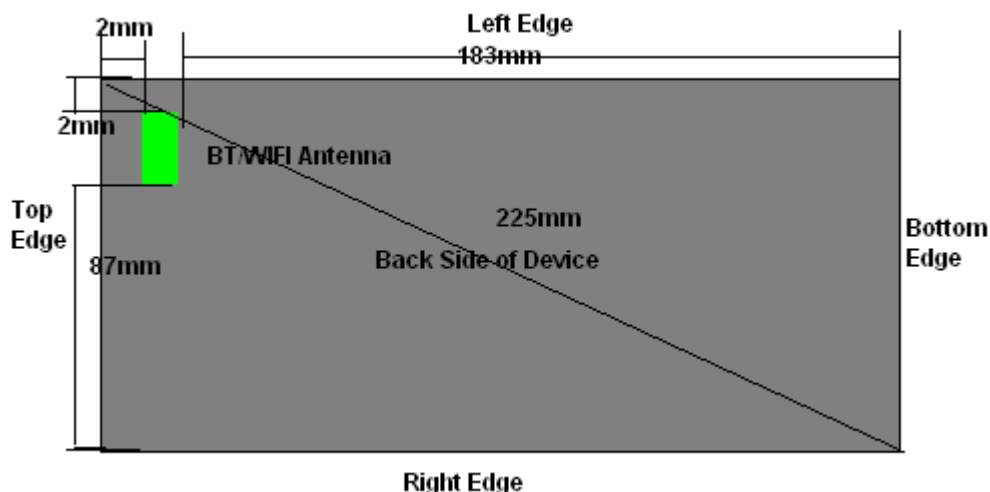
a) at 100 MHz to 1500 MHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{(MHz)}}/150)] \text{ mW}$$

b) at > 1500 MHz and ≤ 6 GHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$$

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



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- Test Position 1: The back surface of the EUT towards to the bottom of the flat phantom. (ANNEX G Picture 4).
SAR is required for wifi antenna in this position.
SAR is not required for BT antenna in this position.
Test Position 1 Evaluation $_{(BT)} = [10^{(4.04/10)}/5] * (2.480^{1/2}) = 0.80 < 3.0$
Test Position 1 Evaluation $_{(wifi)} = [10^{(17.03/10)}/5] * (2.462^{1/2}) = 15.83 > 3.0$
- Test Position 2: The front surface of the EUT towards the bottom of the flat phantom.
SAR evaluation for the front surface of tablet display screens are generally not necessary
- Test Position 3: The left edge of the EUT towards the bottom of the flat phantom. (ANNEX G Picture 5).
SAR is required for wifi antenna in this position.
SAR is not required for BT antenna in this position.
Test Position 3 Evaluation $_{(BT)} = [10^{(4.04/10)}/5] * (2.480^{1/2}) = 0.80 < 3.0$
Test Position 3 Evaluation $_{(wifi)} = [10^{(17.03/10)}/5] * (2.462^{1/2}) = 15.83 > 3.0$
- Test Position 4: The right edge of the EUT towards the bottom of the flat phantom.
SAR is not required for wifi/BT antenna in this position.
Test Position 4 Evaluation $_{(BT)} = 96 + (87-50)*10 = 1426\text{mW} = 26.68 \text{ dBm} > 4.04 \text{ dBm (max.power)}$
Test Position 4 Evaluation $_{(wifi)} = 96 + (87-50)*10 = 466\text{mW} = 26.68 \text{ dBm} > 17.03 \text{ dBm (max.power)}$
- Test Position 5: The top edge of the EUT towards the bottom of the flat phantom. (ANNEX G Picture 6).
SAR is required for wifi antenna in this position.
SAR is not required for BT antenna in this position.
Test Position 5 Evaluation $_{(BT)} = [10^{(4.04/10)}/5] * (2.480^{1/2}) = 0.80 < 3.0$
Test Position 5 Evaluation $_{(wifi)} = [10^{(17.03/10)}/5] * (2.462^{1/2}) = 15.83 > 3.0$
- Test Position 6: The bottom edge of the EUT towards the bottom of the flat phantom.
SAR is not required for wifi/BT antenna in this position.
Test Position 6 Evaluation $_{(BT)} = 96 + (183-50)*10 = 1426\text{mW} = 31.54 \text{ dBm} > 4.04 \text{ dBm (max.power)}$
Test Position 6 Evaluation $_{(wifi)} = 96 + (183-50)*10 = 1426\text{mW} = 31.54 \text{ dBm} > 17.03 \text{ dBm (max.power)}$

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7. Test Results

7.1. Conducted Power Results

Table 6: Conducted Power Measurement Results(WIFI)

| Mode | Channel | Data rate (Mbps) | AV Power (dBm) |
|------|---------|------------------|----------------|
| 11b | 1 | 1 | 14.72 |
| | | 2 | 14.77 |
| | | 5.5 | 14.81 |
| | | 11 | 14.89 |
| | 6 | 1 | 14.78 |
| | | 2 | 14.82 |
| | | 5.5 | 14.86 |
| | | 11 | 14.92 |
| | 11 | 1 | 14.81 |
| | | 2 | 14.85 |
| | | 5.5 | 14.9 |
| | | 11 | 14.95 |
| 11g | 1 | 6 | 7.63 |
| | | 9 | 7.65 |
| | | 12 | 7.69 |
| | | 18 | 7.71 |
| | | 24 | 7.76 |
| | | 36 | 7.78 |
| | | 48 | 7.83 |
| | | 54 | 7.85 |
| | 6 | 6 | 15.92 |
| | | 9 | 15.95 |
| | | 12 | 16 |
| | | 18 | 16.03 |
| | | 24 | 16.08 |
| | | 36 | 16.11 |
| | | 48 | 16.13 |
| | | 54 | 16.18 |

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| | | | | |
|----------|----------|------|-------|-------|
| | 11 | 6 | 9.86 | |
| | | 9 | 9.91 | |
| | | 12 | 9.95 | |
| | | 18 | 9.97 | |
| | | 24 | 10.02 | |
| | | 36 | 10.06 | |
| | | 48 | 10.11 | |
| | | 54 | 10.15 | |
| 11n HT20 | 1 | MCS0 | 8.17 | |
| | | MCS1 | 8.19 | |
| | | MCS2 | 8.22 | |
| | | MCS3 | 8.26 | |
| | | MCS4 | 8.33 | |
| | | MCS5 | 8.36 | |
| | | MCS6 | 8.4 | |
| | | MCS7 | 8.43 | |
| | 6 | MCS0 | 16.03 | |
| | | MCS1 | 16.06 | |
| | | MCS2 | 16.09 | |
| | | MCS3 | 16.13 | |
| | | MCS4 | 16.17 | |
| | | MCS5 | 16.2 | |
| | | MCS6 | 16.25 | |
| | | MCS7 | 16.29 | |
| | 11 | MCS0 | 10.06 | |
| | | MCS1 | 10.09 | |
| | | MCS2 | 10.13 | |
| | | MCS3 | 10.17 | |
| | | MCS4 | 10.21 | |
| | | MCS5 | 10.25 | |
| | | MCS6 | 10.28 | |
| | | MCS7 | 10.32 | |
| | 11n HT40 | 3 | MCS0 | 9.96 |
| | | | MCS1 | 9.98 |
| | | | MCS2 | 10.01 |

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| | | | |
|--|---|------|-------|
| | | MCS3 | 10.05 |
| | | MCS4 | 10.08 |
| | | MCS5 | 10.13 |
| | | MCS6 | 10.16 |
| | | MCS7 | 10.19 |
| | 6 | MCS0 | 13.62 |
| | | MCS1 | 13.65 |
| | | MCS2 | 13.7 |
| | | MCS3 | 13.76 |
| | | MCS4 | 13.79 |
| | | MCS5 | 13.82 |
| | | MCS6 | 13.86 |
| | | MCS7 | 13.89 |
| | 9 | MCS0 | 9.69 |
| | | MCS1 | 9.73 |
| | | MCS2 | 9.78 |
| | | MCS3 | 9.82 |
| | | MCS4 | 9.88 |
| | | MCS5 | 9.92 |
| | | MCS6 | 9.96 |
| | | MCS7 | 10.01 |

Table 7: Conducted Power Measurement Results (BT)

| Channel | Ch 0 2402 MHz | Ch 39 2441 MHz | Ch 78 2480 MHz |
|----------------|--------------------------|---------------------------|---------------------------|
| GFSK(dBm) | 3.04 | 3.32 | 2.25 |
| 8DPSK(dBm) | -0.14 | -0.16 | -1.11 |

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7.2. SAR Test Results

7.2.1. 802.11b/g/n

Table 8: SAR Values (802.11b/g/n)

| Test Position | Channel/ Frequency (MHz) | Service | Duty Cycle | Maximum Allowed Power (dBm) | Conducted Power (dBm) | Drift ± 0.21dB | | Limit SAR _{1g} 1.6 W/kg | | | |
|--|--------------------------------|---------|---------------|--------------------------------------|-----------------------------|-------------------|---|----------------------------------|---|------------------|--|
| | | | | | | Drift (dB) | Measured SAR _{1g} (W/kg) | Scaling Factor | Reported SAR _{1g} (W/kg) | Graph Results | |
| Test Position of Body for 802.11b(distance 0mm) | | | | | | | | | | | |
| Test Position 1 | 11/2462 | DSSS | 1:1 | 16 | 14.81 | -0.080 | 0.837 | 1.32 | 1.101 | Figure 7 | |
| | 6/2437 | DSSS | 1:1 | 16 | 14.78 | -0.139 | 1.010 | 1.32 | 1.338 | Figure 8 | |
| | 1/2412 | DSSS | 1:1 | 16 | 14.72 | -0.150 | 1.010 | 1.34 | 1.356 | Figure 9 | |
| Test Position 2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| Test Position 3 | 11/2462 | DSSS | 1:1 | 16 | 14.81 | 0.024 | 0.565 | 1.32 | 0.743 | Figure 10 | |
| Test Position 4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| Test Position 5 | 11/2462 | DSSS | 1:1 | 16 | 14.81 | 0.025 | 0.222 | 1.32 | 0.292 | Figure 11 | |
| Test Position 6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| Test Position of Body for 802.11g(distance 0mm) | | | | | | | | | | | |
| Test Position 1 | 6/2437 | DSSS | 1:1 | 16.5 | 15.92 | 0.051 | 0.920 | 1.14 | 1.051 | Figure 12 | |
| Test Position of Body for 802.11n(distance 0mm) | | | | | | | | | | | |
| Test Position 1 | 6/2437 | DSSS | 1:1 | 17.03 | 16.03 | 0.033 | 0.922 | 1.26 | 1.161 | Figure 13 | |
| Worst Case Position of Body 1st Repeated SAR(distance 0mm) | | | | | | | | | | | |
| Test Position 1 | 1/2412 | DSSS | 1:1 | 16 | 14.72 | 0.033 | 0.942 | 1.34 | 1.265 | Figure 14 | |

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

2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3. KDB 248227-SAR is not required for 802.11g/n channels when the maximum average output power is less than ¼ dB higher than measured on the corresponding 802.11b channels.

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Table 9: SAR Measurement Variability Results [802.11b]

| Test Position | Channel/ Frequency (MHz) | Measured SAR (1g) | 1 st Repeated SAR (1g) | Ratio | 2 nd Repeated SAR (1g) | 3 rd Repeated SAR (1g) |
|-----------------|--------------------------------|----------------------|---|-------|---|---|
| Test Position 1 | 1/2412 | 1.010 | 0.942 | 1.07 | N/A | N/A |

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

7.2.2. Simultaneous SAR

WIFI antenna and BT antenna can't be simultaneous transmission.

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8. 700MHz to 3GHz Measurement Uncertainty

| No. | source | Type | Uncertainty Value (%) | Probability Distribution | k | c _i | Standard uncertainty u _i (%) | Degree of freedom V _{eff} or v _i |
|---------------------|--|------|-----------------------|--------------------------|------------|----------------|---|--|
| 1 | System repetivity | A | 0.5 | N | 1 | 1 | 0.5 | 9 |
| Measurement system | | | | | | | | |
| 2 | -probe calibration | B | 6.0 | N | 1 | 1 | 6.0 | ∞ |
| 3 | -axial isotropy of the probe | B | 4.7 | R | $\sqrt{3}$ | $\sqrt{0.5}$ | 1.9 | ∞ |
| 4 | - Hemispherical isotropy of the probe | B | 9.4 | R | $\sqrt{3}$ | $\sqrt{0.5}$ | 3.9 | ∞ |
| 6 | -boundary effect | B | 1.9 | R | $\sqrt{3}$ | 1 | 1.1 | ∞ |
| 7 | -probe linearity | B | 4.7 | R | $\sqrt{3}$ | 1 | 2.7 | ∞ |
| 8 | - System detection limits | B | 1.0 | R | $\sqrt{3}$ | 1 | 0.6 | ∞ |
| 9 | -readout Electronics | B | 1.0 | N | 1 | 1 | 1.0 | ∞ |
| 10 | -response time | B | 0 | R | $\sqrt{3}$ | 1 | 0 | ∞ |
| 11 | -integration time | B | 4.32 | R | $\sqrt{3}$ | 1 | 2.5 | ∞ |
| 12 | -noise | B | 0 | R | $\sqrt{3}$ | 1 | 0 | ∞ |
| 13 | -RF Ambient Conditions | B | 3 | R | $\sqrt{3}$ | 1 | 1.73 | ∞ |
| 14 | -Probe Positioner Mechanical Tolerance | B | 0.4 | R | $\sqrt{3}$ | 1 | 0.2 | ∞ |
| 15 | -Probe Positioning with respect to Phantom Shell | B | 2.9 | R | $\sqrt{3}$ | 1 | 1.7 | ∞ |
| 16 | -Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation | B | 3.9 | R | $\sqrt{3}$ | 1 | 2.3 | ∞ |
| Test sample Related | | | | | | | | |
| 17 | -Test Sample Positioning | A | 2.9 | N | 1 | 1 | 2.9 | 71 |
| 18 | -Device Holder Uncertainty | A | 4.1 | N | 1 | 1 | 4.1 | 5 |
| 19 | -Output Power Variation - SAR drift measurement | B | 5.0 | R | $\sqrt{3}$ | 1 | 2.9 | ∞ |
| Physical parameter | | | | | | | | |
| 20 | -phantom Uncertainty | B | 4.0 | R | $\sqrt{3}$ | 1 | 2.3 | ∞ |
| 21 | -liquid conductivity (deviation from target) | B | 5.0 | R | $\sqrt{3}$ | 0.64 | 1.8 | ∞ |

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| | | | | | | | | |
|--|--|--|-----|---|------------|-------|-------|----------|
| 22 | -liquid conductivity (measurement uncertainty) | B | 2.5 | N | 1 | 0.64 | 1.6 | 9 |
| 23 | -liquid permittivity (deviation from target) | B | 5.0 | R | $\sqrt{3}$ | 0.6 | 1.7 | ∞ |
| 24 | -liquid permittivity (measurement uncertainty) | B | 2.5 | N | 1 | 0.6 | 1.5 | 9 |
| Combined standard uncertainty | | $u_c = \sqrt{\sum_{i=1}^{24} c_i^2 u_i^2}$ | | | | | 11.50 | |
| Expanded uncertainty (confidence interval of 95 %) | | $u_e = 2u_c$ | | N | k=2 | 23.00 | | |

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9. Main Test Instruments

Table 10: List of Main Instruments

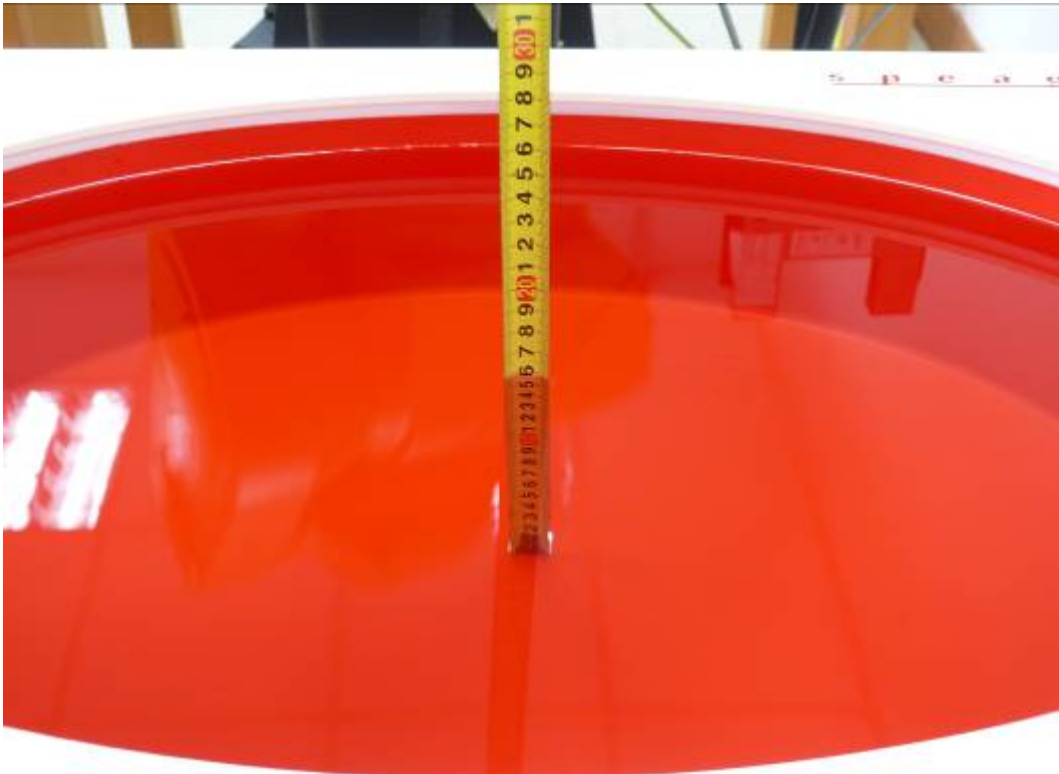
| No. | Name | Type | Serial Number | Calibration Date | Valid Period |
|-----|--------------------------|----------------|---------------|--------------------------|--------------|
| 01 | Network analyzer | Agilent 8753E | US37390326 | September 11, 2012 | One year |
| 02 | Dielectric Probe Kit | Agilent 85070E | US44020115 | No Calibration Requested | |
| 03 | Power meter | Agilent E4417A | GB41291714 | March 10, 2013 | One year |
| 04 | Power sensor | E9327A | US40441622 | January 2, 2013 | One year |
| 05 | Power sensor | Agilent N8481H | MY50350004 | September 24, 2012 | One year |
| 06 | Signal Generator | HP 8341B | 2730A00804 | September 11, 2012 | One year |
| 07 | Amplifier | IXA-020 | 0401 | No Calibration Requested | |
| 08 | E-field Probe | EX3DV4 | 3753 | January 17, 2013 | One year |
| 09 | DAE | DAE4 | 1317 | January 25, 2013 | One year |
| 10 | Validation Kit 2450MHz | D2450V2 | 786 | August 29, 2011 | Two years |
| 11 | Temperature Probe | JM222 | AA1009129 | March 14, 2013 | One year |
| 12 | Hygrothermograph | WS-1 | 64591 | September 27, 2012 | One year |
| 13 | Dual directional coupler | 777D | 50146 | March 25, 2013 | One year |

***END OF REPORT ***

ANNEX A: Test Layout



Picture 1: Specific Absorption Rate Test Layout



Picture 2: Liquid depth in the flat Phantom (2450 MHz, 15.3cm depth)

ANNEX B: System Check Results

System Performance Check at 2450 MHz

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

Date/Time: 8/22/2013 7:32:19AM

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 52.14$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 25.01.2013

Phantom: ELI v4.0; Type: QDOVA001BB;

Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

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

Maximum value of SAR (interpolated) = 17.3 mW/g

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

Reference Value = 90.4 V/m; Power Drift = -0.093 dB

Peak SAR (extrapolated) = 26.1 W/kg

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.27 mW/g

Maximum value of SAR (measured) = 15 mW/g

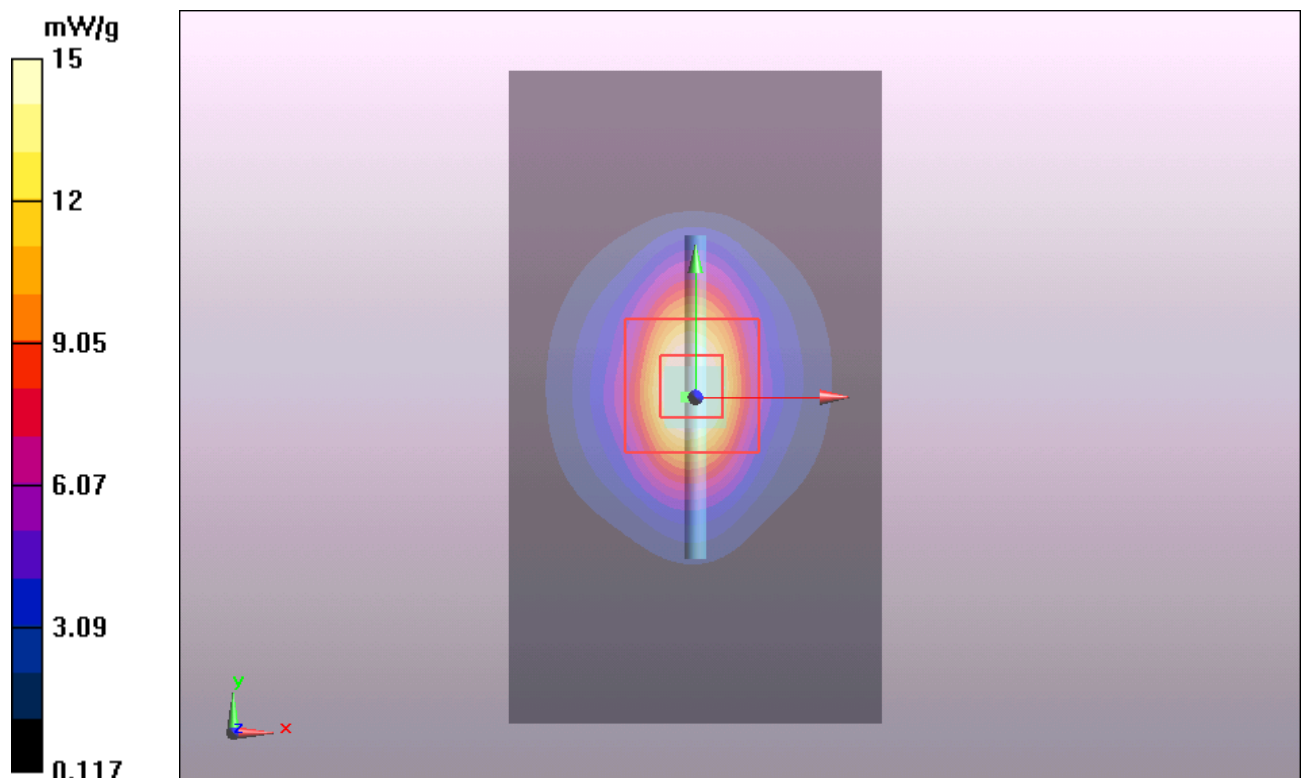


Figure 6 System Performance Check 2450MHz 250mW

ANNEX C: Graph Results

802.11b Test Position 1 High

Date/Time: 8/22/2013 1:45:19 PM

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

Medium parameters used: $f = 2462$ MHz; $\sigma = 2.009$ mho/m; $\epsilon_r = 52.109$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 1 High /Area Scan (151x221x1): Interpolated grid: dx=10 mm, dy=10 mm

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

Test Position 1 High /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.209 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.847 mW/g

SAR(1 g) = 0.873 mW/g; SAR(10 g) = 0.408 mW/g

Maximum value of SAR (measured) = 1.02 W/kg

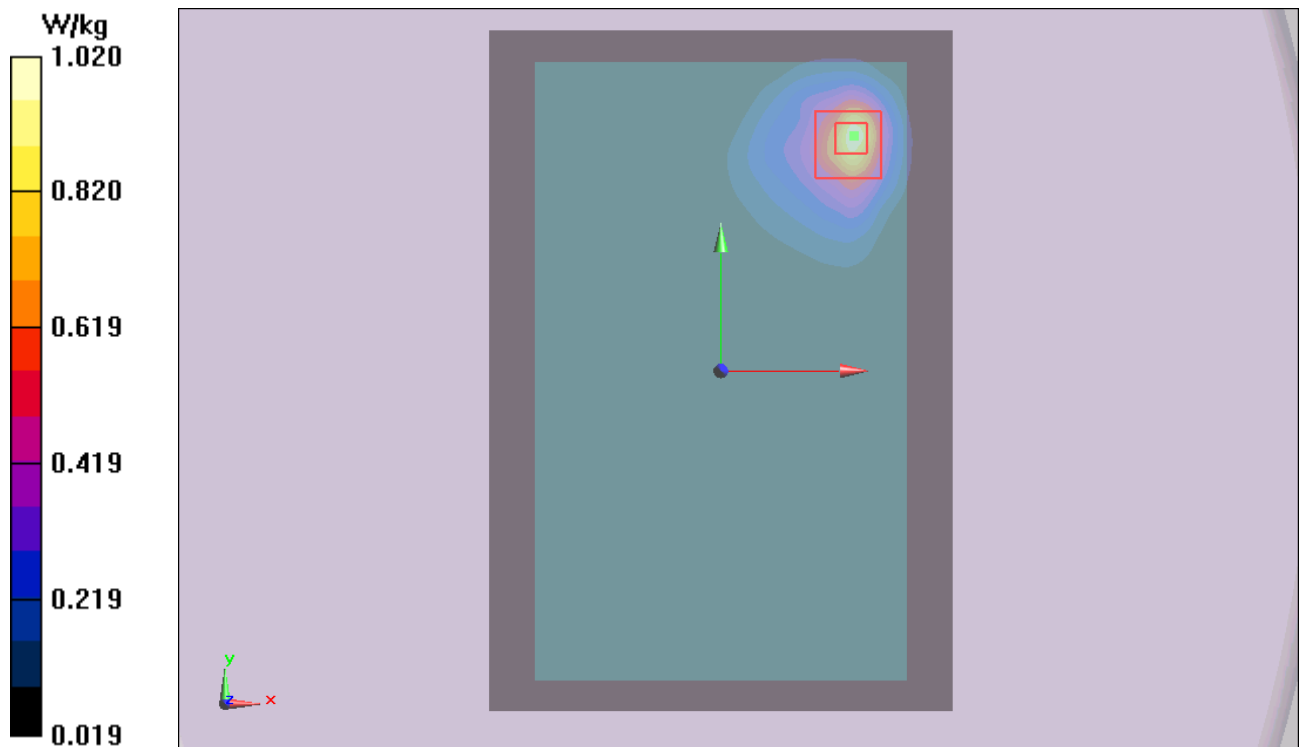


Figure 7 802.11b Test Position 1 Channel 11

802.11b Test Position 1 Middle

Date/Time: 8/22/2013 9:28:00 AM

Communication System: 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.977$ mho/m; $\epsilon_r = 52.177$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 1 Middle /Area Scan (151x221x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.15 W/kg

Test Position 1 Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.943 V/m; Power Drift = -0.139 dB

Peak SAR (extrapolated) = 2.112 mW/g

SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.515 mW/g

Maximum value of SAR (measured) = 1.14 W/kg

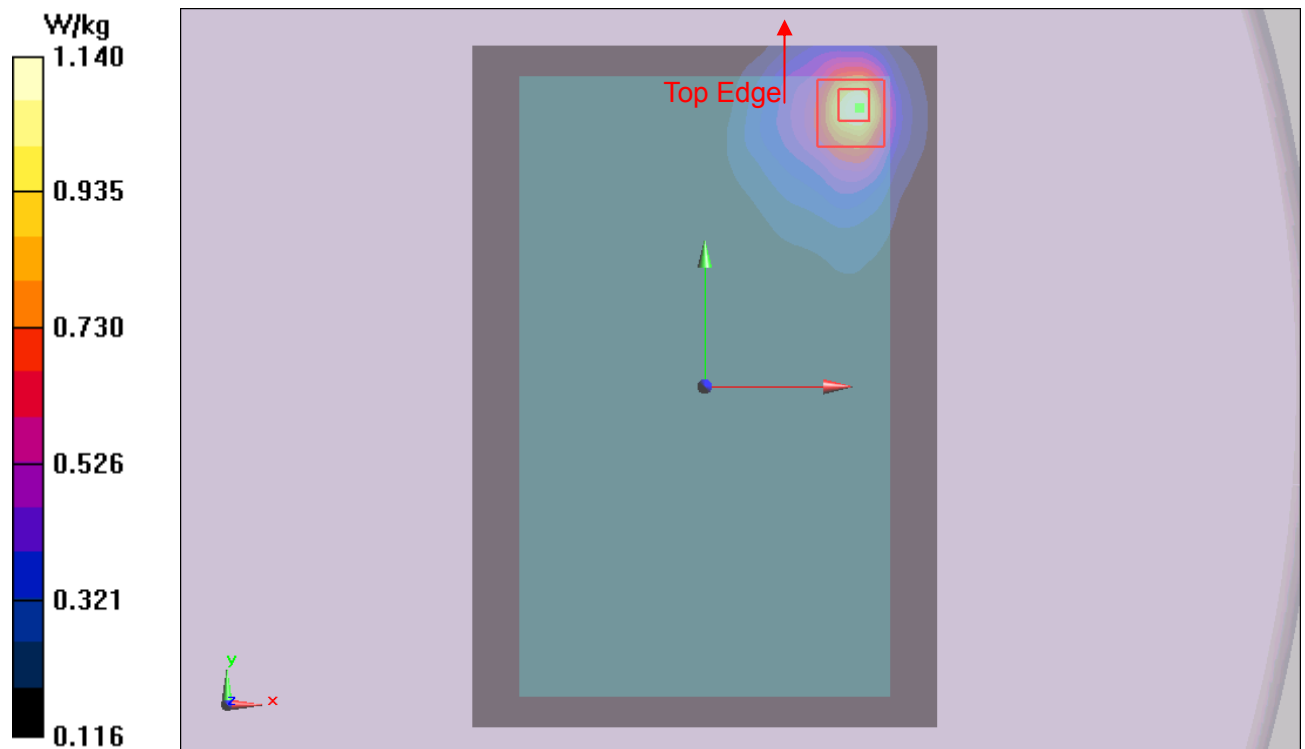


Figure 8 802.11b Test Position 1 Channel 6

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802.11b Test Position 1 Low

Date/Time: 8/22/2013 1:42:06 PM

Communication System: 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.945$ mho/m; $\epsilon_r = 52.239$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 1 Low /Area Scan (151x221x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.10 W/kg

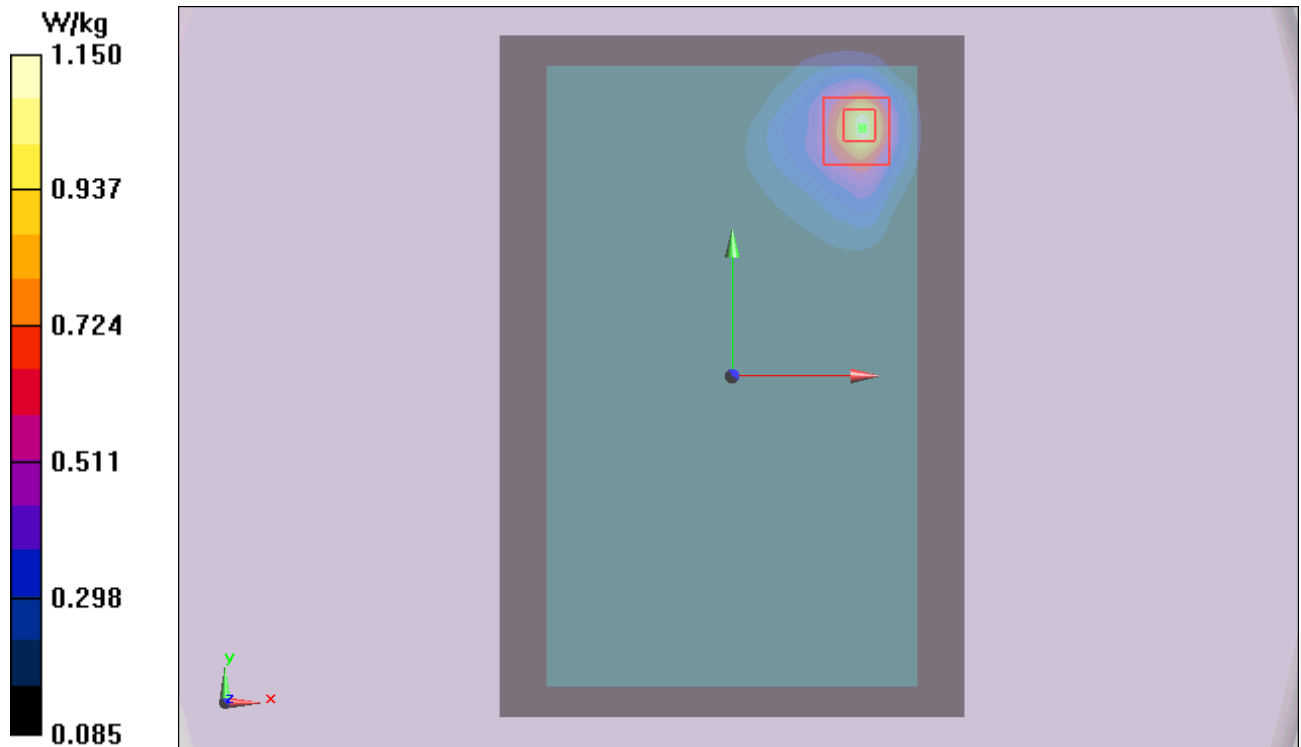
Test Position 1 Low /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.700 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 2.349 mW/g

SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.488 mW/g

Maximum value of SAR (measured) = 1.15 W/kg



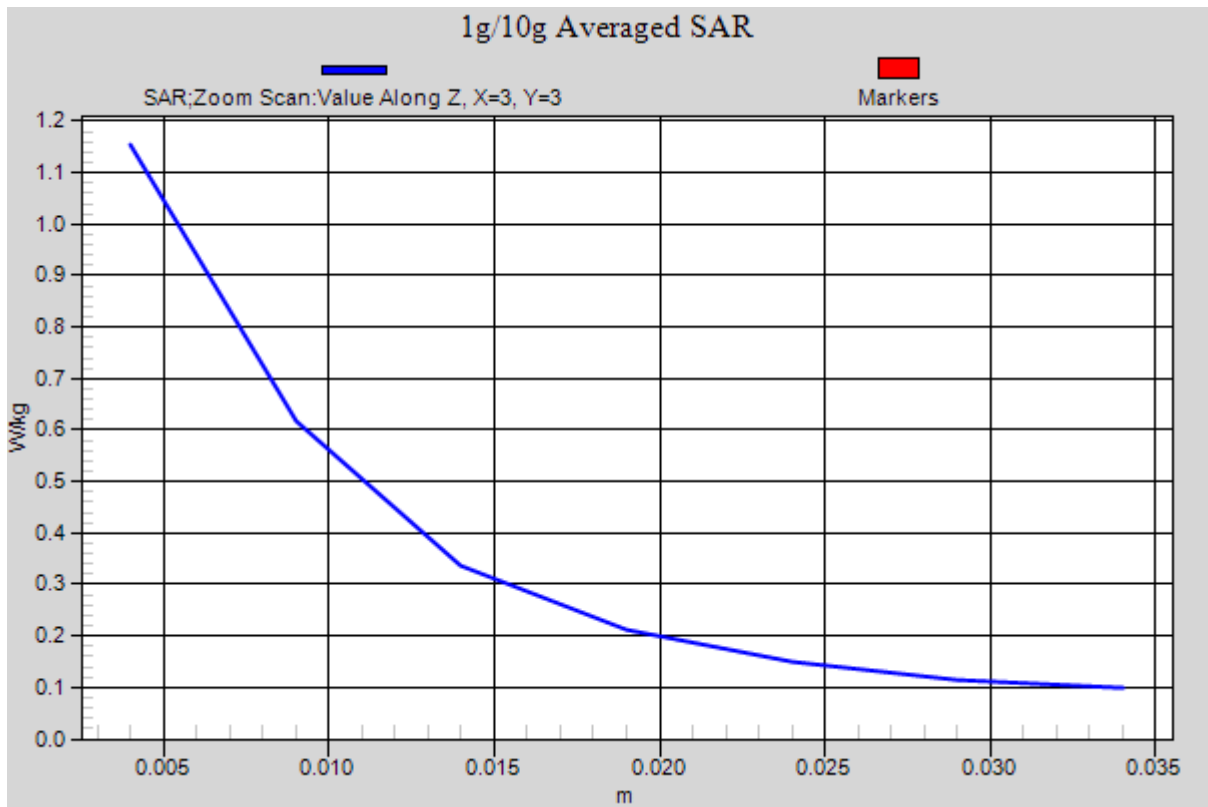


Figure 9 802.11b Test Position 1 Channel 1

802.11b Test Position 3 High

Date/Time: 8/22/2013 2:59:08 PM

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

Medium parameters used: $f = 2462$ MHz; $\sigma = 2.009$ mho/m; $\epsilon_r = 52.109$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 3 High /Area Scan (41x221x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.781 W/kg

Test Position 3 High /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.048 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 1.270 mW/g

SAR(1 g) = 0.565 mW/g; SAR(10 g) = 0.253 mW/g

Maximum value of SAR (measured) = 0.654 W/kg

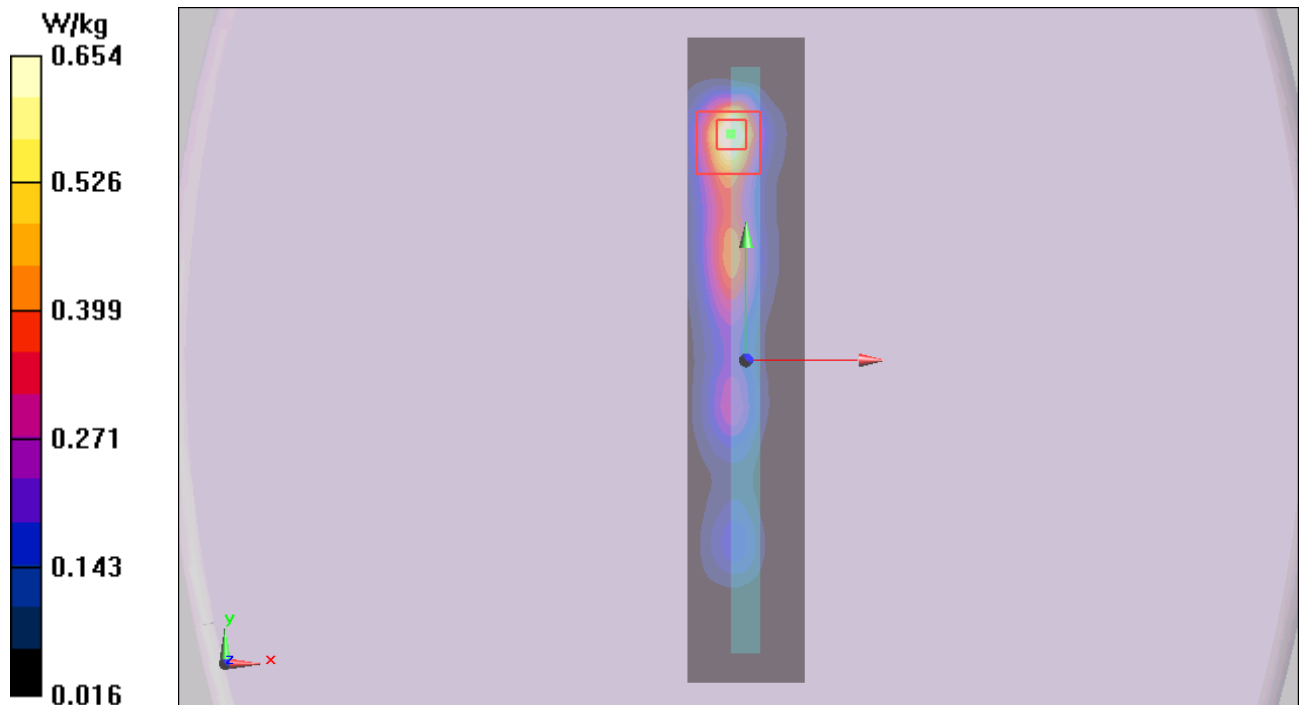


Figure 10 802.11b Test Position 3 Channel 11

802.11b Test Position 5 High

Date/Time: 8/22/2013 3:39:12 PM

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

Medium parameters used: $f = 2462$ MHz; $\sigma = 2.009$ mho/m; $\epsilon_r = 52.109$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 5 High /Area Scan (41x151x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.278 W/kg

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

Reference Value = 6.223 V/m; Power Drift = 0.025 dB

Peak SAR (extrapolated) = 0.501 mW/g

SAR(1 g) = 0.222 mW/g; SAR(10 g) = 0.098 mW/g

Maximum value of SAR (measured) = 0.261 W/kg

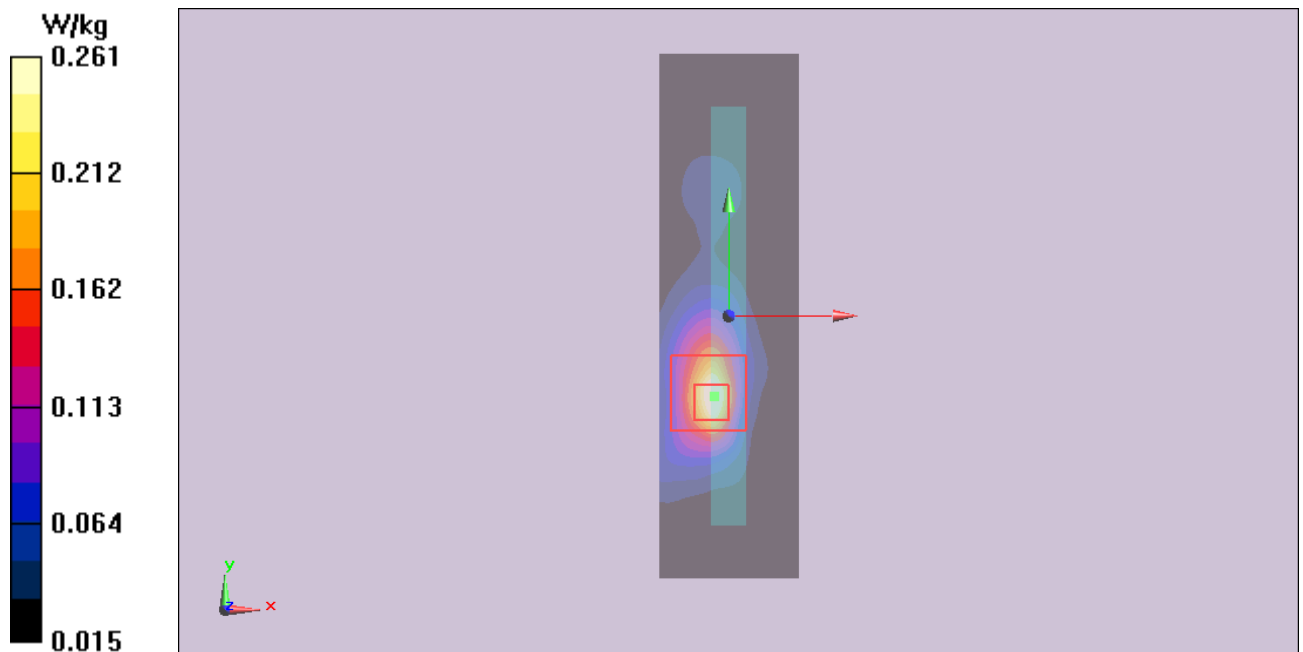


Figure 11 802.11b Test Position 5 Channel 11

802.11g Test Position 1 Middle

Date/Time: 8/22/2013 5:36:54 PM

Communication System: 802.11g; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.977$ mho/m; $\epsilon_r = 52.177$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 1 Middle /Area Scan (151x221x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.10 W/kg

Test Position 1 Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.216 V/m; Power Drift = 0.051 dB

Peak SAR (extrapolated) = 1.969 mW/g

SAR(1 g) = 0.920 mW/g; SAR(10 g) = 0.407 mW/g

Maximum value of SAR (measured) = 1.07 W/kg

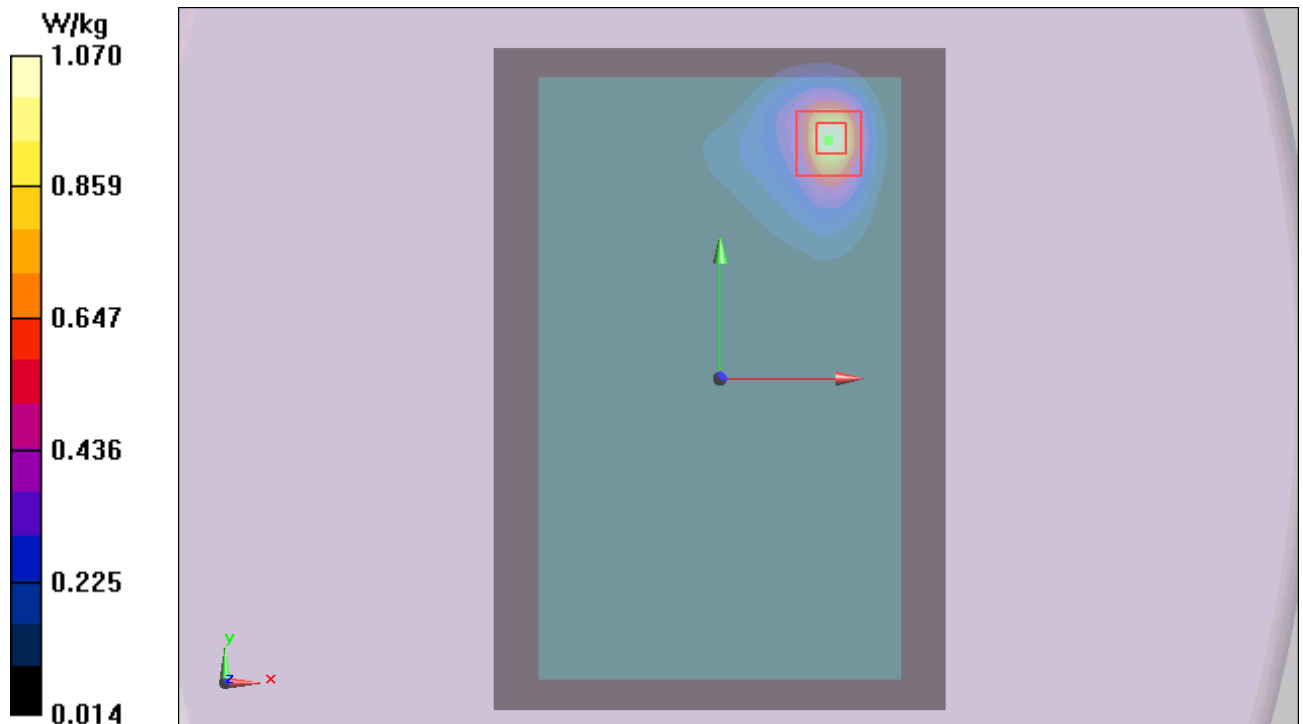


Figure 12 802.11g Test Position 1 Channel 6

802.11n Test Position 1 Middle

Date/Time: 8/22/2013 7:15:00 PM

Communication System: 802.11n HT20; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.977$ mho/m; $\epsilon_r = 52.177$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 1 Middle /Area Scan (151x221x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.04 W/kg

Test Position 1 Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.225 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 1.959 mW/g

SAR(1 g) = 0.922 mW/g; SAR(10 g) = 0.411 mW/g

Maximum value of SAR (measured) = 1.07 W/kg

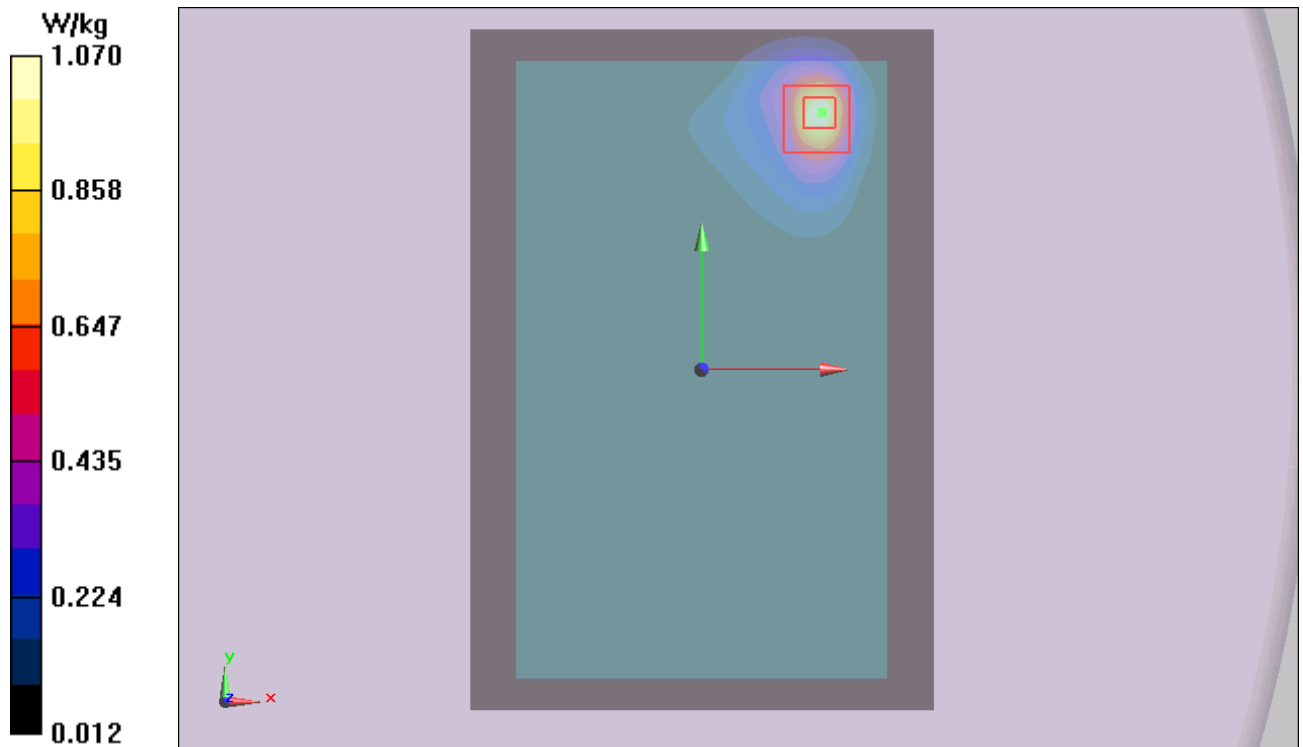


Figure 13 802.11n Test Position 1 Channel 6

802.11b Test Position 1 1st Repeated Low

Date/Time: 8/22/2013 11:40:59 AM

Communication System: 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.945$ mho/m; $\epsilon_r = 52.239$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3753; ConvF(6.90, 6.90, 6.90); Calibrated: 1/17/2013

Electronics: DAE4 Sn1317; Calibrated: 1/25/2013

Phantom: ELI 4.0; Type: QDOVA001BA;

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

Test Position 1 Low /Area Scan (151x221x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 1.14 W/kg

Test Position 1 Low /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.915 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 2.241 mW/g

SAR(1 g) = 0.942 mW/g; SAR(10 g) = 0.463 mW/g

Maximum value of SAR (measured) = 1.07 W/kg

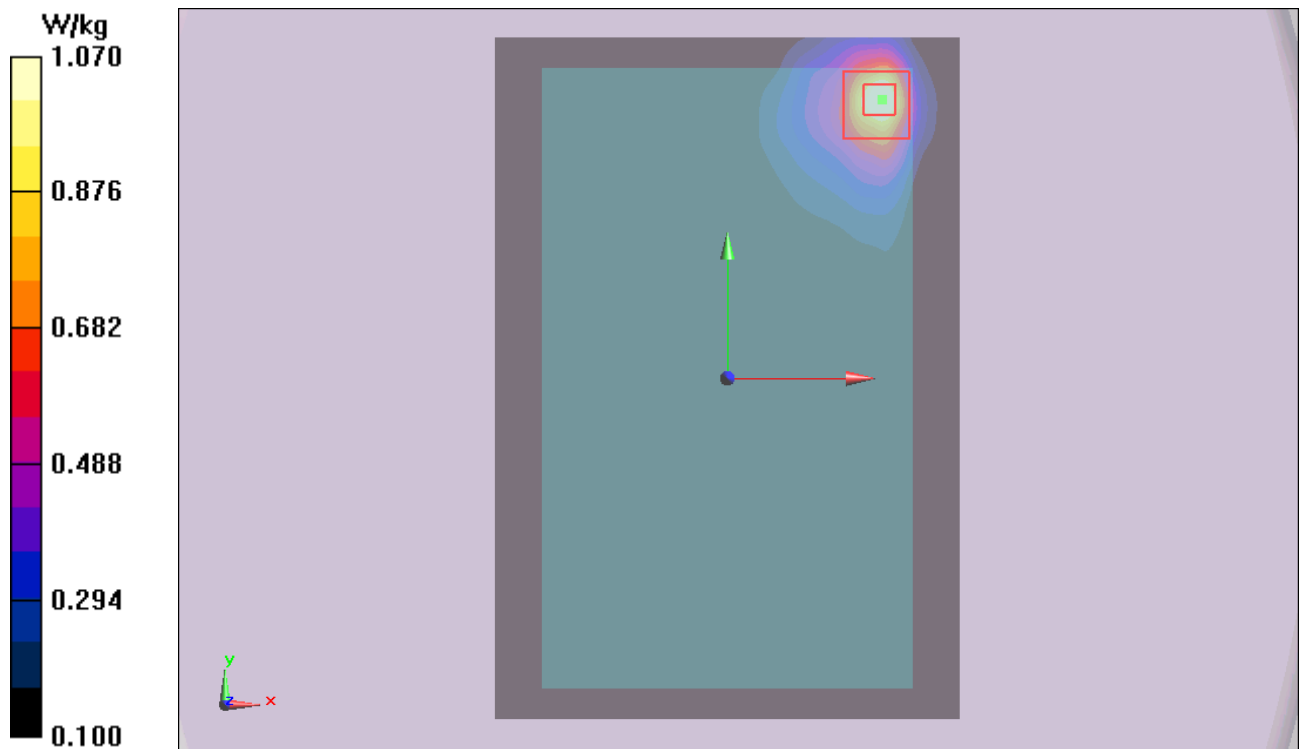


Figure 14 802.11b Test Position 1 Channel 1

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No.: RXA1308-0113SAR01

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ANNEX D: Probe Calibration Certificate

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



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

Certificate No: **EX3-3753_Jan13**

CALIBRATION CERTIFICATE

| | |
|--|---|
| Object | EX3DV4 - SN:3753 |
| Calibration procedure(s) | QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes |
| Calibration date: | January 17, 2013 |
| <p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> | |

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B | GB41293874 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Power sensor E4412A | MY41498087 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 27-Mar-12 (No. 217-01531) | Apr-13 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529) | Apr-13 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532) | Apr-13 |
| Reference Probe ES3DV2 | SN: 3013 | 28-Dec-12 (No. ES3-3013 Dec12) | Dec-13 |
| DAE4 | SN: 660 | 20-Jun-12 (No. DAE4-660_Jun12) | Jun-13 |
| | | | |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-11) | 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: January 17, 2013 |
| <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> | | | |

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



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

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

Accreditation No.: **SCS 108**

Glossary:

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

- **NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- **NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- **DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep 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
- **A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- **ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ 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 NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 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.

EX3DV4 – SN:3753

January 17, 2013

Probe EX3DV4

SN:3753

Manufactured: March 16, 2010
Calibrated: January 17, 2013

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

TA Technology (Shanghai) Co., Ltd.

Test Report

EX3DV4- SN:3753

January 17, 2013

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|-----------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.47 | 0.31 | 0.45 | ± 10.1 % |
| DCP (mV) ^B | 101.8 | 102.3 | 102.3 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB $\sqrt{\mu\text{V}}$ | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 163.7 | ±3.5 % |
| | | Y | 0.0 | 0.0 | 1.0 | | 168.5 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 159.9 | |

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 E²-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.

TA Technology (Shanghai) Co., Ltd.

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EX3DV4– SN:3753

January 17, 2013

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753

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) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 41.9 | 0.89 | 9.46 | 9.46 | 9.46 | 0.45 | 0.83 | ± 12.0 % |
| 835 | 41.5 | 0.90 | 8.95 | 8.95 | 8.95 | 0.26 | 1.19 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 7.86 | 7.86 | 7.86 | 0.52 | 0.79 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 7.63 | 7.63 | 7.63 | 0.54 | 0.73 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 7.50 | 7.50 | 7.50 | 0.53 | 0.77 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 6.86 | 6.86 | 6.86 | 0.44 | 0.80 | ± 12.0 % |
| 5200 | 36.0 | 4.66 | 4.65 | 4.65 | 4.65 | 0.40 | 1.80 | ± 13.1 % |
| 5300 | 35.9 | 4.76 | 4.48 | 4.48 | 4.48 | 0.40 | 1.80 | ± 13.1 % |
| 5500 | 35.6 | 4.96 | 4.46 | 4.46 | 4.46 | 0.40 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.51 | 4.51 | 4.51 | 0.35 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 4.36 | 4.36 | 4.36 | 0.45 | 1.80 | ± 13.1 % |

^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.

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

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EX3DV4- SN:3753

January 17, 2013

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753

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) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|-------|------------|-------------|
| 750 | 55.5 | 0.96 | 9.25 | 9.25 | 9.25 | 0.54 | 0.75 | ± 12.0 % |
| 835 | 55.2 | 0.97 | 9.05 | 9.05 | 9.05 | 0.68 | 0.68 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 7.82 | 7.82 | 7.82 | 0.50 | 0.84 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 7.33 | 7.33 | 7.33 | 0.31 | 1.01 | ± 12.0 % |
| 2000 | 53.3 | 1.52 | 7.43 | 7.43 | 7.43 | 0.57 | 0.73 | ± 12.0 % |
| 2300 | 52.9 | 1.81 | 7.07 | 7.07 | 7.07 | 0.74 | 0.64 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 6.90 | 6.90 | 6.90 | 0.80 | 0.50 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 6.66 | 6.66 | 6.66 | 0.80 | 0.50 | ± 12.0 % |
| 3500 | 51.3 | 3.31 | 6.30 | 6.30 | 6.30 | 0.38 | 1.11 | ± 13.1 % |
| 5200 | 49.0 | 5.30 | 4.38 | 4.38 | 4.38 | 0.50 | 1.90 | ± 13.1 % |
| 5300 | 48.9 | 5.42 | 4.13 | 4.13 | 4.13 | 0.50 | 1.90 | ± 13.1 % |
| 5500 | 48.6 | 5.65 | 4.09 | 4.09 | 4.09 | 0.50 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 4.10 | 4.10 | 4.10 | 0.45 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 4.02 | 4.02 | 4.02 | 0.55 | 1.90 | ± 13.1 % |

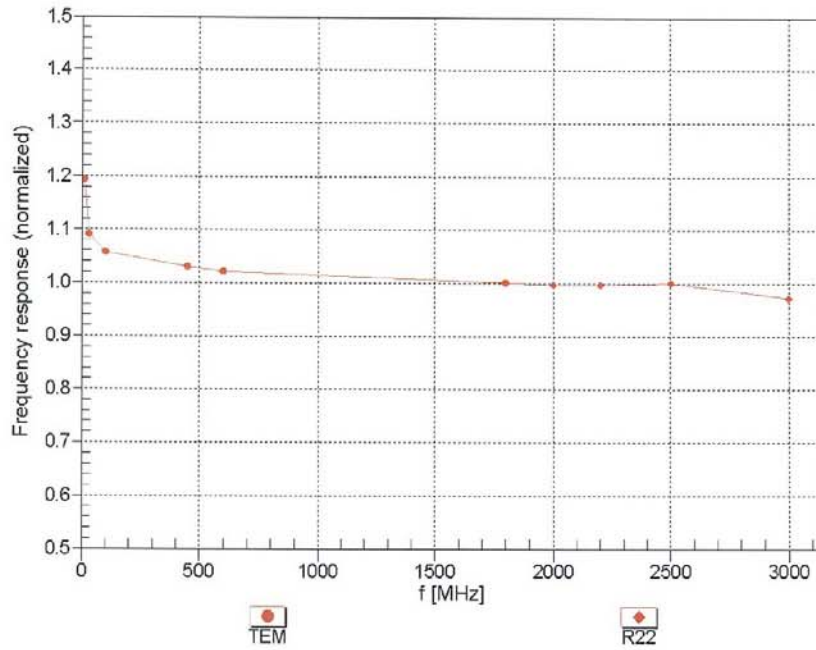
^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^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.

EX3DV4- SN:3753

January 17, 2013

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

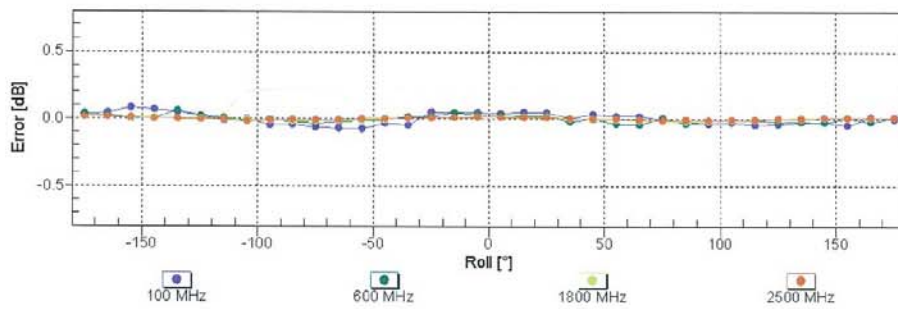
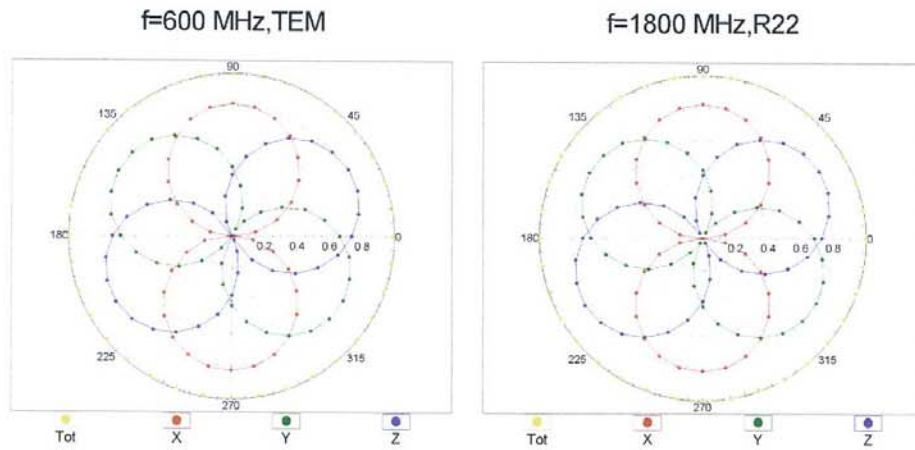


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

EX3DV4-SN:3753

January 17, 2013

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

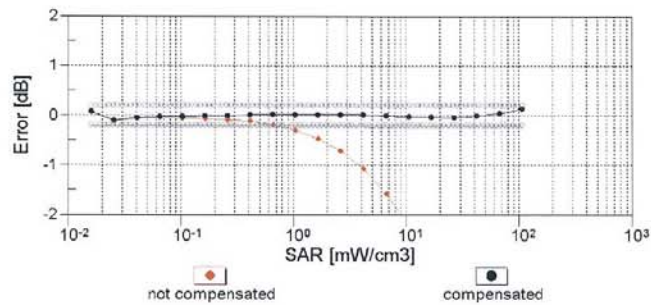
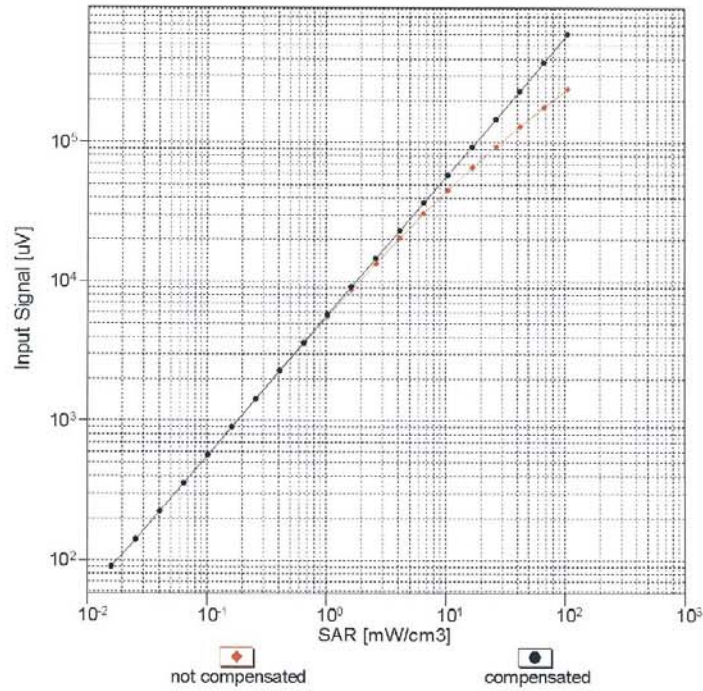


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

EX3DV4- SN:3753

January 17, 2013

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

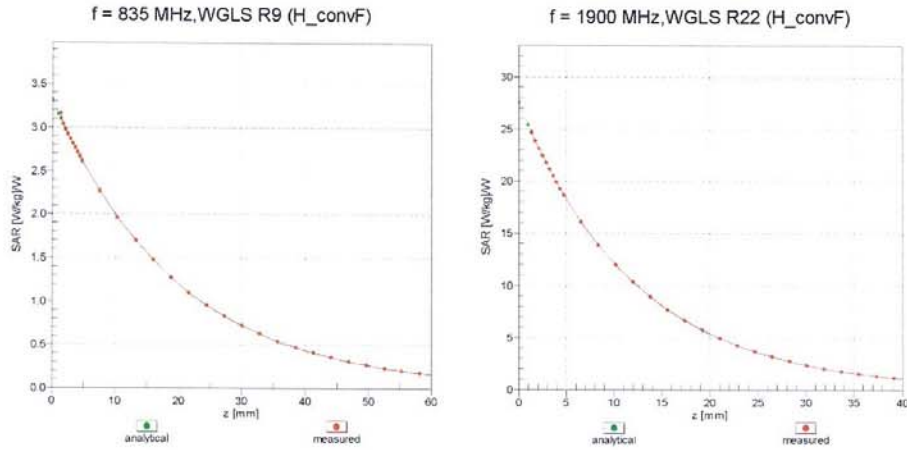


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

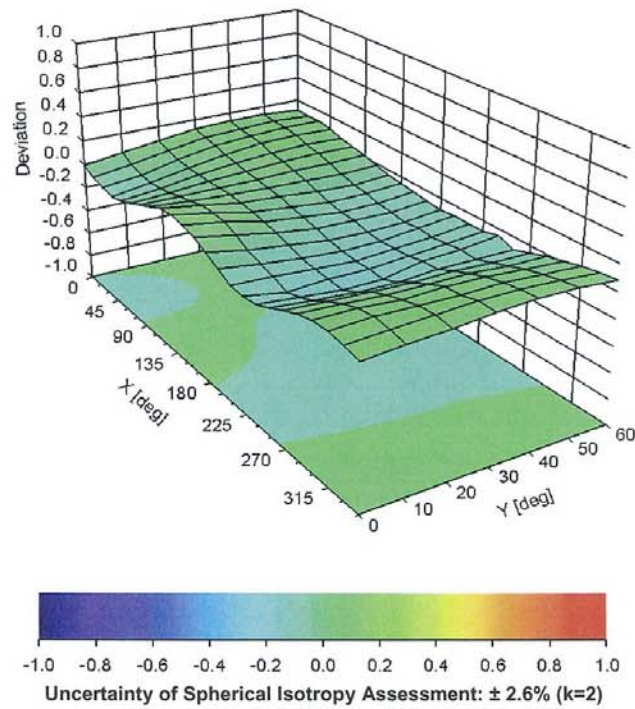
EX3DV4- SN:3753

January 17, 2013

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, ϑ), f = 900 MHz



TA Technology (Shanghai) Co., Ltd.
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EX3DV4- SN:3753

January 17, 2013

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3753

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 55.2 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 2 mm |

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

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ANNEX E: D2450V2 Dipole Calibration Certificate

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



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

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

Accreditation No.: **SCS 108**

Client **TA-Shanghai (Auden)**

Certificate No: **D2450V2-786_Aug11**

CALIBRATION CERTIFICATE

Object: **D2450V2 - SN: 786**

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

Calibration date: **August 29, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: August 29, 2011

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**Calibration Laboratory of
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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:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

| | | |
|-------------------------------------|------------------------|-------------|
| DASY Version | DASY5 | V52.6.2 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2450 MHz ± 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 | 38.4 ± 6 % | 1.85 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 | 53.8 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 6.41 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 25.4 mW / g ± 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 | 51.8 ± 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 | 13.2 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 51.7 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 6.10 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 24.2 mW / g ± 16.5 % (k=2) |

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Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

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

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

| | |
|-----------------|--------------|
| Manufactured by | SPEAG |
| Manufactured on | May 06, 2005 |

DASY5 Validation Report for Head TSL

Date: 29.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 38.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

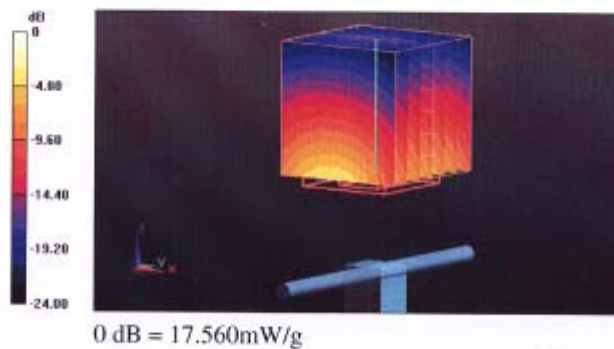
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

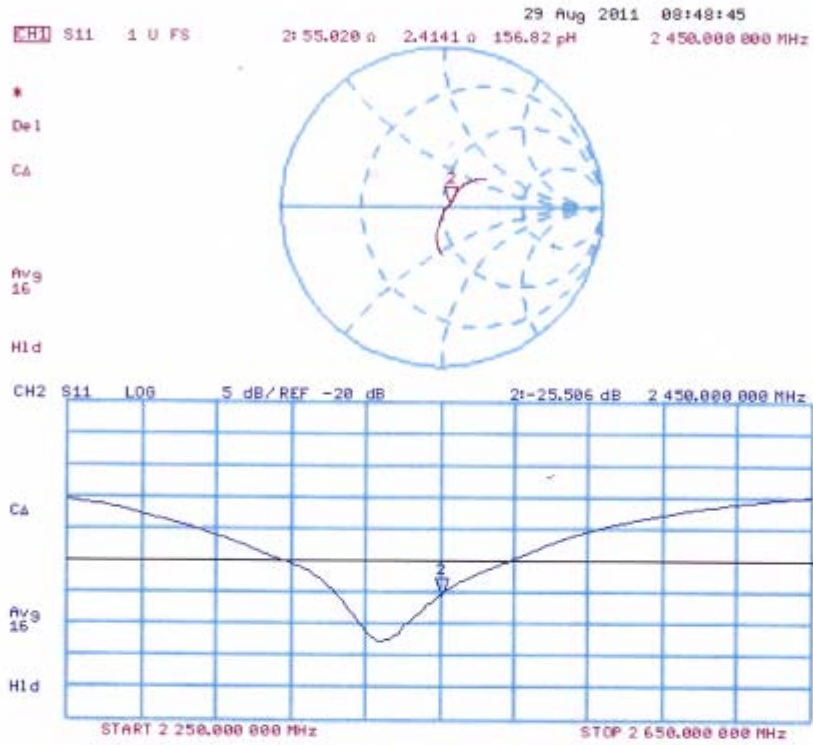
Peak SAR (extrapolated) = 28.303 W/kg

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

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



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 29.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ mho/m; $\epsilon_r = 51.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

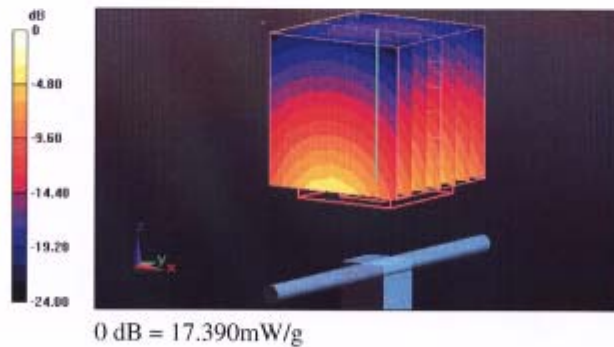
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 27.129 W/kg

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

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

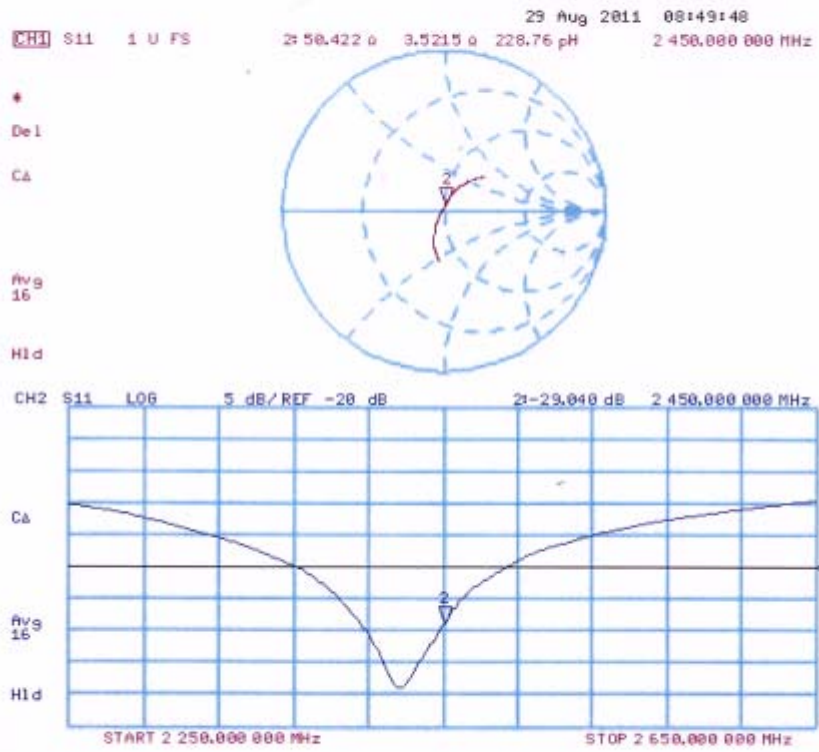


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Impedance Measurement Plot for Body TSL



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ANNEX F: DAE4 Calibration Certificate

**Calibration Laboratory of
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **TA Shanghai (Auden)**

Certificate No: **DAE4-1317_Jan13**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 1317**

Calibration procedure(s) **QA CAL-06.v25
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **January 25, 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 | 02-Oct-12 (No:12728) | Oct-13 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 07-Jan-13 (in house check) | In house check: Jan-14 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 07-Jan-13 (in house check) | In house check: Jan-14 |

| | Name | Function | Signature |
|----------------|-------------|--------------------------|--------------------|
| Calibrated by: | R. Mayoraz | Technician | <i>R. Mayoraz</i> |
| Approved by: | Fin Bomholt | Deputy Technical Manager | <i>Fin Bomholt</i> |

Issued: January 25, 2013

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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.

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DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 404.011 \pm 0.02% (k=2) | 404.006 \pm 0.02% (k=2) | 403.901 \pm 0.02% (k=2) |
| Low Range | 3.98819 \pm 1.55% (k=2) | 3.99805 \pm 1.55% (k=2) | 3.98192 \pm 1.55% (k=2) |

Connector Angle

| | |
|---|-----------------------------------|
| Connector Angle to be used in DASY system | 117 $^{\circ}$ \pm 1 $^{\circ}$ |
|---|-----------------------------------|

TA Technology (Shanghai) Co., Ltd.

Test Report

Appendix

1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 199994.16 | -0.78 | -0.00 |
| Channel X | + Input | 20000.75 | 0.37 | 0.00 |
| Channel X | - Input | -19997.98 | 2.89 | -0.01 |
| Channel Y | + Input | 199995.20 | 0.02 | 0.00 |
| Channel Y | + Input | 19999.08 | -1.15 | -0.01 |
| Channel Y | - Input | -20002.66 | -1.68 | 0.01 |
| Channel Z | + Input | 199994.67 | -0.43 | -0.00 |
| Channel Z | + Input | 19997.92 | -2.31 | -0.01 |
| Channel Z | - Input | -20000.66 | 0.26 | -0.00 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2001.23 | 0.59 | 0.03 |
| Channel X | + Input | 201.53 | 0.55 | 0.28 |
| Channel X | - Input | -198.20 | 0.62 | -0.31 |
| Channel Y | + Input | 2000.33 | -0.29 | -0.01 |
| Channel Y | + Input | 200.43 | -0.68 | -0.34 |
| Channel Y | - Input | -199.64 | -0.69 | 0.35 |
| Channel Z | + Input | 2000.78 | 0.22 | 0.01 |
| Channel Z | + Input | 200.32 | -0.69 | -0.34 |
| Channel Z | - Input | -199.27 | -0.35 | 0.18 |

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 | -23.69 | -25.75 |
| | - 200 | 28.59 | 26.45 |
| Channel Y | 200 | -1.44 | -1.70 |
| | - 200 | -0.06 | -0.16 |
| Channel Z | 200 | -10.76 | -11.18 |
| | - 200 | 9.82 | 9.91 |

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 | - | 1.52 | -4.72 |
| Channel Y | 200 | 8.54 | - | 4.31 |
| Channel Z | 200 | 10.79 | 5.34 | - |

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

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 | 16104 | 15986 |
| Channel Y | 16111 | 15993 |
| Channel Z | 16217 | 16069 |

5. Input Offset Measurement

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

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 1.28 | 0.53 | 2.45 | 0.33 |
| Channel Y | -1.29 | -2.89 | 0.51 | 0.58 |
| Channel Z | -0.39 | -1.47 | 1.06 | 0.37 |

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 |

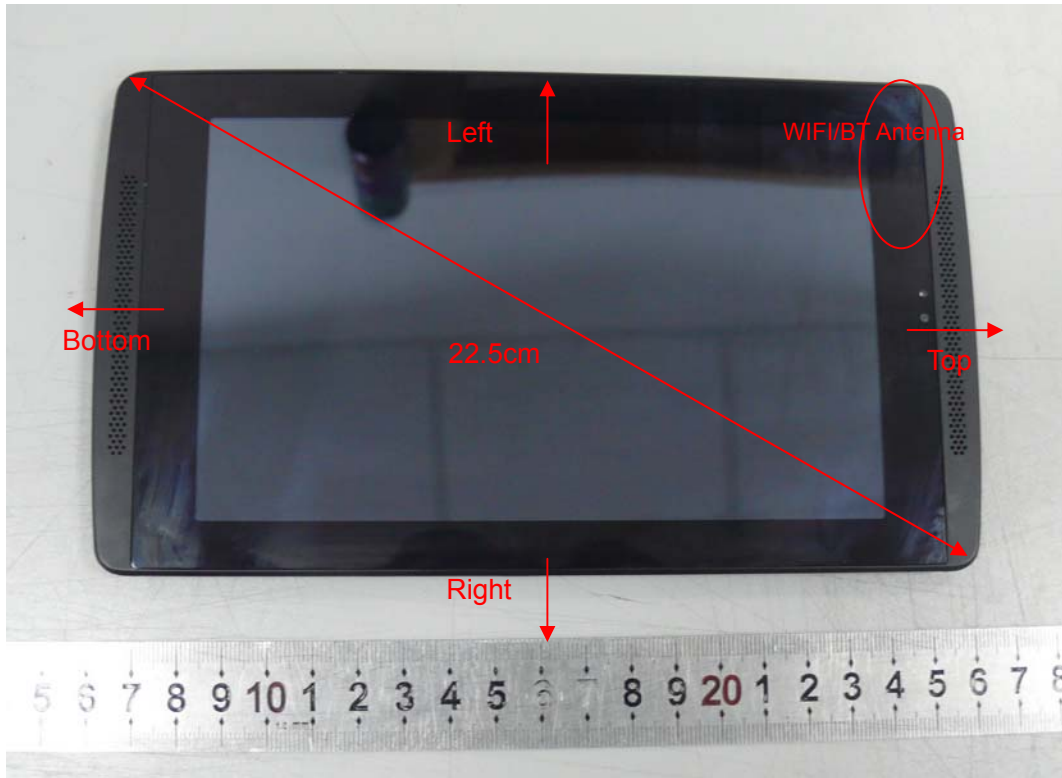
8. Low Battery Alarm Voltage (Typical values for information)

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

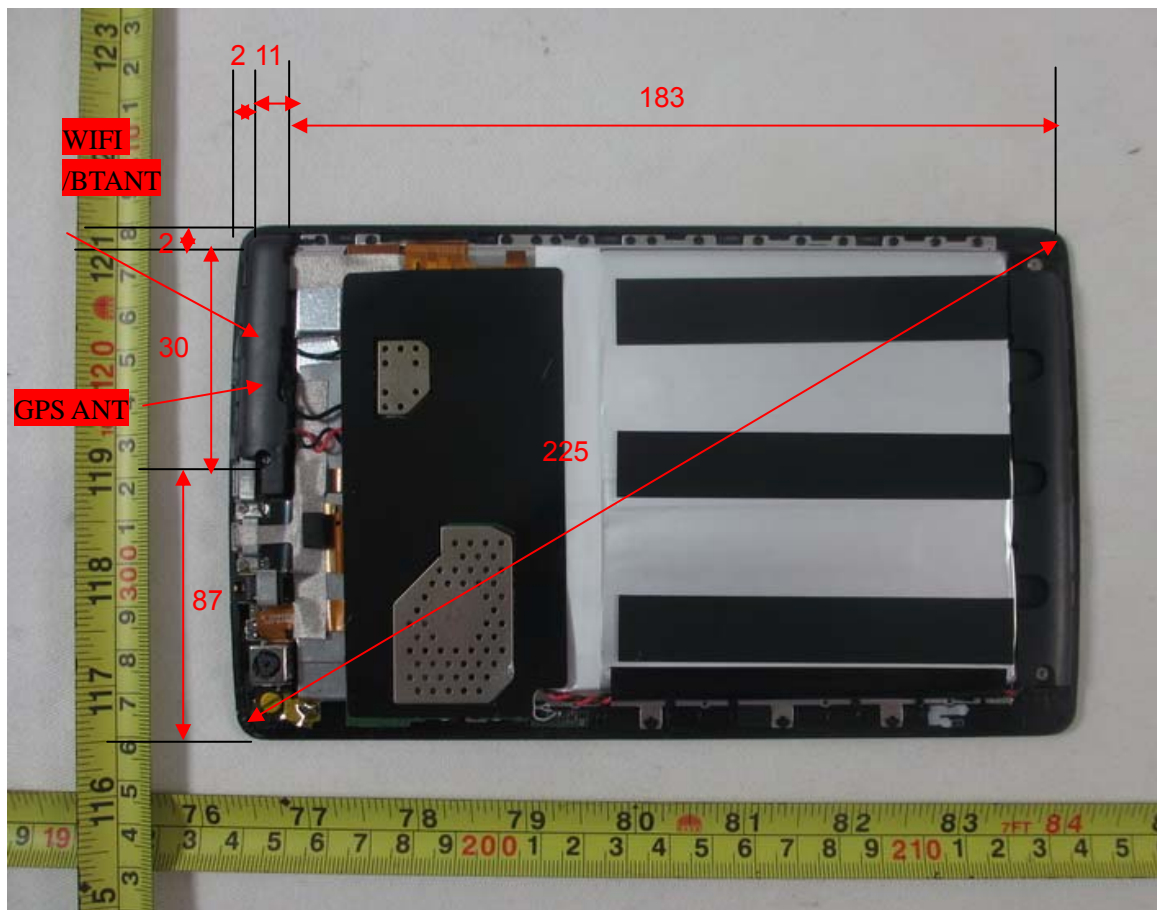
9. Power Consumption (Typical values for information)

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

ANNEX G: The EUT Appearances and Test Configuration

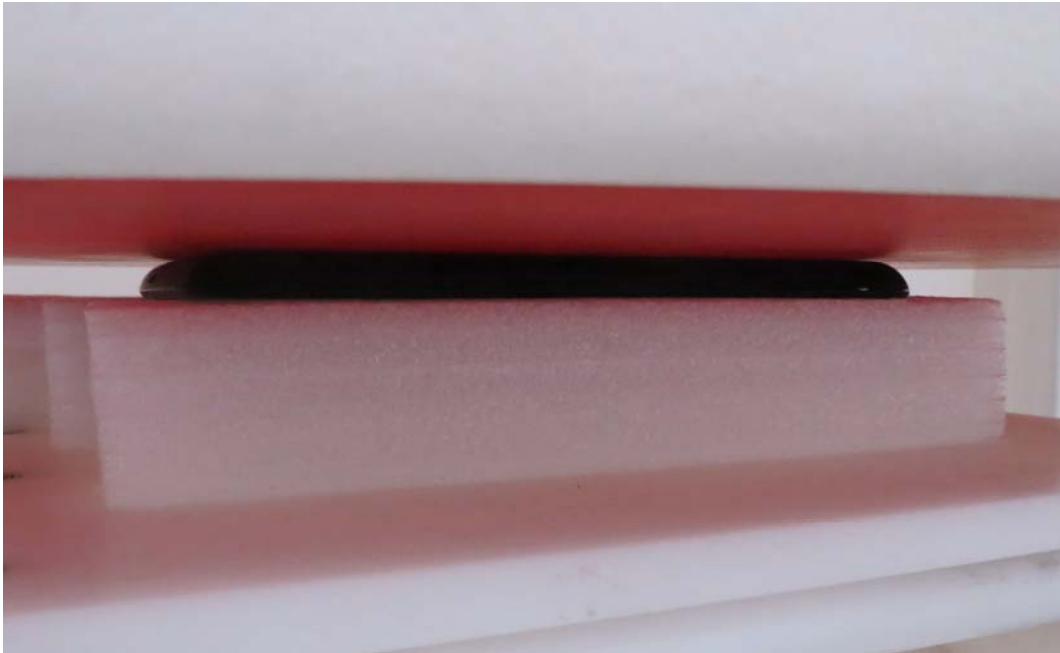


a: Front side



b: Back side

Picture 3: Constituents of the EUT



Picture 4: Test position 1



Picture 5: Test position 3



Picture 6: Test position 5