TESTING
No. L2264

SAR TEST REPORT

Product Name	Tablet
Model	WPT005,WP005,WPG005
FCC ID	ZYQ-WPT005
Client	KEEN HIGH HOLDING(HK) LIMITED
Manufacturer	KEEN HIGH HOLDING(HK) LIMITED
Date of issue	May 24, 2013

TA Technology (Shanghai) Co., Ltd.

GENERAL SUMMARY

Reference Standard(s)	**FCC 47CFR §2.1093** Radiofrequency Radiation Exposure Evaluation: Portable Devices **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) **SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438, published June 2002:** Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radio frequency Emissions. **KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01** SAR Measurement Requirements for 100 MHz to 6 GHz **KDB 447498 D01 Mobile Portable RF Exposure v05:** 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 **KDB 248227 D01 SAR meas for 802 11 a b g v01r02:** SAR Measurement Procedures for 802.11a/b/g Transmitters.
Conclusion	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. General Judgment: **Pass**
Comment	The test result only responds to the measured sample.

Approved by 杨伟中
Director

Revised by 凌敏宝
SAR Manager

Performed by 许红梅
SAR Engineer

TABLE OF CONTENT

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.

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

If the 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:	KEEN HIGH HOLDING(HK) LIMITED
Address:	Unit 13, 7/F Technology Park, 18 On Lai street Shatin New Territories HK
City:	/
Postal Code:	/
Country:	Hongkong

1.4. Manufacturer Information

Company:	KEEN HIGH HOLDING(HK) LIMITED
Address:	Unit 13, 7/F Technology Park, 18 On Lai street Shatin New Territories HK
City:	/
Postal Code:	/
Country:	Hongkong

1.5. Information of EUT

General Information

Device Type:	Portable Device	
Exposure Category:	Uncontrolled Environment /General Population	
State of Sample:	Prototype Unit	
IMEI:	S2013AS7452AQD	
Hardware Version:	PCB205121REVA_05	
Software Version:	P0AQD.Rev.1.00.2013XXXX	
Antenna Type:	Internal Antenna	
Device Operating Configurations:		
Supporting Mode(s):	802.11b; (tested)	
	802.11n g/HT20(2.4G); (untested)	
	802.11n HT20(5G); (untested)	
	802.11a; (untested)	
	Bluetooth; (untested)	
Operating Frequency Range(s):	Mode	Tx (MHz)
	802.11b/g/n HT20	2412 ~ 2462MHz
	802.11a（5G）	5745~5805 MHz
	802.11n HT20（5G）	5745~5805 MHz
	Bluetooth	2402~2480 MHz
Test Channel: (Low - Middle - High)	1-6-11 (802.11b)	

Auxiliary Equipment Details

AE1: Battery

Model: /

Manufacturer: /

S/N: /

Equipment under Test (EUT) has an internal antenna for WiFi/BT antenna that can be used for Tx/Rx. The detail about EUT is in chapter 1.5 in this report..

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	Test Position 5/Top Side	1/2412	1.45	1.48

1.7. Test Date

The test performed on April 9, 2013 to April 10,2013.

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.

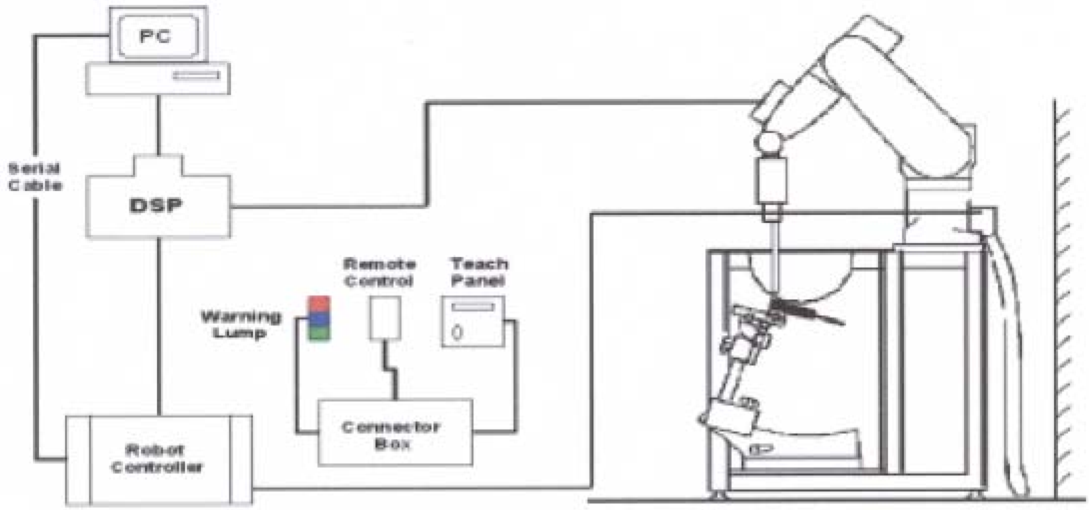


Figure 1. SAR Lab Test Measurement Set-up

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 μW/g to > 100 mW/g Linearity: ± 0.2dB (noise: typically < 1 μW/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 ± 10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. 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 bellow 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.

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

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

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

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 andbody-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI isfully compatible with the IEC 62209-2 standard and all known tissuesimulating liquids. ELI has been optimized regarding its performance and can beintegrated into our standard phantom tables. A cover prevents evaporation ofthe liquid. Reference markings on the phantom allow installation of thecomplete setup, including all predefined phantom positions and measurementgrids, by teaching three points. The phantom is compatible with all SPEAGdosimetric 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

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 D01v01

Frequency	**Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})**	**Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{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 peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

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

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

. = conductivity in [mho/m] or [Siemens/m]

. = equivalent tissue density in g/cm^3

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.

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm^2

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

$\boldsymbol{H_{tot}}$ = 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 OET 65.

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 ε=52.70 σ=1.95

4.2. Tissue-equivalent Liquid Properties

Table 4: Dielectric Performance of Tissue Simulating Liquid

Frequency	Test Date	Temp ℃	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within ±5%)	
			ε_r	σ(s/m)	ε_r	σ(s/m)	Dev ε_r(%)	Dev σ(%)
2450MHz (body)	2013-4-9	21.5	51.69	1.90	52.70	1.95	-1.92	-2.56

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 (±10 %).

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

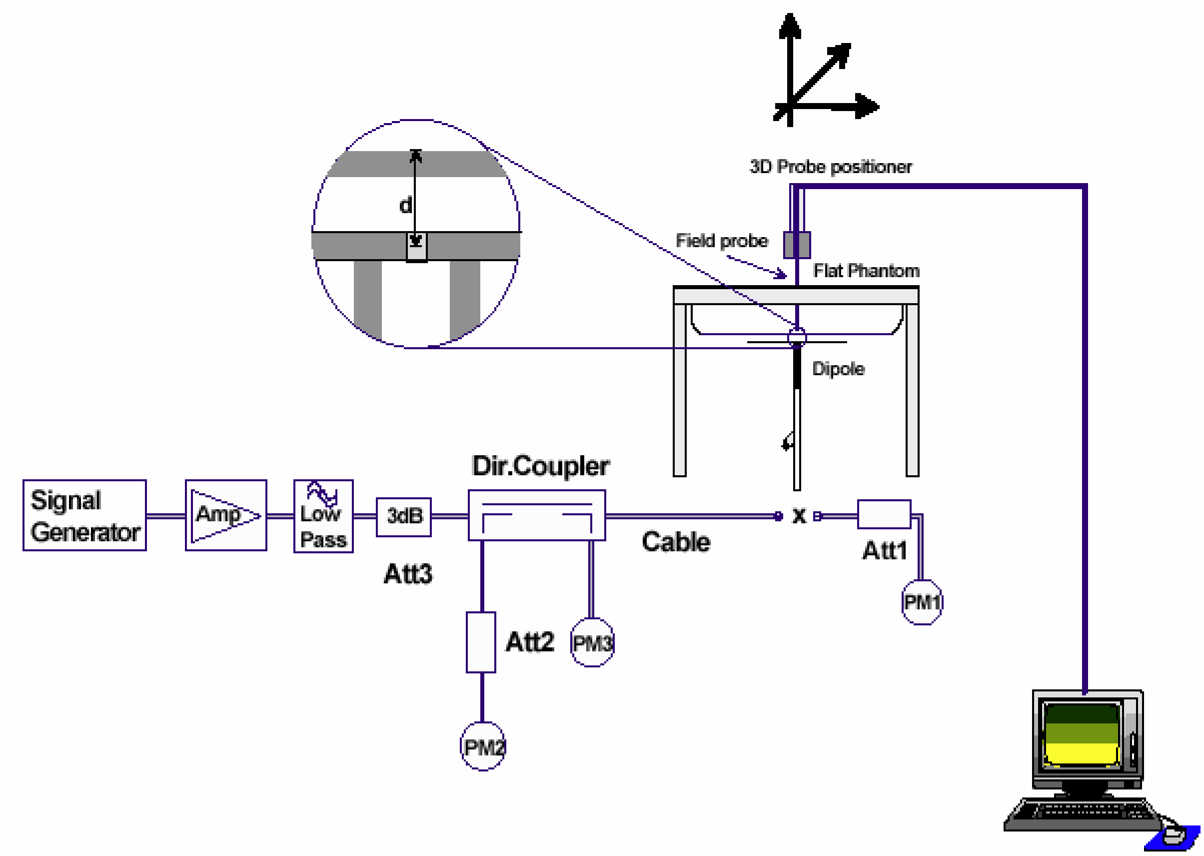


Figure 5. System Check Set-up

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 Publication 450824:

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

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 (±10% Deviation)**
		ε_r	**σ(s/m)**	**(℃)**	**(W/kg)**			
2450MHz	2013-4-9	51.69	1.903	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. 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 D01v01, 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 preformed 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 23.3 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 D01v05 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:

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

(2) The SAR exclusion threshold for distances >50mm is defined by the following equation, as illustrated in KDB 447498 D01v05 Appendix B:

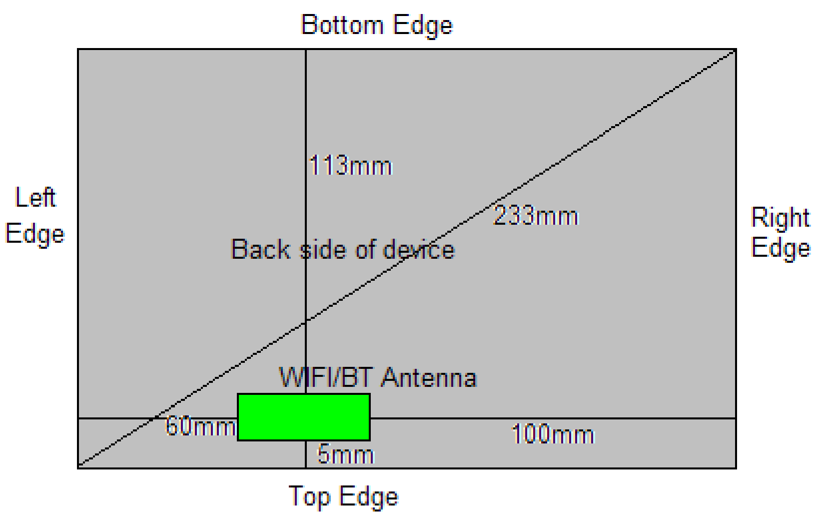
a) at 100 MHz to 1500 MHz

[Threshold at 50 mm in step 1) +(test separation distance - 50 mm)·(f (MHz)/150)] mW

b) at > 1500 MHz and ≤ 6 GHz

[Threshold at 50 mm in step 1) + (test separation distance - 50 mm) ·10] mW

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



- 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 (2.4G) antenna in this position.
  SAR is not required for wifi (5G)/BT antenna in this position.
  Test Position 1 Evaluation $_{(BT)}$ = $[10^{(2/10)}/5] * (2.480^{1/2})$ =0.5 <3.0
  Test Position 1 Evaluation $_{(wifi.2.4G)}$ = $[10^{(13.7/10)}/5] * (2.462^{1/2})$ =7.4 >3.0
  Test Position 1 Evaluation $_{(wifi.5G)}$ = $[10^{(8/10)}/5] * (5.805^{1/2})$ =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.
  SAR is not required for wifi/BT antenna in this position.
  Test Position 3 Evaluation $_{(BT)}$ =96+ (60-50)*10=196mW=22.9 dBm>2 dBm (max.power)
  Test Position 3 Evaluation $_{(Wifi.2.4G)}$ =96+ (60-50)*10=196mW=22.9 dBm>13.7 dBm (max.power)
  Test Position 3 Evaluation $_{(Wifi.5G)}$ =62+ (60-50)*10=162mW=22.1 dBm>8 dBm (max.power)

- 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+ (100-50)*10=596mW=27.8 dBm>2 dBm (max.power)
  Test Position 4 Evaluation $_{(Wifi.2.4G)}$ =96+ (100-50)*10=596mW=27.8 dBm>13.7 dBm (max.power)
  Test Position 4 Evaluation $_{(Wifi.5G)}$ =62+ (100-50)*10=562mW=27.5 dBm>8 dBm (max.power)

- Test Position 5: The top edge of the EUT towards the bottom of the flat phantom. . (ANNEX G Picture 5)
  SAR is required for wifi (2.4G) antenna in this position.
  SAR is not required for wifi (5G)/BT antenna in this position.
  Test Position 5 Evaluation $_{(BT)}$ = $[10^{(2/10)}/5] * (2.480^{1/2})$ =0.5 <3.0
  Test Position 5 Evaluation $_{(wifi.2.4G)}$ = $[10^{(13.7/10)}/5] * (2.462^{1/2})$ =7.4 >3.0
  Test Position 5 Evaluation $_{(wifi.5G)}$ = $[10^{(8/10)}/5] * (5.805^{1/2})$ =3.0

- Test Position 6: The bottom edge of the EUT towards the bottom of the flat phantom.
  SAR is not required for wifi/BTantenna in this position.
  Test Position 6 Evaluation $_{(BT)}$ =96+ (113-50)*10=726mW=28.6 dBm>2 dBm (max.power)
  Test Position 6 Evaluation $_{(Wifi.2.4G)}$ =96+ (113-50)*10=726mW=28.6 dBm>13.7 dBm (max.power)
  Test Position 6 Evaluation $_{(Wifi.5G)}$ =62+ (113-50)*10=692mW=28.4 dBm>8 dBm (max.power)

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	13.61
		2	13.49
		5.5	13.38
		11	13.32
	6	1	13.52
		2	13.46
		5.5	13.49
		11	13.44
	11	1	13.11
		2	12.88
		5.5	13.21
		11	13.24
11g	1	6	13.65
		9	13.59
		12	13.58
		18	13.29
		24	12.76
		36	12.54
		48	12.36
		54	12.16
	6	6	13.55
		9	13.01
		12	12.83
		18	12.73
		24	12.55
		36	12.48
		48	12.24
		54	12.02
	11	6	12.83

		9	12.66
		12	12.14
		18	12.12
		24	11.95
		36	11.71
		48	11.34
		54	11.12
11n HT20	1	MCS0	12.21
		MCS1	12.31
		MCS2	12
		MCS3	11.79
		MCS4	11.65
		MCS5	11.37
		MCS6	11.39
		MCS7	11.35
	6	MCS0	12.57
		MCS1	12.37
		MCS2	12.15
		MCS3	11.93
		MCS4	11.72
		MCS5	11.5
		MCS6	11.36
		MCS7	11.22
	11	MCS0	11.79
		MCS1	11.63
		MCS2	11.38
		MCS3	11.25
		MCS4	11.08
		MCS5	10.85
		MCS6	10.77
		MCS7	10.37
11a 5G	149	6	7.84
		12	7.53
		24	7.28
		54	6.95

	153	6	7.65
		12	7.40
		24	7.35
		54	7.22
	157	6	7.34
		12	7.38
		24	7.15
		54	6.97
	161	6	7.65
		12	7.58
		24	7.51
		54	7.40
11n5G	149	MCS0	7.84
		MCS1	7.70
		MCS2	7.73
		MCS3	7.66
		MCS4	7.34
		MCS5	7.17
		MCS6	6.95
		MCS7	6.91
	153	MCS0	7.65
		MCS1	7.20
		MCS2	7.15
		MCS3	7.00
		MCS4	6.85
		MCS5	6.50
		MCS6	6.43
		MCS7	6.29
	157	MCS0	6.82
		MCS1	6.75
		MCS2	6.63
		MCS3	6.54
		MCS4	6.31
		MCS5	6.34
		MCS6	6.12

		MCS7	6.10
	161	MCS0	7.33
		MCS1	7.10
		MCS2	7.95
		MCS3	6.73
		MCS4	6.66
		MCS5	6.52
		MCS6	6.41
		MCS7	6.39
Note: 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.			

Table 7: Conducted Power Measurement Results (BT)

Channel	Ch 1 2402 MHz	Ch 40 2441 MHz	Ch 79 2480 MHz
GFSK(dBm)	1.72	1.60	1.45
π/4DQPSK(dBm)	1.55	1.48	1.34
8DPSK(dBm)	1.38	1.20	0.75

7.2. SAR Test Results

7.2.1. 802.11b

Table 8: SAR Values (802.11b)

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	13.7	13.11	0.08	1.22	1.15	1.40	Figure 7
	6/2437	DSSS	1:1	13.7	13.52	-0.21	1.12	1.04	1.17	Figure 8
	1/2412	DSSS	1:1	13.7	13.61	-0.029	1.08	1.02	1.10	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	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	13.7	13.11	-0.04	1.27	1.15	1.46	Figure 10
	6/2437	DSSS	1:1	13.7	13.52	0.17	1.349(max,cube)	1.04	1.40	Figure 11
	1/2412	DSSS	1:1	13.7	13.61	-0.04	1.45(max,cube)	1.02	1.48	Figure 12
Test Position 6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Worst Case Position of Body 1st Repeated SAR(distance 0mm)										
Test Position 5	1/2412	DSSS	1:1	13.7	13.61	0.09	1.43(max,cube)	1.02	1.46	Figure 13
Worst Case Position of Body 2nd Repeated SAR(distance 0mm)										
Test Position 5	1/2412	DSSS	1:1	13.7	13.61	0.037	1.45(max,cube)	1.02	1.48	Figure 14

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

2. Per FCC KDB Publication 447498 D01v05, 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 g/802.11n(2.4G) channels when the maximum average output power is less than ¼ dB higher than measured on the corresponding 802.11b channels.

4. The (max.cube) labeling indicates that during the grid scanning an additional peak was found which was within 2.0dB of the highest peak. The value of the highest cube is given in the table above.

Table 9: SAR Measurement Variability Results [802.11b]

Test Position	Channel/ Frequency (MHz)	Measured SAR (1g)	1st Repeated SAR (1g)	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)
Test Position 5	1/2412	1.45	1.43	1.45	1.01	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 preformed 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

7.3. Simultaneous Transmission Conditions

When standalone SAR is not required to be measured per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

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

Per FCC KDB 447498 D01v05 IV.C.1.iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. When the sum is greater than the SAR limit, SAR test exclusion is determined by the SAR to peak location separation ratio.

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

Estimated $SAR_{BT.test\ position\ 1}$= $[10^{(2/10)}/5] * (2.\ 480^{1/2})/7.5=0.067$ W/kg
Estimated $SAR_{BT.test\ position\ 5}$= $[10^{(2/10)}/5] * (2.\ 480^{1/2})/7.5=0.067$ W/kg

BT &WIFI Mode

Reported SAR_{1g}(W/kg) / Test Position	BT	WIFI	MAX. ΣSAR_{1g}
Test Position 1	0.067	1.40	1.467
Test Position 2	NA	NA	NA
Test Position 3	NA	NA	NA
Test Position 4	NA	NA	NA
Test Position 5	0.067	1.48	1.547
Test Position 6	NA	NA	NA

MAX. ΣSAR_{1g} =1.547 W/kg <1.6 W/kg,
So the Simultaneous SAR are not required for BT and wifi antenna.

8. 700MHz to 3GHz Measurement Uncertainty

No.	source	Type	Uncertainty Value (%)	Probability Distribution	k	c_i	Standard ncertainty $u_i^{'}$ (%)	Degree of freedom V_{eff} or v_i
1	System repetivity	A	0.5	N	1	1	0.5	9
Measurement system								
2	-probe calibration	B	6.0	N	1	1	6.0	∞
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	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	∞

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	

9. Main Test Instruments

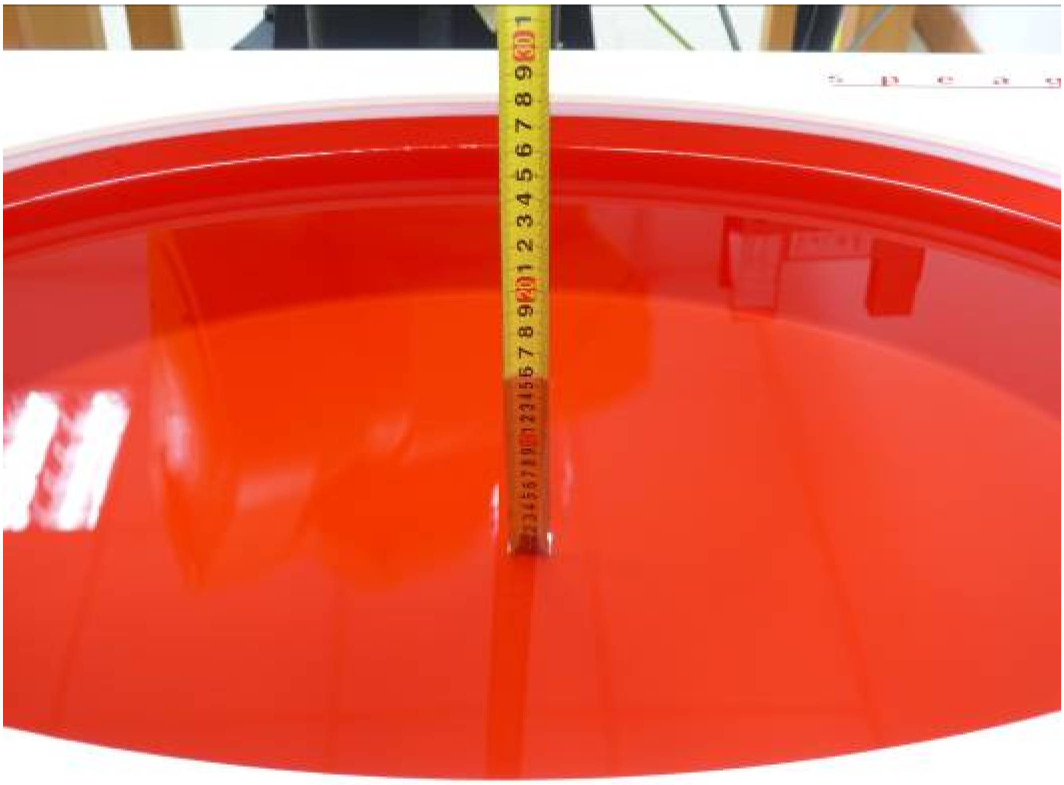
Table 10: List of Main Instruments

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	3578	June 21, 2012	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: 4/9/13 2:07:21PM

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

Medium parameters used: f = 2450 MHz; σ = 1.903 mho/m; ε_r = 51.69; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI v4.0; Type: QDOVA001BB;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

d=10mm, Pin=250mW/Area Scan (41x71x1): Measurement grid: dx=12mm, dy=12mm

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

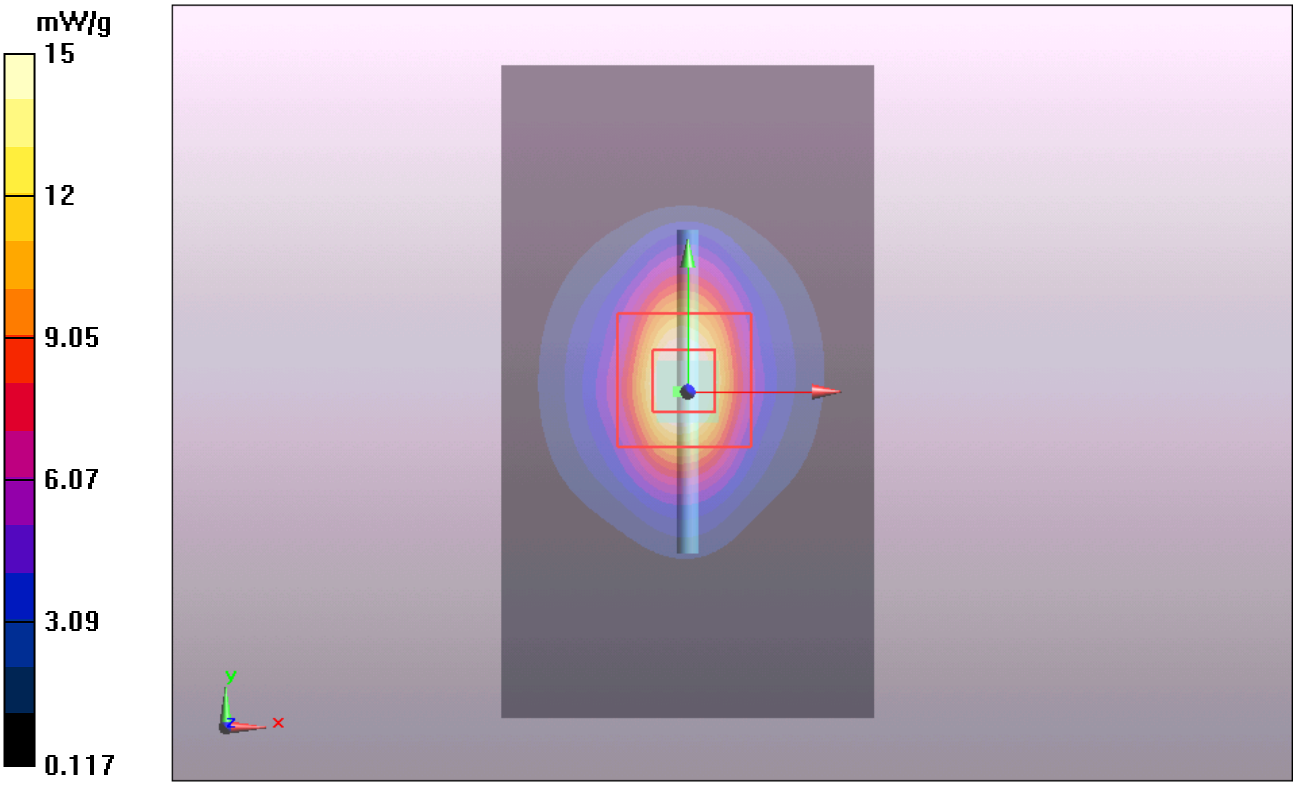


Figure 6 System Performance Check 2450MHz 250mW

ANNEX C: Graph Results

802.11b Test Position 1 High

Date/Time: 4/10/2013 10:50:17 AM

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

Medium parameters used: f = 2462 MHz; σ = 1.92 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 1 High/ Area Scan (131x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.43 mW/g

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

Reference Value = 1.01 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 3.35 W/kg

SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.483 mW/g

Maximum value of SAR (measured) = 1.41 mW/g

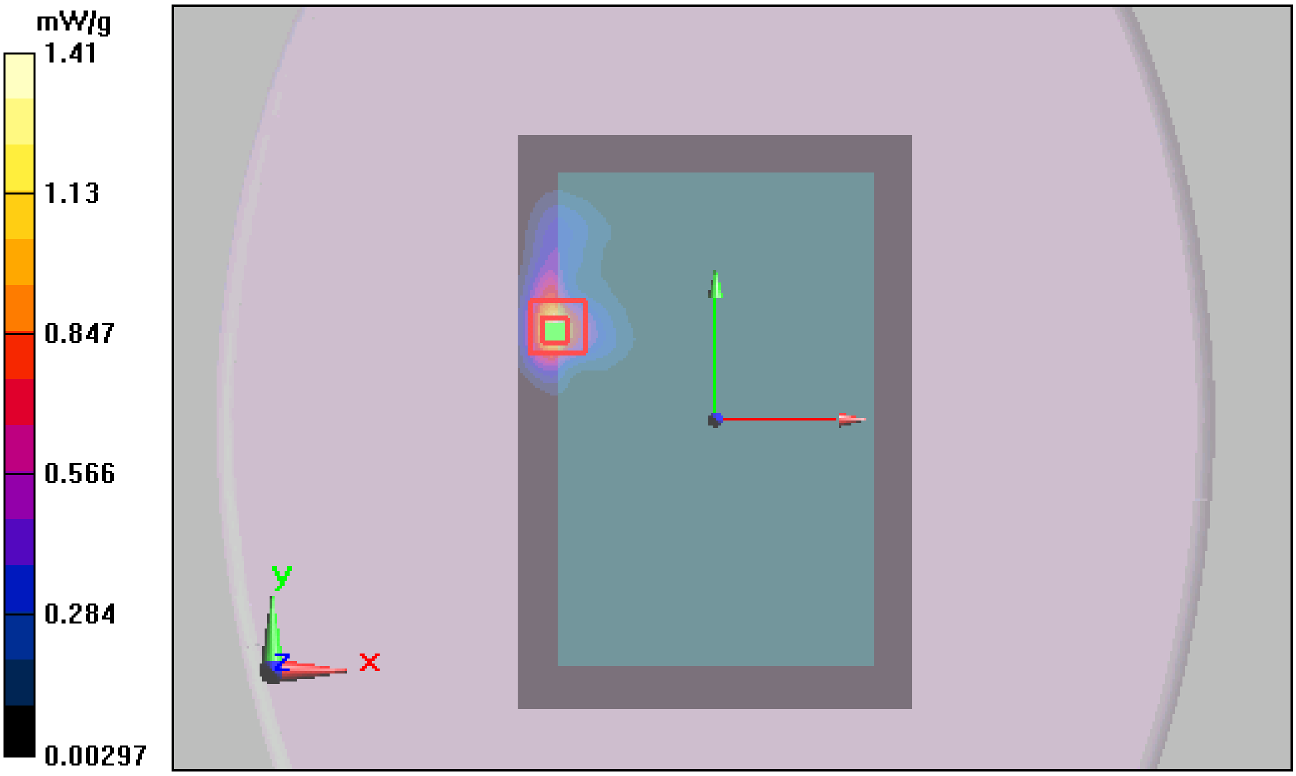


Figure 7 802.11b Test Position 1 Channel 11

802.11b Test Position 1 Middle

Date/Time: 4/10/2013 9:56:39 AM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.88 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 1 Middle/ Area Scan (131x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.25 mW/g

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

Reference Value = 2.04 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 3.03 W/kg

SAR(1 g) = 1.12 mW/g; SAR(10 g) = 0.452 mW/g

Maximum value of SAR (measured) = 1.28 mW/g

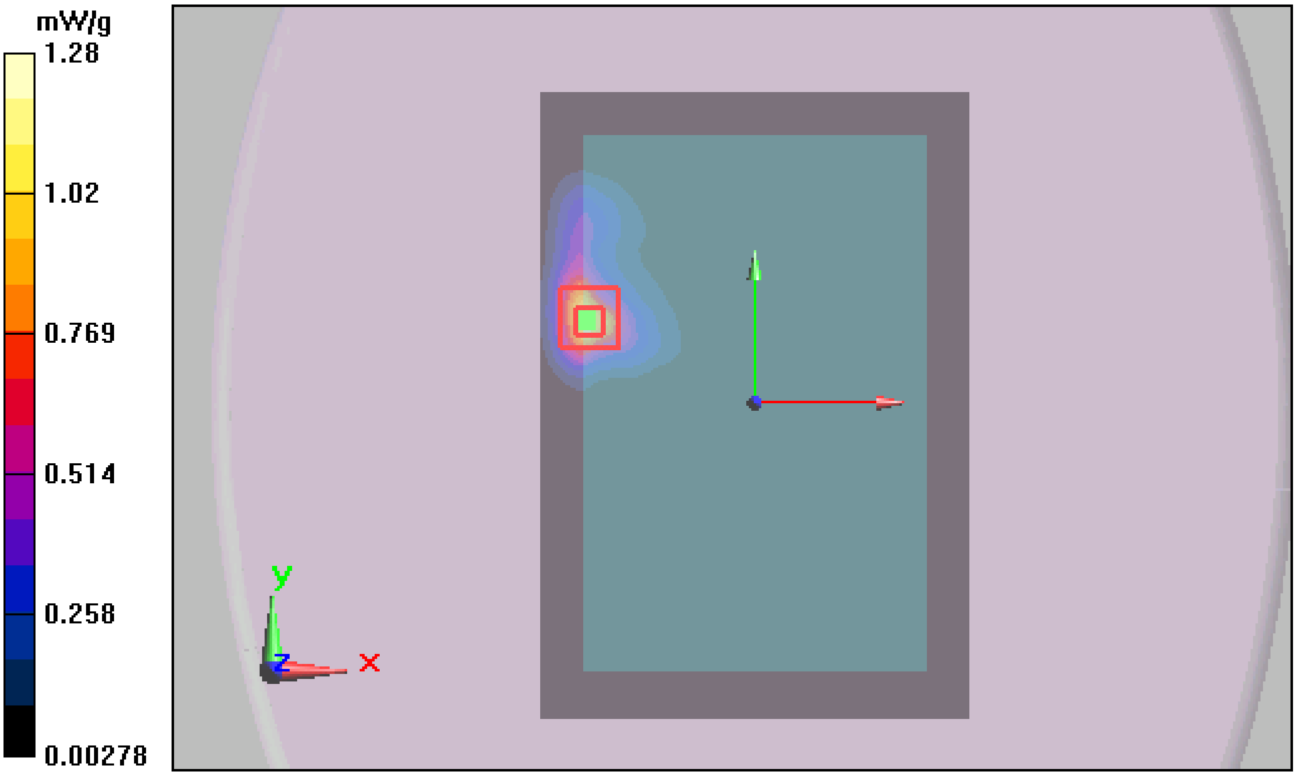


Figure 8 802.11b Test Position 1 Channel 6

802.11b Test Position 1 Low

Date/Time: 4/10/2013 11:49:29 AM

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

Medium parameters used: f = 2412 MHz; σ = 1.85 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 1 Low / Area Scan (131x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.24 mW/g

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

Reference Value = 3.19 V/m; Power Drift = -0.029 dB

Peak SAR (extrapolated) = 2.88 W/kg

SAR(1 g) = 1.08 mW/g; SAR(10 g) = 0.450 mW/g

Maximum value of SAR (measured) = 1.21 mW/g

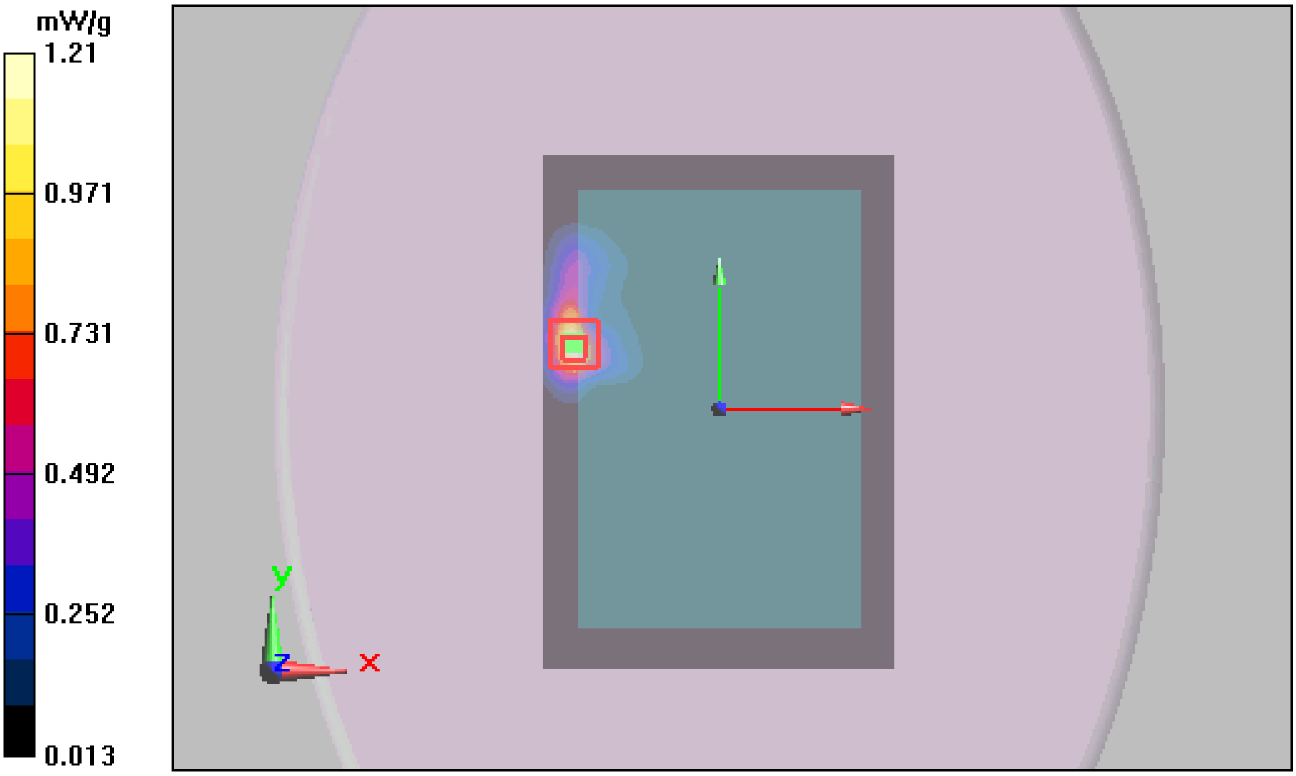


Figure 9 802.11b Test Position 1 Channel 1

802.11b Test Position 5 High

Date/Time: 4/9/2013 5:50:26 PM

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

Medium parameters used: f = 2462 MHz; σ = 1.92 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 5 High/Area Scan (51x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.55 mW/g

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

Reference Value = 6.11 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.05 W/kg

SAR(1 g) = 1.27 mW/g; SAR(10 g) = 0.500 mW/g

Maximum value of SAR (measured) = 1.52 mW/g

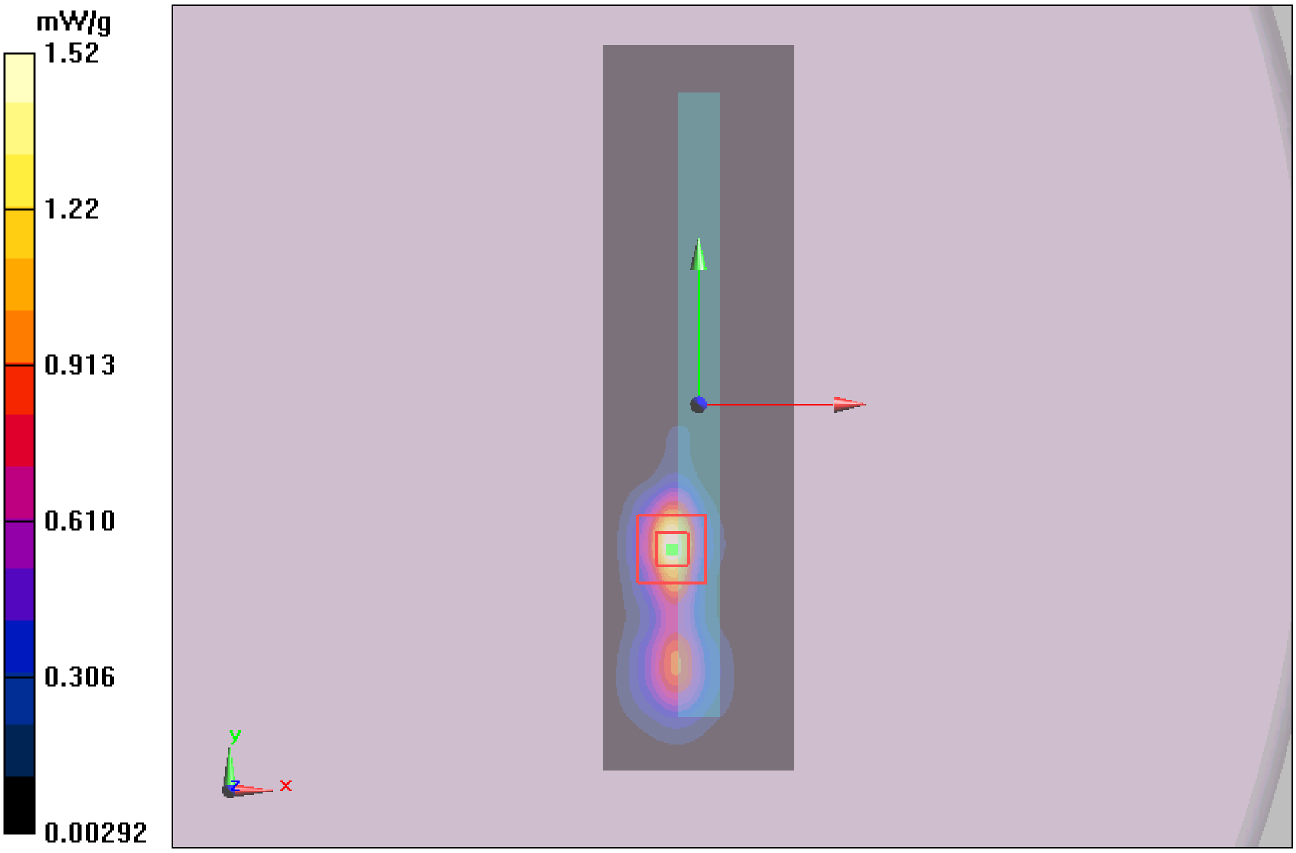


Figure 10 802.11b Test Position 1 Channel 11

802.11b Test Position 5 Middle

Date/Time: 4/9/2013 5:16:45 PM

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

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.88 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 5 Middle/Area Scan (51x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.65 mW/g

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

Reference Value = 5.21 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 1.98 W/kg

SAR(1 g) = 0.932 mW/g; SAR(10 g) = 0.414 mW/g

Maximum value of SAR (measured) = 1.08 mW/g

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

Reference Value = 5.21 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 3.22 W/kg

SAR(1 g) = 1.34 mW/g; SAR(10 g) = 0.526 mW/g

Maximum value of SAR (measured) = 1.62 mW/g

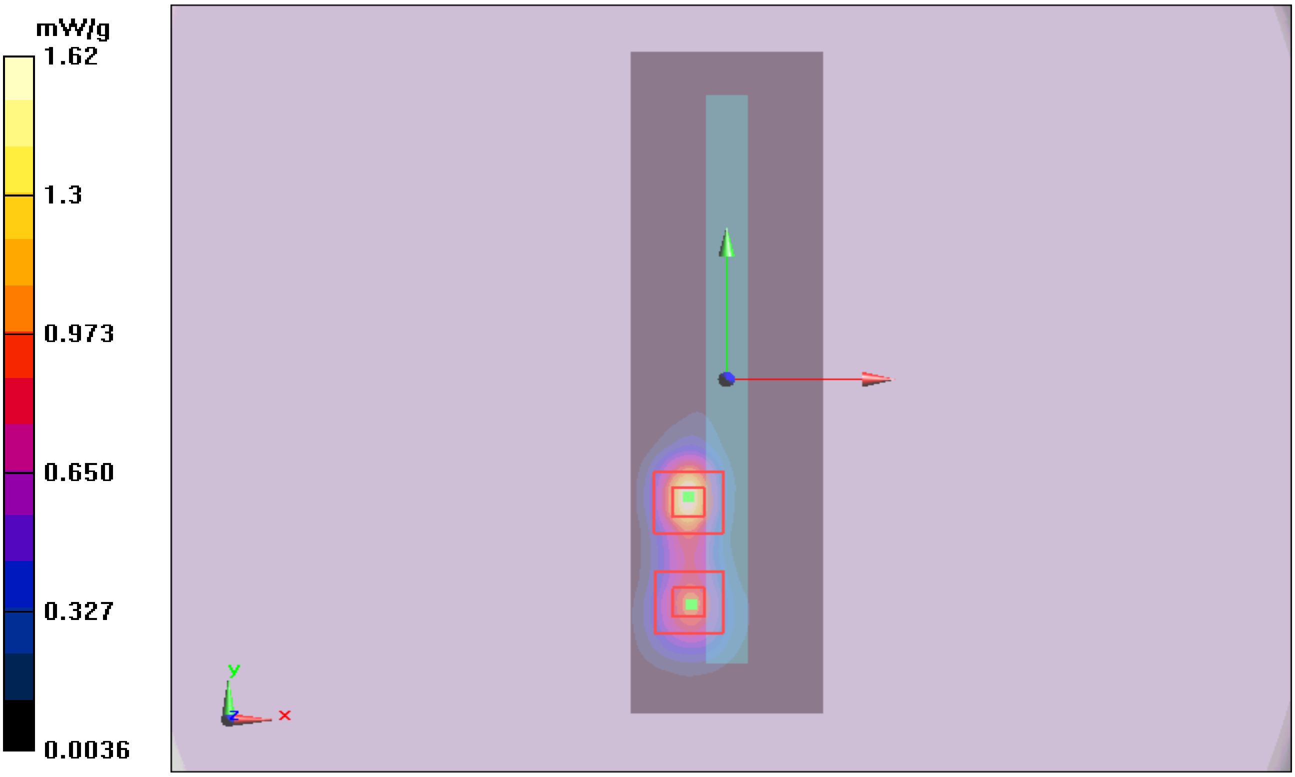


Figure 11 802.11b Test Position 1 Channel 6

802.11b Test Position 5 Low

Date/Time: 4/9/2013 2:58:27 PM

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

Medium parameters used: f = 2412 MHz; σ = 1.85 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 5 Low/Area Scan (51x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.81 mW/g

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

Reference Value = 4.37 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 2.18 W/kg

SAR(1 g) = 1.05 mW/g; SAR(10 g) = 0.465 mW/g

Maximum value of SAR (measured) = 1.23 mW/g

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

Reference Value = 4.37 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.44 W/kg

SAR(1 g) = 1.45 mW/g; SAR(10 g) = 0.567 mW/g

Maximum value of SAR (measured) = 1.75 mW/g

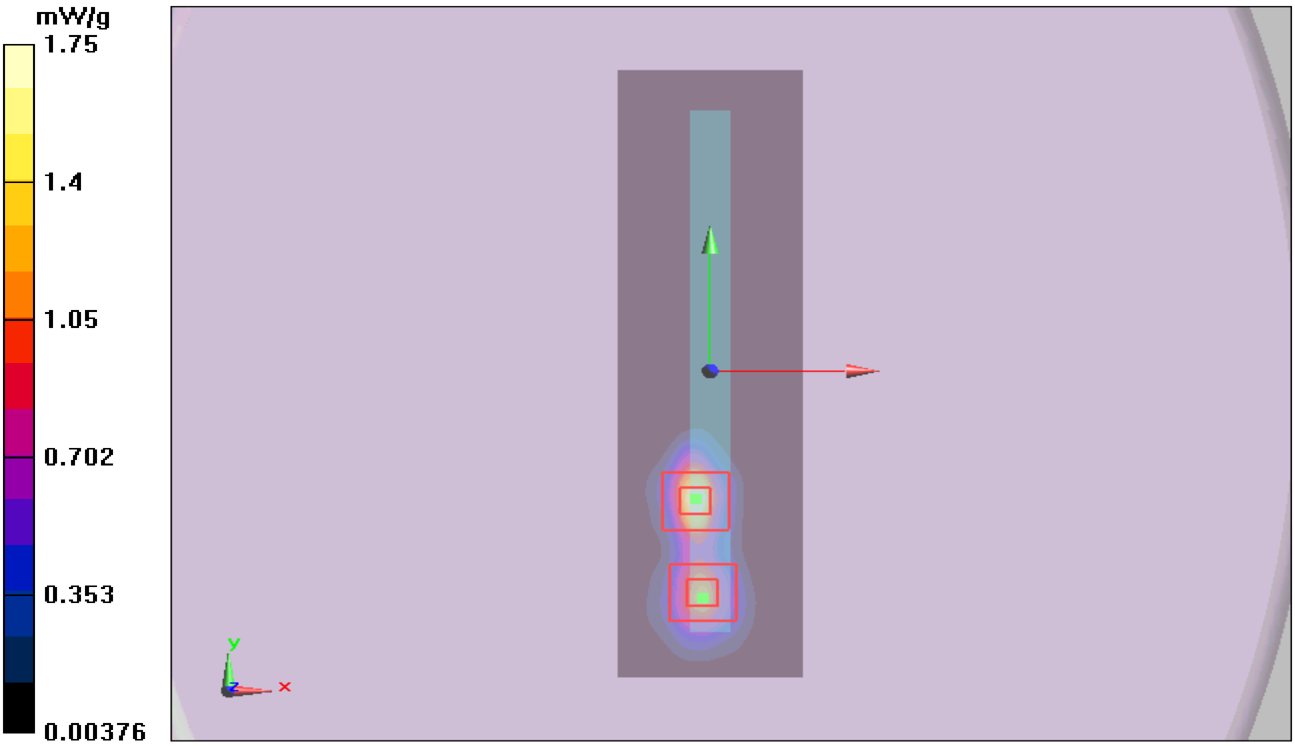


Figure 12 802.11b Test Position 5 Channel 1

802.11b Test Position 5 1st Repeated Low

Date/Time: 4/10/2013 11:28:13 AM

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

Medium parameters used: f = 2412 MHz; σ = 1.85 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 5 Low/Area Scan (51x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.72 mW/g

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

Reference Value = 13.8 V/m; Power Drift = 0.090 dB

Peak SAR (extrapolated) = 2.12 W/kg

SAR(1 g) = 1 mW/g; SAR(10 g) = 0.444 mW/g

Maximum value of SAR (measured) = 1.18 mW/g

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

Reference Value = 13.8 V/m; Power Drift = 0.090 dB

Peak SAR (extrapolated) = 3.42 W/kg

SAR(1 g) = 1.43 mW/g; SAR(10 g) = 0.557 mW/g

Maximum value of SAR (measured) = 1.73 mW/g

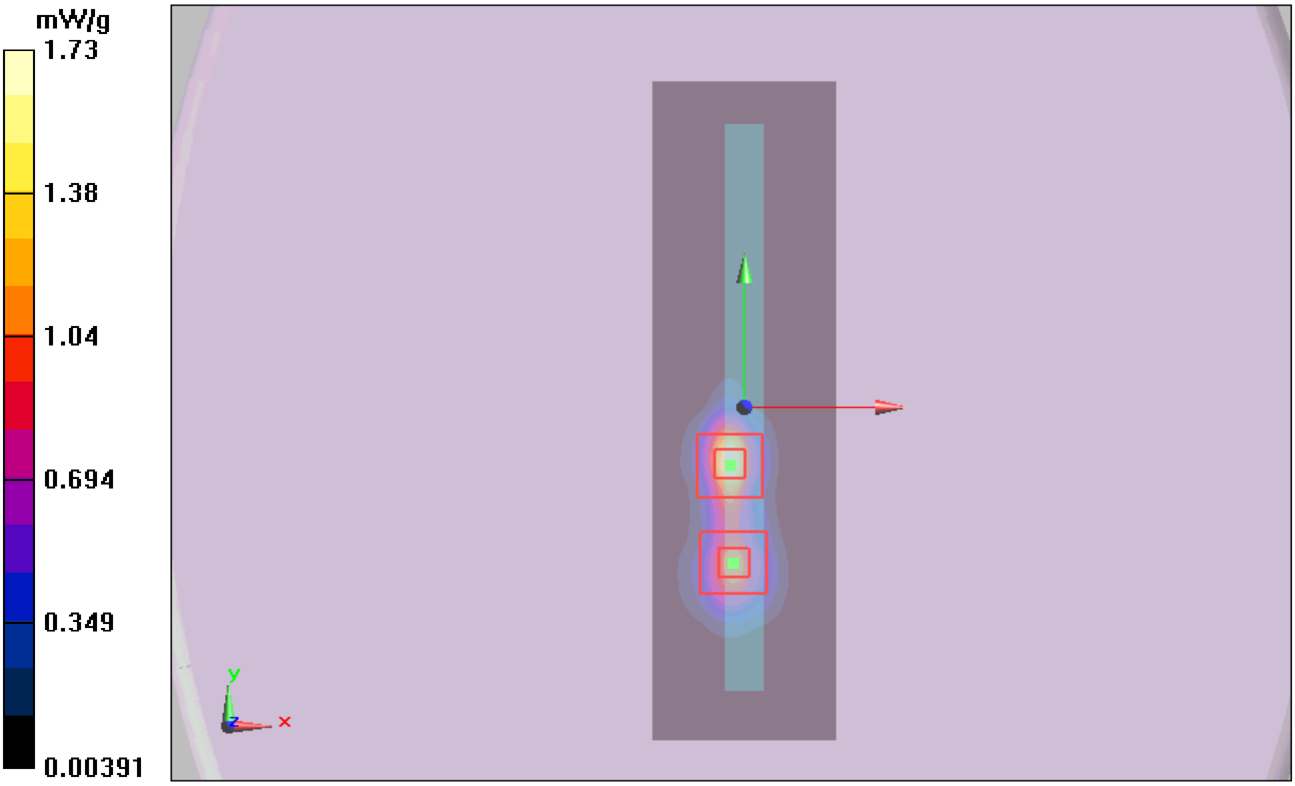


Figure 13 802.11b Test Position 5 1st Repeated Channel 1

802.11b Test Position 5 2nd Repeated Low

Date/Time: 4/10/2013 12:12:10 PM

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

Medium parameters used: f = 2412 MHz; σ = 1.85 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3578; ConvF(6.43, 6.43, 6.43); Calibrated: 6/21/2012

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

Phantom: ELI 4.0; Type: QDOVA001BA;

Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 59

Test Position 5 Low /Area Scan (51x191x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.78 mW/g

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

Reference Value = 13.5 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 2.14 W/kg

SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.444 mW/g

Maximum value of SAR (measured) = 1.18 mW/g

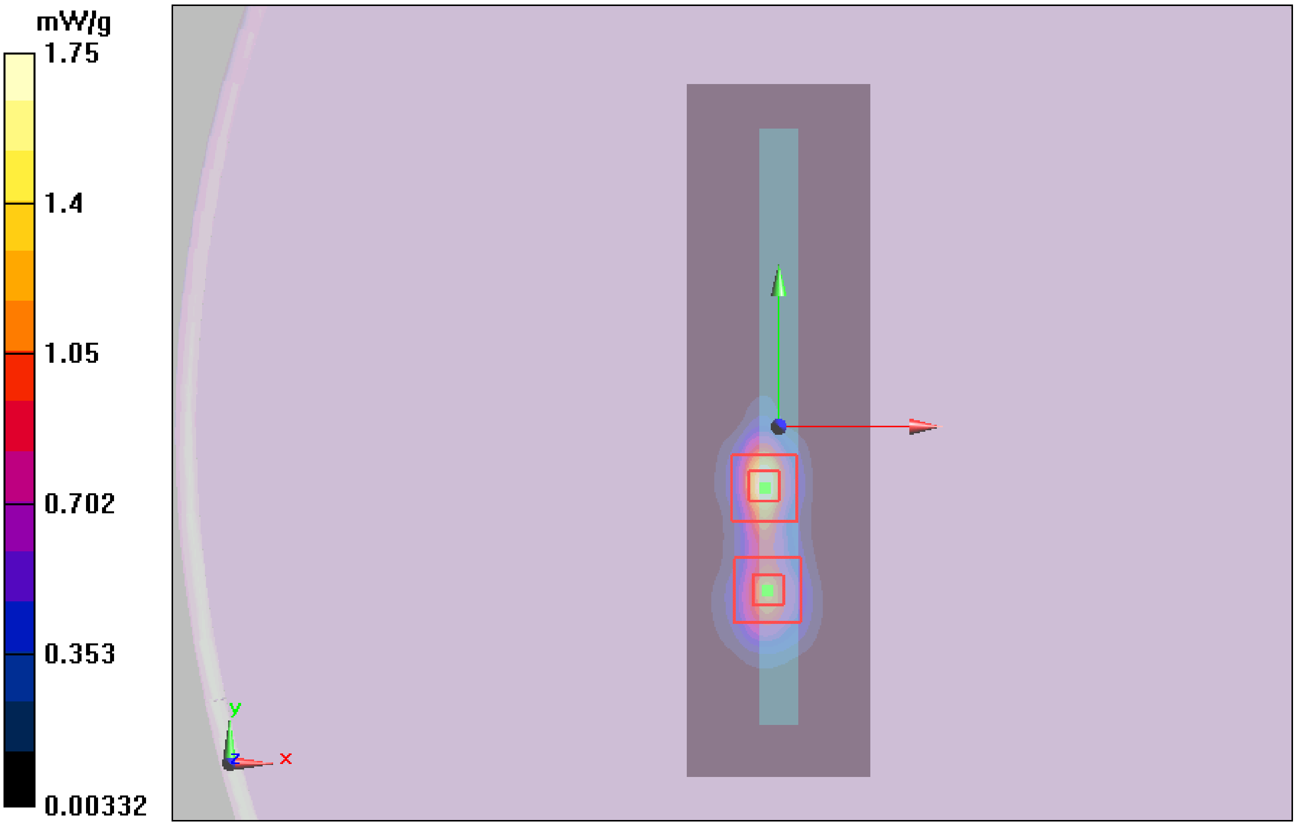
Test Position 5 Low /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.5 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 3.5 W/kg

SAR(1 g) = 1.45 mW/g; SAR(10 g) = 0.564 mW/g

Maximum value of SAR (measured) = 1.75 mW/g



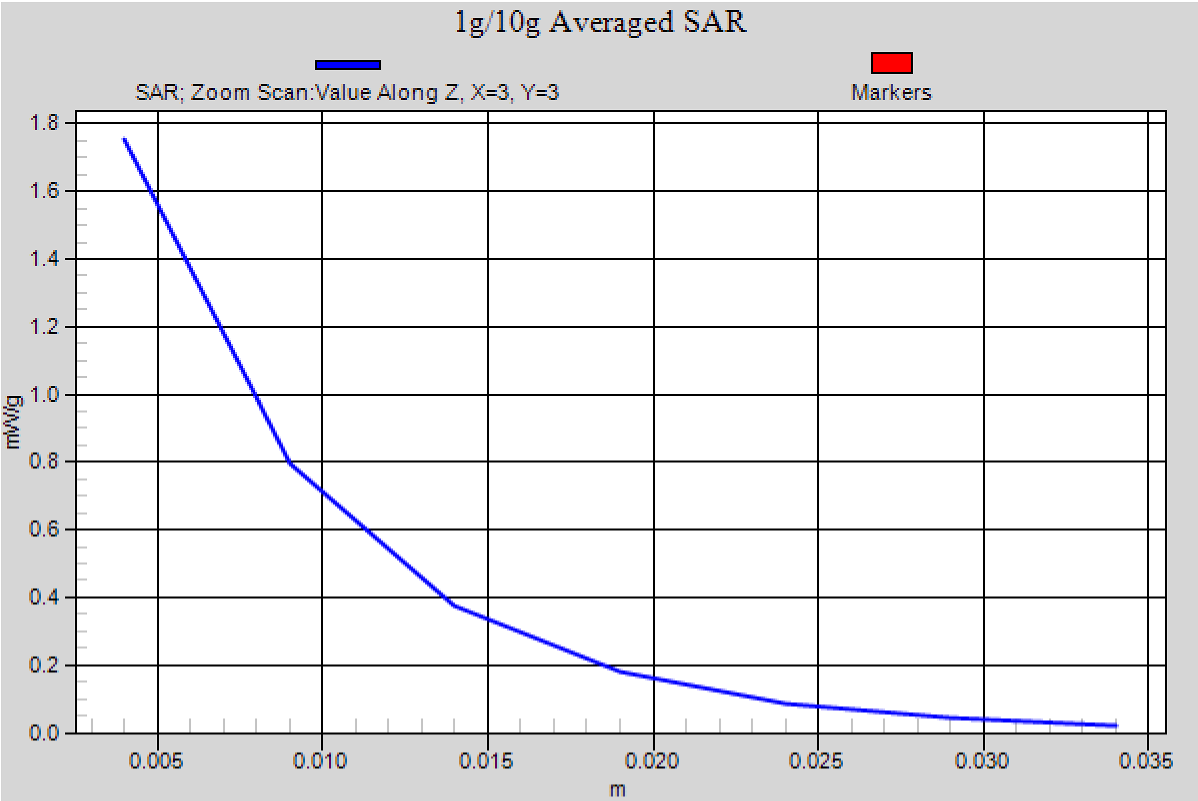


Figure 14 802.11b Test Position 5 2nd Repeated Channel 1

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: **EX3-3578_Jun12**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3578
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:	June 21, 2012

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	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	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	10-Jan-12 (No. DAE4-660_Jan12)	Jan-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-11)	In house check: Oct-12

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

Issued: June 22, 2012

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**

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 EX3DV4

SN:3578

Manufactured: November 4, 2005
Calibrated: June 21, 2012

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3578

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)^2)[A]	0.53	0.50	0.55	± 10.1 %
DCP (mV)[B]	102.4	101.5	103.4	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	166.9	±2.2 %
			Y	0.00	0.00	1.00	173.1	
			Z	0.00	0.00	1.00	178.2	

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: EX3DV4 - SN:3578

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	8.77	8.77	8.77	0.80	0.64	± 12.0 %
835	41.5	0.90	8.30	8.30	8.30	0.29	0.99	± 12.0 %
900	41.5	0.97	8.35	8.35	8.35	0.58	0.75	± 12.0 %
1750	40.1	1.37	7.50	7.50	7.50	0.80	0.62	± 12.0 %
1900	40.0	1.40	7.19	7.19	7.19	0.75	0.65	± 12.0 %
2000	40.0	1.40	7.13	7.13	7.13	0.77	0.58	± 12.0 %
2450	39.2	1.80	6.43	6.43	6.43	0.28	1.01	± 12.0 %
5200	36.0	4.66	4.55	4.55	4.55	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.39	4.39	4.39	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.07	4.07	4.07	0.50	1.80	± 13.1 %
5600	35.5	5.07	3.92	3.92	3.92	0.50	1.80	± 13.1 %
5800	35.3	5.27	3.72	3.72	3.72	0.55	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.

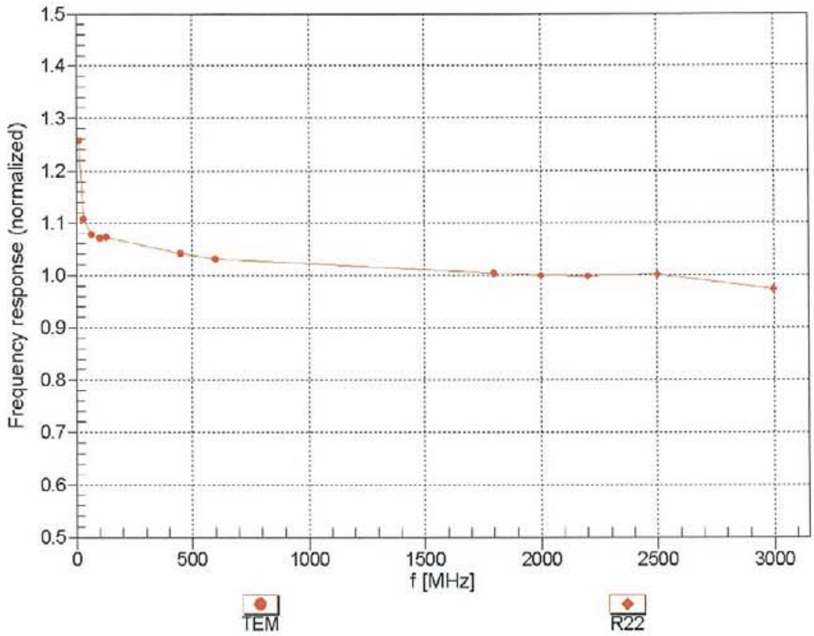
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3578

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	8.52	8.52	8.52	0.42	0.88	± 12.0 %
835	55.2	0.97	8.45	8.45	8.45	0.32	1.06	± 12.0 %
900	55.0	1.05	8.33	8.33	8.33	0.36	0.95	± 12.0 %
1750	53.4	1.49	7.10	7.10	7.10	0.39	0.89	± 12.0 %
1900	53.3	1.52	6.69	6.69	6.69	0.69	0.68	± 12.0 %
2000	53.3	1.52	6.86	6.86	6.86	0.70	0.67	± 12.0 %
2450	52.7	1.95	6.43	6.43	6.43	0.80	0.50	± 12.0 %
5200	49.0	5.30	3.93	3.93	3.93	0.50	1.90	± 13.1 %
5300	48.9	5.42	3.66	3.66	3.66	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.45	3.45	3.45	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.25	3.25	3.25	0.55	1.90	± 13.1 %
5800	48.2	6.00	3.43	3.43	3.43	0.55	1.90	± 13.1 %

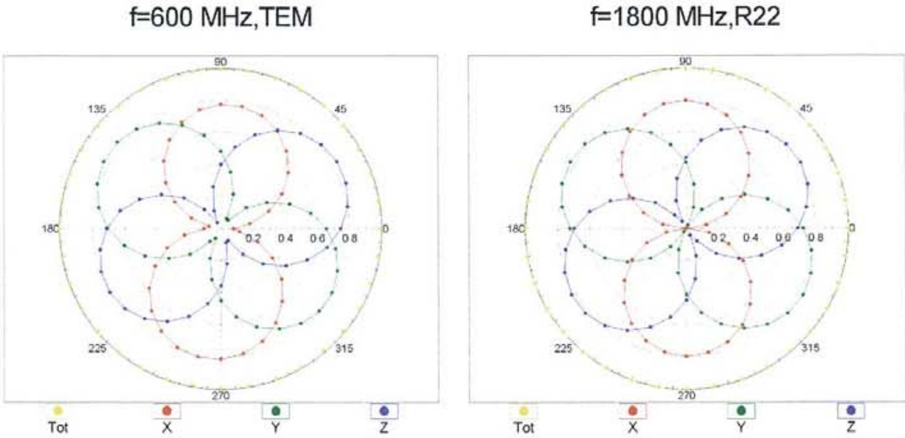
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of 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.

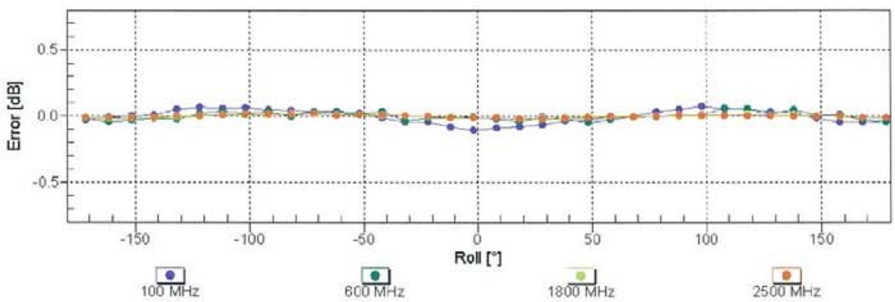
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

Receiving Pattern (φ), ϑ = 0°

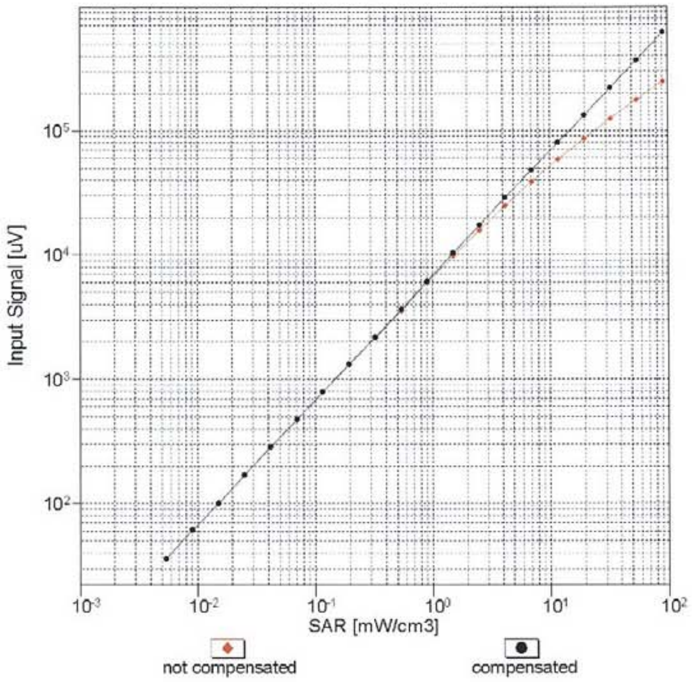


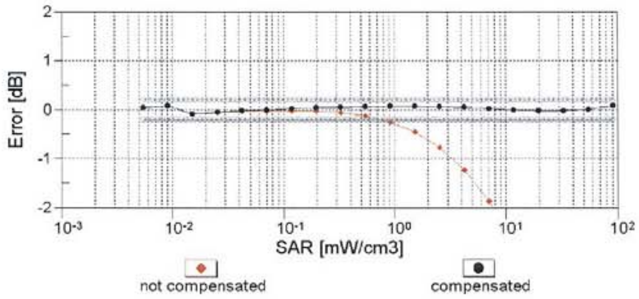


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3578 June 21, 2012

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

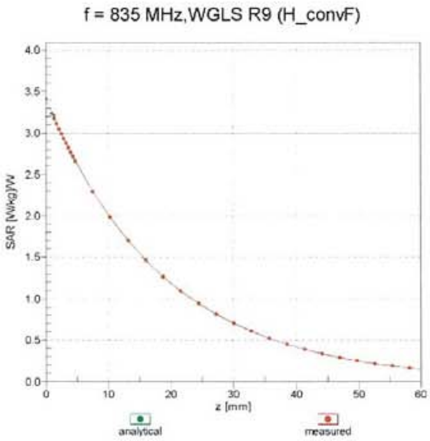


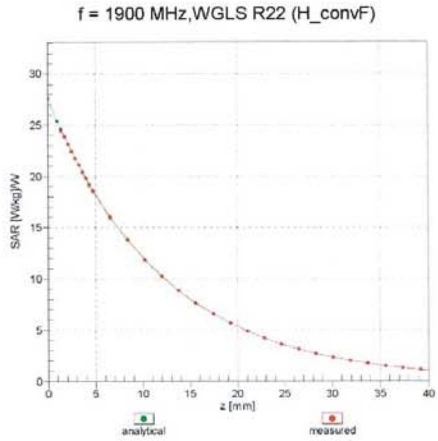


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

EX3DV4– SN:3578 June 21, 2012

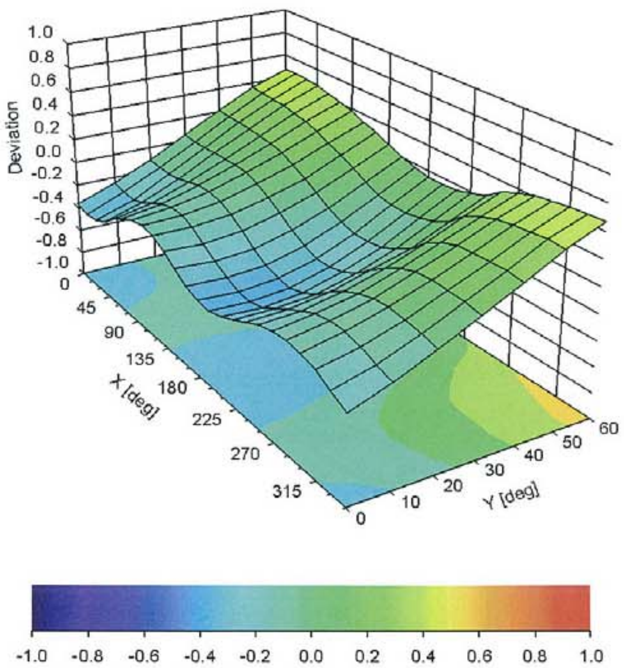
Conversion Factor Assessment





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: EX3DV4 - SN:3578

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	68.2
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

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
Servizio svizzero di taratura
S 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 **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:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 29, 2011

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**

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	V52.6.2
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 cm^3 (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 cm^3 (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 cm^3 (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 cm^3 (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)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.0 Ω + 2.4 jΩ
Return Loss	- 25.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.4 Ω + 3.5 jΩ
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

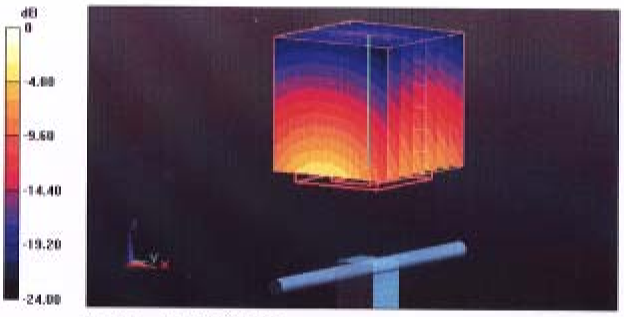
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

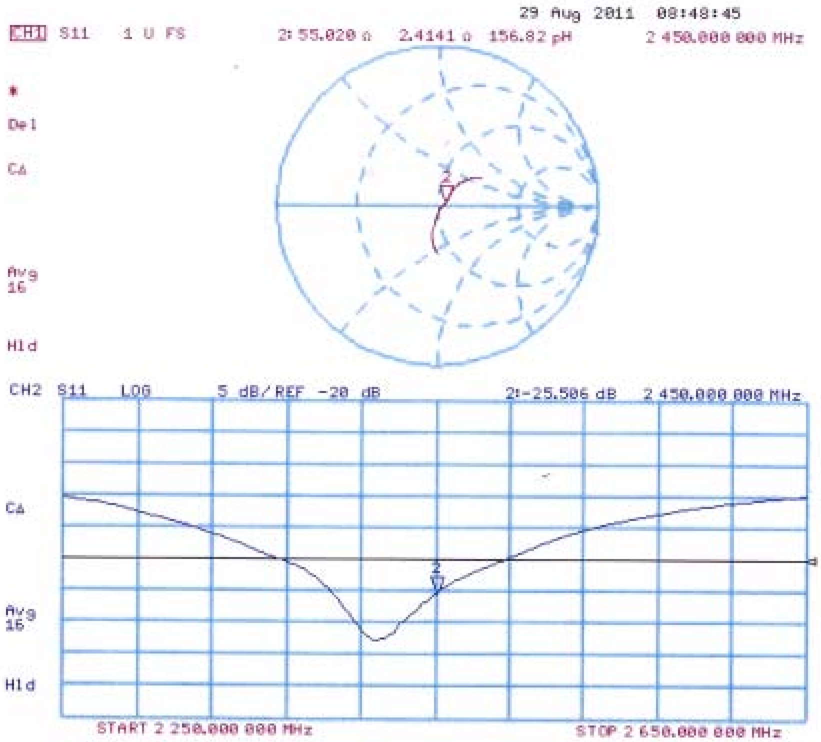
- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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



0 dB = 17.560mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 29.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

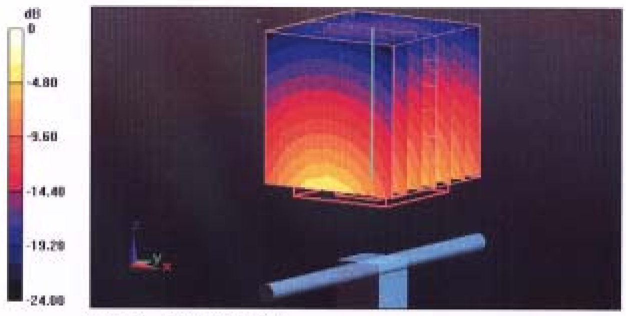
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

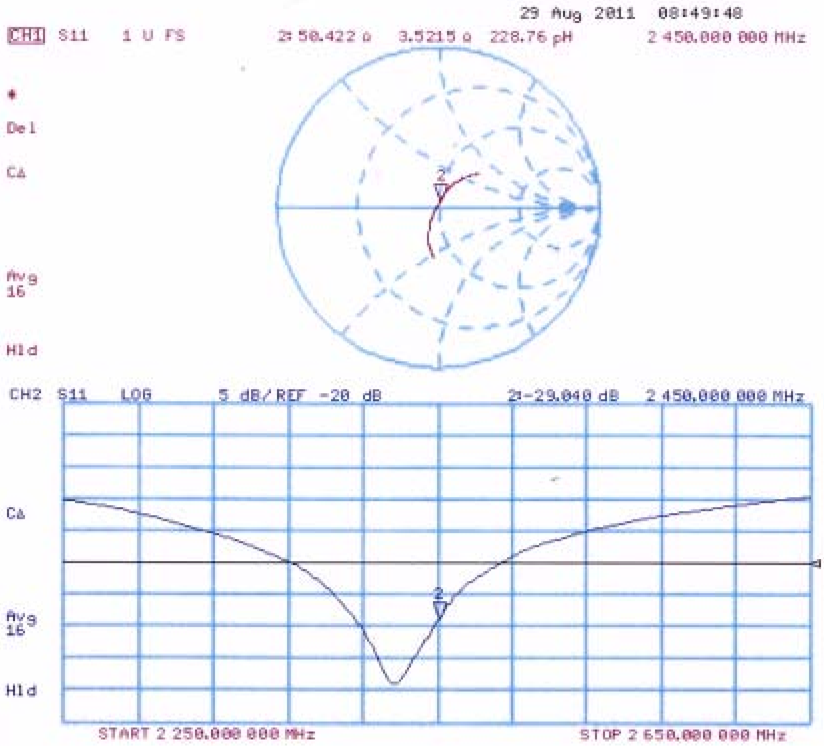
- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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



0 dB = 17.390mW/g

Impedance Measurement Plot for Body TSL



ANNEX F: DAE4 Calibration Certificate

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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: **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	R. Mayoraz
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V. Blum

Issued: January 25, 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
C Service suisse d'étalonnage
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

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	404.011 ± 0.02% (k=2)	404.006 ± 0.02% (k=2)	403.901 ± 0.02% (k=2)
Low Range	3.98819 ± 1.55% (k=2)	3.99805 ± 1.55% (k=2)	3.98192 ± 1.55% (k=2)

Connector Angle

Connector Angle to be used in DASY system	117 ° ± 1 °

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	-

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 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
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

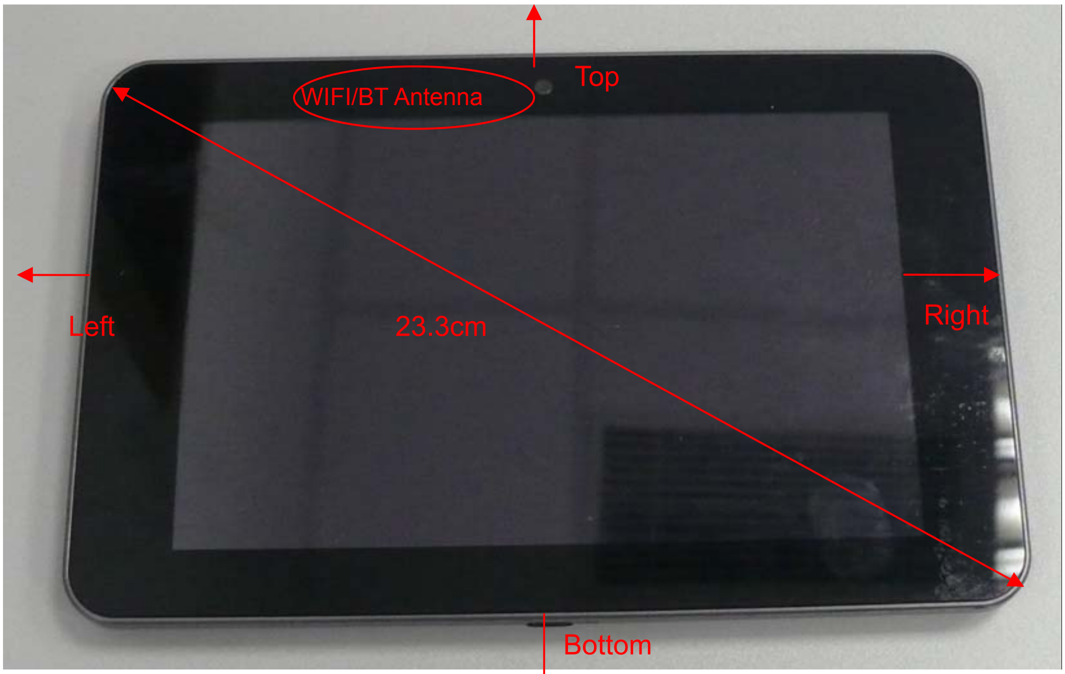
8. Low Battery Alarm Voltage (Typical values for information)

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



Front side

Picture 3: Constituents of the EUT

Picture 4: Test position 1

Picture 5: Test position 5