

SAR TEST REPORT
for
T-Link Industrial Development Co., Ltd.

Tablet PC
Model No.: M718 NEXTab 7

Prepared for : T-Link Industrial Development Co., Ltd.
Address : 2F A4th Bldg., Hekan Industrial Zone, WuHe Road S.,
Longgang District, Shenzhen, Guangdong, China 518129
Tel: 0755-28805505
Fax: 0755-28805665

Prepared By : Shenzhen Anbotek Compliance Laboratory Limited
Address : 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road,
Nanshan District, Shenzhen, Guangdong, China
Tel: (86) 755-26066544
Fax: (86) 755-26014772

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TABLE OF CONTENT

Description

	Page
Test Report	
1. GENERAL INFORMATION	4
1.1. Description of Device (EUT).....	4
1.2. Description of Test Facility	5
1.3. Operating Configurations	5
1.4. The Maximum SAR _{1g} Values.....	6
2. SAR MEASUREMENTS SYSTEM CONFIGURATION	7
2.1. SAR Measurement Set-up	7
2.2. DASY5 E-field Probe System	8
2.3. Scanning Procedure	9
2.4. Data Storage and Evaluation	10
3. TISSUE-EQUIVALENT LIQUID	13
3.1. Tissue-equivalent Liquid Ingredients	13
3.2. Tissue-equivalent Liquid Properties	13
4. SYSTEM CHECK	14
4.1. Description of System Check	14
4.2. System Check Results.....	15
5. OPERATIONAL CONDITIONS DURING TEST	16
5.1. General Description of Test Procedures	16
5.2. Test Position	16
6. TEST RESULTS	17
6.1. Conducted Power Results	17
6.2. SAR Test Results.....	19
7. 700MHZ TO 3GHZ MEASUREMENT UNCERTAINTY	20
8. MEASURING DEVICE AND TEST EQUIPMENT	22
APPENDIX I: TEST PHOTOGRAPHS	23
APPENDIX II: SYSTEM CHECK RESULTS	24
APPENDIX III: PHOTOS OF EUT AND TEST CONFIGURATION	54

TEST REPORT

Applicant : T-Link Industrial Development Co., Ltd.
Manufacturer : T-Link Industrial Development Co., Ltd.
EUT : Tablet PC
Model No. : M718 NEXTab 7
Serial No. : N/A
Trade Mark : NEXGeneration Electronics
Rating : DC 5V, 2000mA Via Adapter (Input: AC 100-240V, 0.3A, 50/60Hz)

Measurement Procedure Used:

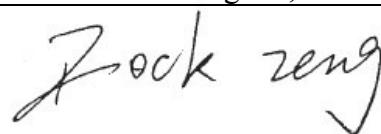
FCC 47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices
IEEE Std C95.1, 1999

SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001
including DA 02-1438, published June 2002
IEC 62209-2:2010

The device described above is tested by TA Technology (Shanghai) Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

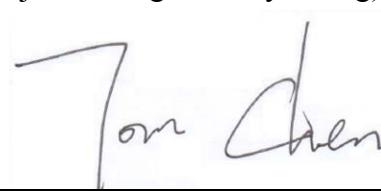
Date of Test : Jul. 12~Aug. 07, 2013



Prepared by : (Engineer / Rock Zeng)



Reviewer : (Project Manager / Sally Zhang)



Approved & Authorized Signer : (Manager /Tom Chen)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT : Tablet PC

Model Number : M718 NEXTab 7

Test Power Supply : AC 120V/60Hz for adapter

Adapter : Power Supply

Model: BA-520

Input: AC 100-240V, 0.3A, 50/60Hz

Output: DC 5V, 2000mA

Device Type : Portable Device

Exposure Category : Uncontrolled Environment / General Population

State of Sample : Prototype Unit

Hardware Version : M718_HW_V1.0

Software Version : M718_SW_V1.0

Antenna Type : Internal Antenna

Applicant : T-Link Industrial Development Co., Ltd.

Address : 2F A4th Bldg., Hekan Industrial Zone, WuHe Road S., Longgang District, Shenzhen, Guangdong, China 518129

Manufacturer : T-Link Industrial Development Co., Ltd.

Address : 2F A4th Bldg., Hekan Industrial Zone, WuHe Road S., Longgang District, Shenzhen, Guangdong, China 518129

Date of receiver : Jul. 11, 2013

Date of Test : Jul. 12~ Aug. 07, 2013

1.2. Description of Test Facility

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

CNAS - LAB Code: L3503

Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

FCC-Registration No.: 752021

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 10, 2013.

IC-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, February 22, 2013.

Test Location

All Emissions tests were performed at

Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

1.3. Operating Configurations

Equipment Under Test (EUT) is a Tablet PC. The detail about EUT is in chapter 1.1 in this report. The EUT has an internal antenna for WiFi antenna that can be used for Tx/Rx. During SAR test of the EUT, SAR is only tested for 802.11b. SAR is not required for 802.11 g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Operating Mode(s):	802.11b (Tested)
	802.11g (Untested)
	802.11n HT20/HT40 (Untested)
Operating Frequency Range(s):	2412-2462MHz for 802.11b
Test Channel:	2412MHz, 2437MHz, 2462MHz

1.4. The Maximum SAR1g Values

Body Worn Configuration

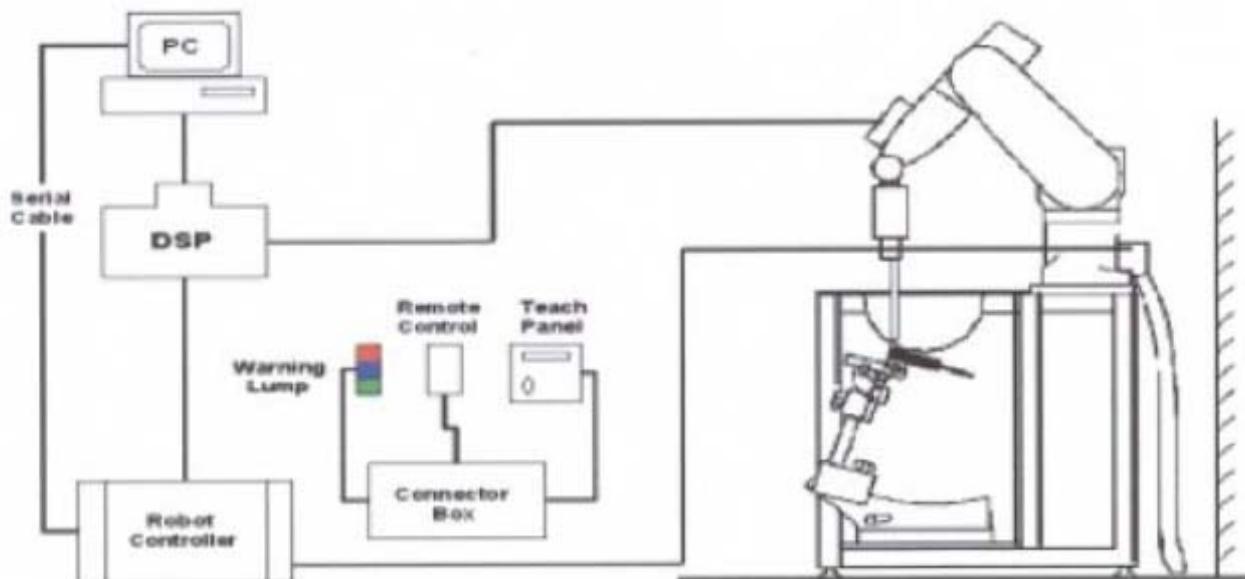
Mode	Test Position	Channel	Measurement Result		Tune up procedure Max Average Power (dBm)	1g Average Limit 1.6W/kg Report Result (W/kg)
			Average Conducted Power(dBm)	1g Average (W/kg)		
802.11b	Back Side	Mid/6	14.26	0.818	15.5	1.088

2. SAR Measurements System Configuration

2.1. SAR Measurement Set-up

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

- 1) A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
- 2) An arm extension for accommodating the data acquisition electronics (DAE).
- 3) 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.
- 4) 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.
- 5) A unit to operate the optical surface detector which is connected to the EOC.
- 6) 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.
- 7) 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
- 8) DASY5 software and SEMCAD data evaluation software.
- 9) Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- 10) The generic twin phantom enabling the testing of left-hand and right-hand usage.
- 11) The device holder for handheld mobile phones.
- 12) System validation dipoles allowing to validate the proper functioning of the system.



SAR Lab Test Measurement Set-up

2.2. DASY5 E-field Probe System

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

2.2.1. ES3DV3 Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors 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 4 GHz Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 μ W/g to > 100 mW/g Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones

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 ± 0.25 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. Scanning Procedure

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

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. $\pm 5\%$.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 12 mm x 12 mm(2GHz ~ 3GHz) is set. During the scan the distance of the probe to

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

Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

Spatial Peak Detection

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

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

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions. Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

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

2.4. Data Storage and Evaluation

2.4.1. 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.

2.4.2. 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, ai0, ai1, ai2
	- Conversion factor	ConvF
	- Diode compression point	Dcpi
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:

$$Vi =Ui +Ui^2 \cdot cf / d cpi$$

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

From the compensated input signals the primary field data for each channel can be evaluated:
 E-field probes: **Ei** = (**Vi** / **Normi** · **ConvF**)^{1/2}

H-field probes: **Hi** = (**Vi**)^{1/2} · (**ai0** + **ai1 f** + **ai2f2**) / **f**

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

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

$$\mathbf{E}_{\text{tot}} = (\mathbf{E}_x^2 + \mathbf{E}_y^2 + \mathbf{E}_z^2)^{1/2}$$

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

$$\mathbf{SAR} = (\mathbf{E}_{\text{tot}})^2 \cdot \sigma / (\rho \cdot 1000)$$

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

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

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.

$$\mathbf{P}_{\text{pwe}} = \mathbf{E}_{\text{tot}}^2 / 3770 \quad \text{or} \quad \mathbf{P}_{\text{pwe}} = \mathbf{H}_{\text{tot}}^2 \cdot 37.7$$

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. Tissue-equivalent Liquid

3.1. Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, salt, Glycol. The liquid has previously been proven to be suited for worst-case. The table 2 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the OET 65.

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 $\epsilon_r=52.70$ $\sigma=1.95$

3.2. Tissue-equivalent Liquid Properties

Dielectric Performance of Body Tissue Simulating Liquid

Frequency	Description	Dielectric Parameters		Temp °C	Limit
		ϵ_r	σ (s/m)		
2450MHz (body)	Target value	52.70	1.95	22.0	\leq the target ϵ_r \geq the target σ within 5%
	Measurement value 2012-12-26	51.97	1.97	21.5	
	Deviation	1.4%	1.0%	/	

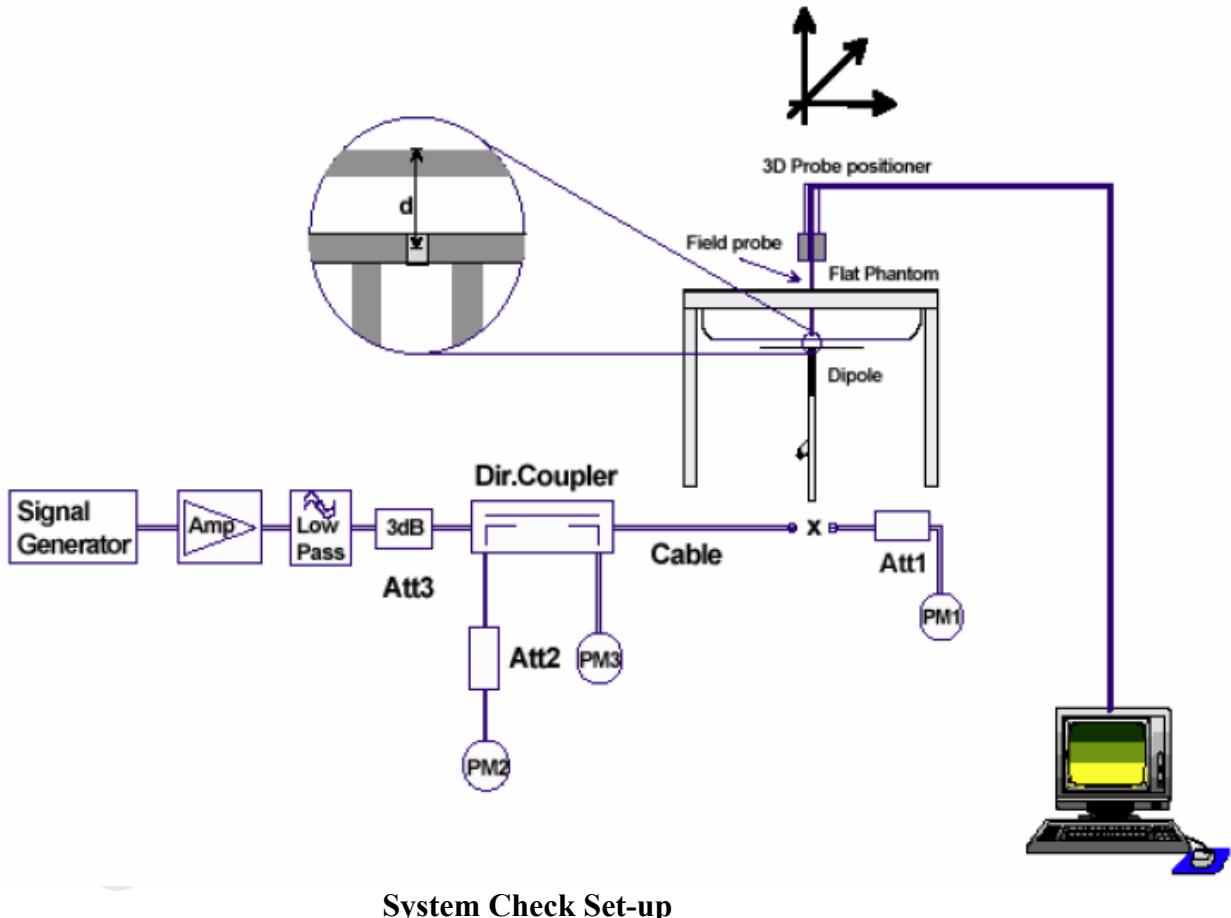
4. System Check

4.1. Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulates, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 4.

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.



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)	Δ Ω
8/29/2011	-29.0	/	50.4	/
8/28/2012	-28.1	3.1%	48.9	1.5Ω

4.2. System Check Results**System Check in Body Tissue Simulating Liquid**

Frequency	Test Date	Dielectric Parameters		Temp (°C)	250mW Measured SAR1g	1W Normalized SAR1g	1W Target SAR1g (±10% deviation)
		ε r	σ (s/m)			(W/kg)	
2450MHz	2013-08-05	51.69	1.90	21.5	13.20	52.80	51.70 (46.53~56.87)

5. Operational Conditions during Test

5.1. General Description of Test Procedures

For WLAN SAR testing, WLAN engineering testing software installed on the DUT 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.

802.11bg/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.

5.2. Test Position

For tablets with a display or overall diagonal dimension 22 cm >20 cm, the SAR procedures in 616217 D04 should be used.

Based upon 616217 D04, when the antenna-to-edge distance is greater than 0.5cm, such position does not need to be tested, the EUT is tested at the following 5 test positions:

Test Position 1: The back side of the EUT towards and directed tightly to touch the bottom of the flat phantom. The antenna to back surface distance is less than 0.5cm, so this position does need to be tested.

Test Position 2: The top side of the EUT towards and directed tightly to touch the bottom of the flat phantom. The antenna-to-edge distance is greater than 0.5cm, so this position does not need to be tested.

Test Position 3: The bottom side of the EUT towards and directed tightly to touch the bottom of the flat phantom. The antenna-to-edge distance is less than 0.5cm, so this position does need to be tested.

Test Position 4: The left side of the EUT towards and directed tightly to touch the bottom of the flat phantom. The antenna-to-edge distance is greater than 0.5cm, so this position does not need to be tested.

Test Position 5: The right side of the EUT towards and directed tightly to touch the bottom of the flat phantom. The antenna-to-edge distance is greater than 0.5cm, so this position does not need to be tested.

6. Test Results

6.1. Conducted Power Results

Mode	Channel	Data Rate (Mbps)	AV Power (dBm)
11b	1	1	14.56
		2	14.27
		5.5	14.32
		11	14.41
	6	1	14.26
		2	14.01
		5.5	14.06
		11	14.00
	11	1	14.40
		2	14.02
		5.5	14.05
		11	14.10
11g	1	6	9.90
		9	8.83
		12	8.62
		18	8.72
		24	8.68
		36	8.79
		48	8.93
		54	8.81
	6	6	10.0
		9	8.78
		12	8.63
		18	8.75
		24	8.66
		36	8.77
		48	8.90
		54	8.86
	11	6	9.80
		9	8.79
		12	8.63
		18	8.73
		24	8.67
		36	8.70
		48	8.81
		54	8.83
11n HT20	1	MCS 0	8.74
		MCS 1	8.68
		MCS 2	8.75

11n HT40	6	MCS 3	8.54
		MCS 4	8.62
		MCS 5	8.58
		MCS 6	8.47
		MCS 7	8.36
	11	MCS 0	8.73
		MCS 1	8.66
		MCS 2	8.77
		MCS 3	8.52
		MCS 4	8.60
		MCS 5	8.60
		MCS 6	8.50
	3	MCS 7	8.42
		MCS 0	8.72
		MCS 1	8.63
		MCS 2	8.73
		MCS 3	8.52
		MCS 4	8.63
		MCS 5	8.61
	6	MCS 6	8.51
		MCS 7	8.43
		MCS 0	7.74
		MCS 1	7.76
		MCS 2	7.54
		MCS 3	7.65
		MCS 4	7.53
	9	MCS 5	7.48
		MCS 6	7.51
		MCS 7	7.34
		MCS 0	7.75
		MCS 1	7.66
		MCS 2	7.56
		MCS 3	7.80

6.2. SAR Test Results

6.2.1. 802.11b

Limit of SAR		10 g Average	1g Average	Power Drift	Graph Results	
		2.0 W/kg	1.6 W/kg	±0.21 dB		
Test Case Of Body		Measurement Result (W/kg)		Power Drift (dB)		
Test Position	Channel	10 g Average	1 g Average			
Test position of Body (Distance 0mm)						
Test Position 1	High/11	0.329	0.811	0.020	Picture 1	
	Middle/6	0.333	0.818	0.140	Picture 2	
	Low/1	0.324	0.793	0.166	Picture 3	
Test Position 2	N/A	N/A	N/A	N/A	N/A	
Test Position 3	Low/1	0.101	0.207	-0.055	Picture 4	
Test Position 4	N/A	N/A	N/A	N/A	N/A	
Test Position 5	N/A	N/A	N/A	N/A	N/A	
Note: 1. The value with blue color is the maximum SAR Value of each test band. 2. The SAR test shall be performed at the highest output power channel of each operating mode. If the SAR measured is at least 3.0 dB lower than the SAR limit (< 0.8W/kg), testing at the other channels is optional. 3. The other channels were measured at the worst case. 4. 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. 5. N/A: WIFI antenna is located at bottom edge. Based upon 616217 D04, when the antenna-to-edge distance is greater than 0.5cm, such position does not need to be tested.						

Report SAR Values of the highest measured SAR

Mode	Test Position	Channel	Measurement Result		Tune up procedure Max Average Power (dBm)	1g Average Limit 1.6W/kg Report Result (W/kg)
			Average Conducted Power(dBm)	1g Average (W/kg)		
802.11b	Back Side	Mid/6	14.26	0.818	15.5	1.088

7. 700MHz to 3GHz Measurement Uncertainty

No.	source	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard uncertainty ui(%)	Degree of freedom V_{eff} or v_i
1	System repetitivity	A	0.5	N	1	1	0.5	9
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	∞
5	boundary effect	B	1.9	R	$\sqrt{3}$	1	1.1	∞
6	probe linearity	B	4.7	R	$\sqrt{3}$	1	2.7	∞
7	System detection limits	B	1.0	R	$\sqrt{3}$	1	0.6	∞
8	readout Electronics	B	1.0	N	1	1	1.0	∞
9	response time	B	0	R	$\sqrt{3}$	1	0	∞
10	integration time	B	4.32	R	$\sqrt{3}$	1	2.5	∞
11	noise	B	0	R	$\sqrt{3}$	1	0	∞
12	RF Ambient Conditions	B	3	R	$\sqrt{3}$	1	1.73	∞
13	Probe Positioner Mechanical Tolerance	B	0.4	R	$\sqrt{3}$	1	0.2	∞
14	Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	∞
15	Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	∞
16	Test Sample Positioning	A	2.9	N	1	1	2.9	71
17	Device Holder Uncertainty	A	4.1	N	1	1	4.1	5
18	Output Power Variation - SAR drift mea.	B	5.0	R	$\sqrt{3}$	1	2.9	∞

19	phantom	B	4.0	R	$\sqrt{3}$	1	2.3	∞
20	liquid conductivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.64	1.8	∞
21	liquid conductivity (measurement uncertainty)	B	2.5	N	1	0.64	1.6	9
22	liquid permittivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.6	1.7	∞
23	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	

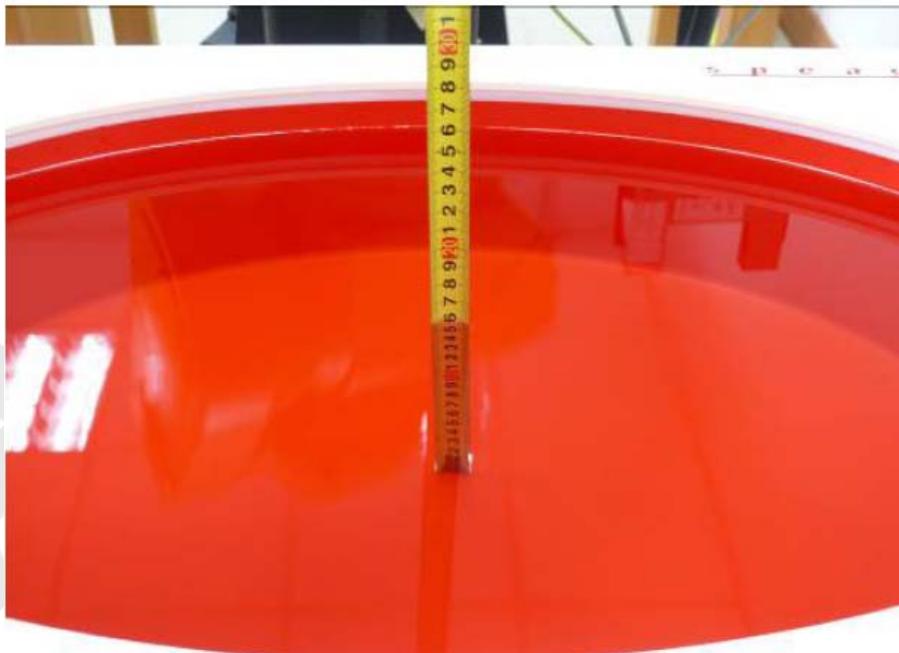
8. MEASURING DEVICE AND TEST EQUIPMENT

No.	Name	Type	Serial Number	Calibration Date	Valid Period
1	Network analyzer	Agilent 8753E	US37390326	September 11, 2012	One year
2	Dielectric Probe Kit	Agilent 85070E	US44020115	No Calibration Requested	
3	Power meter	Agilent E4417A	GB41291714	March 11, 2013	One year
4	Power sensor	Agilent N8481H	MY50350004	September 24, 2012	One year
5	Power sensor	E9327A	US40441622	September 23, 2012	One year
6	Dual directional coupler	778D-012	50519	March 26, 2013	One year
7	Signal Generator	HP 8341B	2730A00804	September 11, 2012	One year
8	Amplifier	IXA-020	0401	No Calibration Requested	
9	BTS	E5515C	MY48360988	December 1, 2012	One year
10	E-field Probe	ES3DV3	3189	June 22, 2013	One year
11	DAE	DAE4	1317	January 25, 2013	One year
12	Validation Kit 2450MHz	D2450V2	786	August 29, 2011	Two years
13	Temperature Probe	JM222	AA1009129	March 15, 2013	One year
14	Hygrothermograph	WS-1	64591	September 27, 2012	One year

APPENDIX I: TEST PHOTOGRAPHS



Specific Absorption Rate Test Layout



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

APPENDIX II: SYSTEM CHECK RESULTS

System Performance Check at 2450 MHz Body TSL

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

Date/Time: 08/05/2013 4:06:55 PM Communication System: CW; Frequency: 2450 MHz;

Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 51.97$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(3.96, 3.96, 3.96); Calibrated: 6/22/2013

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

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

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

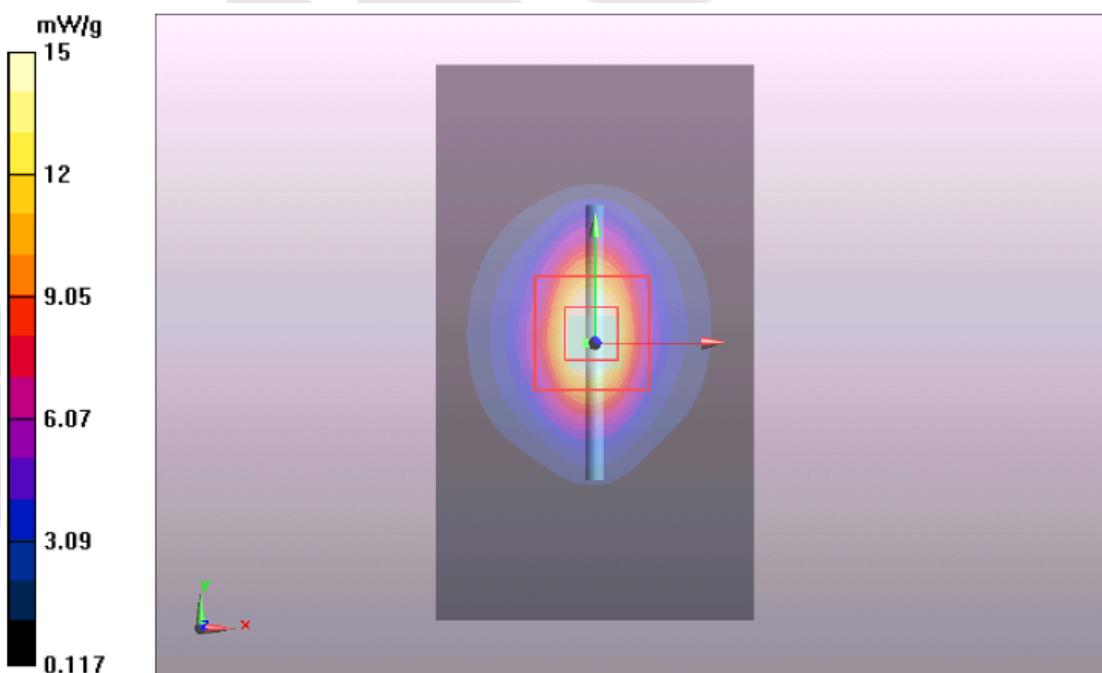
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



System Performance Check 2450MHz 250mW

APPENDIX III: GRAPH RESULTS

802.11b Test Position 1 High

Date/Time: 08/05/2013 4:42:16 PM

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

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.98$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(3.96, 3.96, 3.96); Calibrated: 6/22/2013

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 (91x141x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 1.03 mW/g

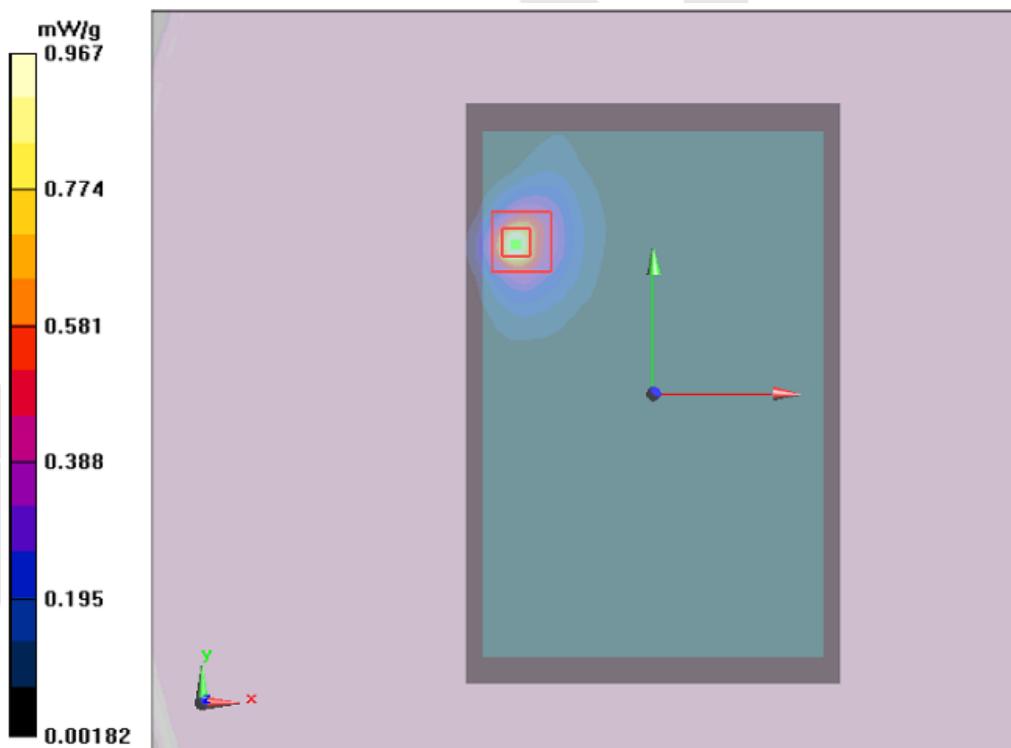
Test Position 1 High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.6 V/m; Power Drift = 0.020 Db

Peak SAR (extrapolated) = 2.14 W/kg

SAR(1 g) = 0.811 mW/g; SAR(10 g) = 0.329 mW/g

Maximum value of SAR (measured) = 0.967 mW/g



802.11b Test Position 1 Channel 11

802.11b Test Position 1 Middle

Date/Time: 08/05/2013 5:19:42 PM

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.95$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(3.96, 3.96, 3.96); Calibrated: 6/22/2013

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 (91x141x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.896 mW/g

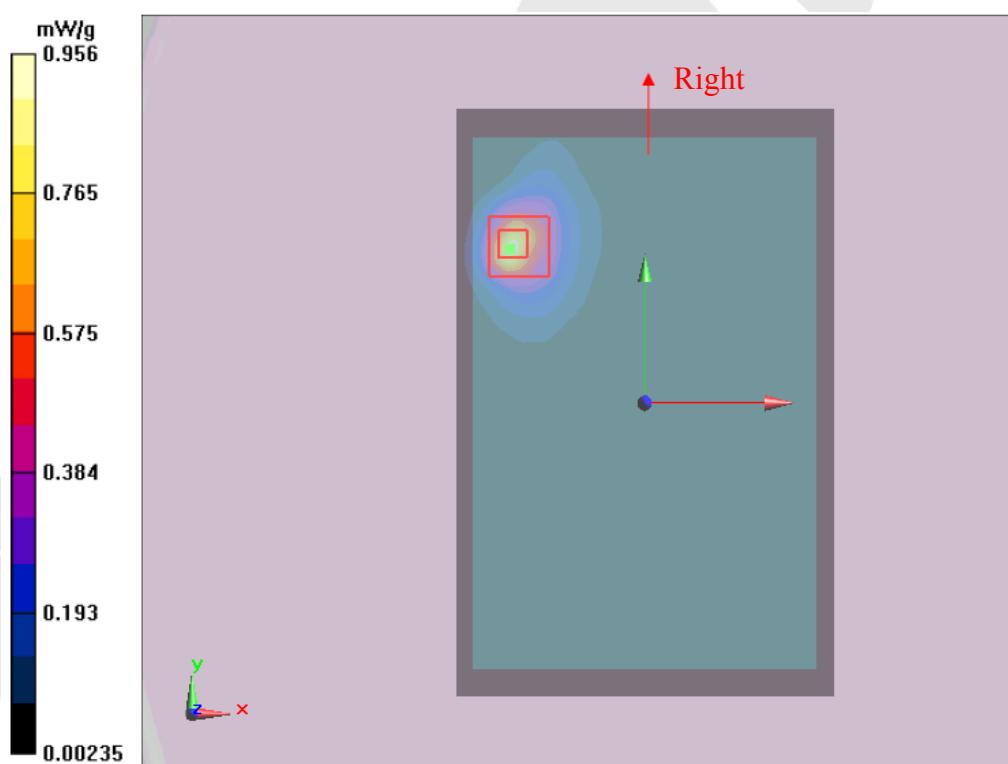
Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

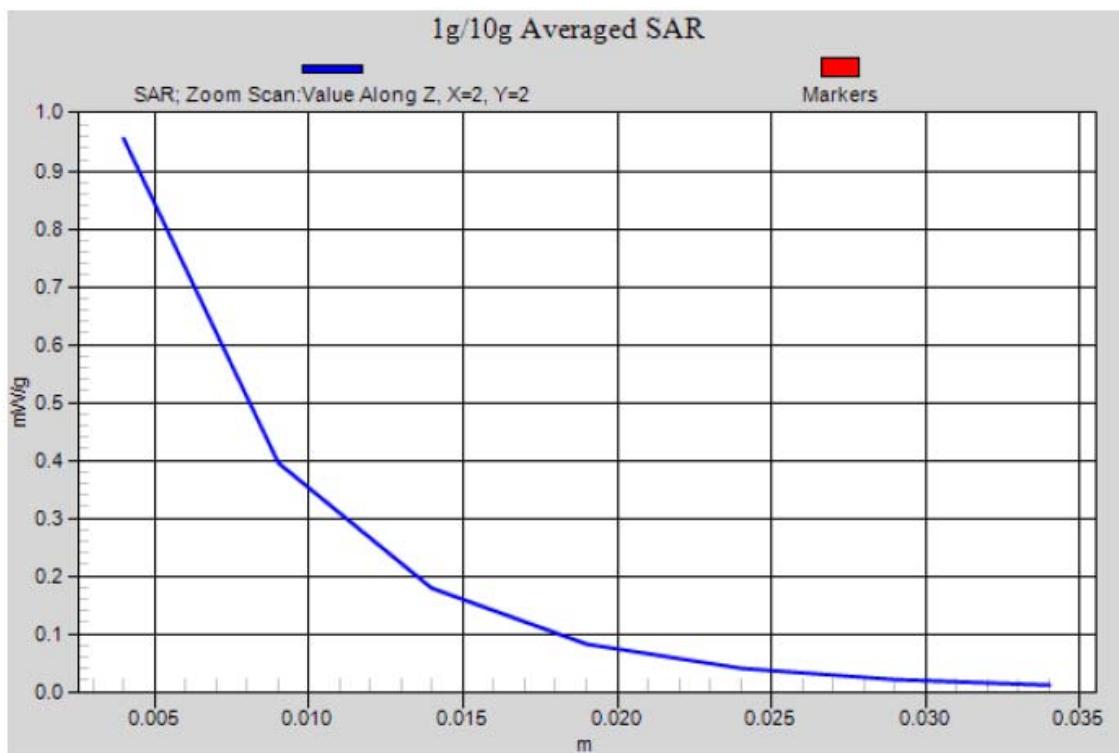
Reference Value = 1.7 V/m; Power Drift = 0.140 dB

Peak SAR (extrapolated) = 2.17 W/kg

SAR(1 g) = 0.818 mW/g; SAR(10 g) = 0.333 mW/g

Maximum value of SAR (measured) = 0.956 mW/g





802.11b Test Position 1 Channel 6

802.11b Test Position 1 Low

Date/Time: 08/05/2013 5:47:03 PM

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

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(3.96, 3.96, 3.96); Calibrated: 6/22/2013

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 (91x141x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.769 mW/g

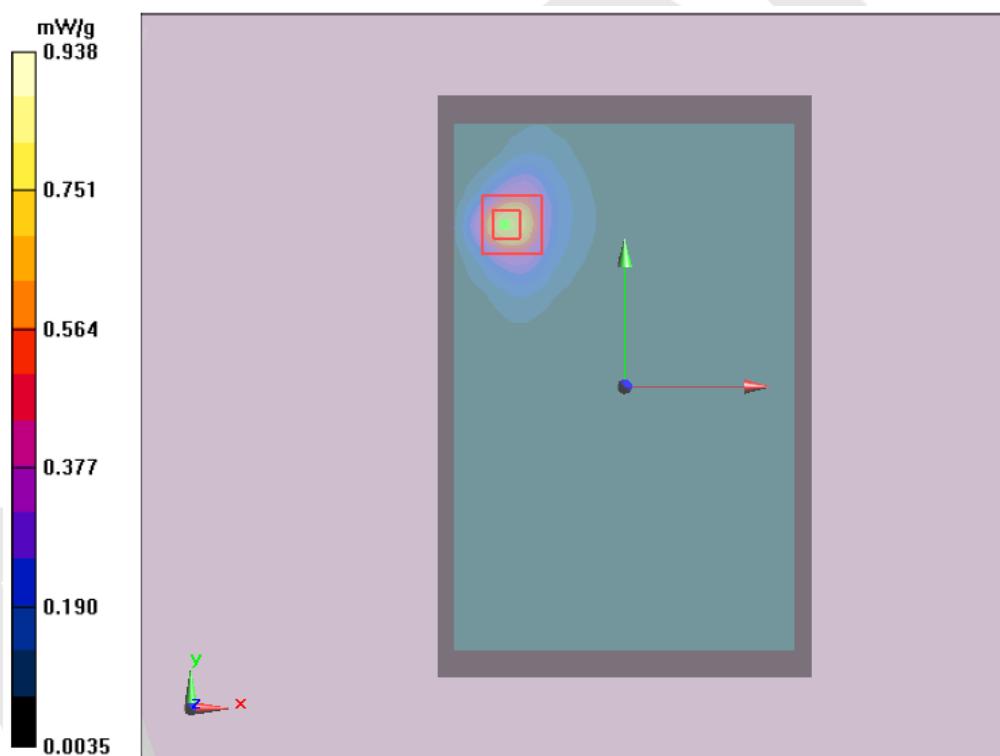
Test Position 1 Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.2 V/m; Power Drift = 0.166 dB

Peak SAR (extrapolated) = 2.08 W/kg

SAR(1 g) = 0.793 mW/g; SAR(10 g) = 0.324 mW/g

Maximum value of SAR (measured) = 0.938 mW/g

**802.11b Test Position 1 Channel 1**

802.11b Test Position 3 Low

Date/Time: 08/05/2013 6:09:45 PM

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

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

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

Phantom section: Flat Section

DASY5 Configuration:

Probe: ES3DV3 - SN3189; ConvF(3.96, 3.96, 3.96); Calibrated: 6/22/2013

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

Position 3 Low /Area Scan (31x141x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.217 mW/g

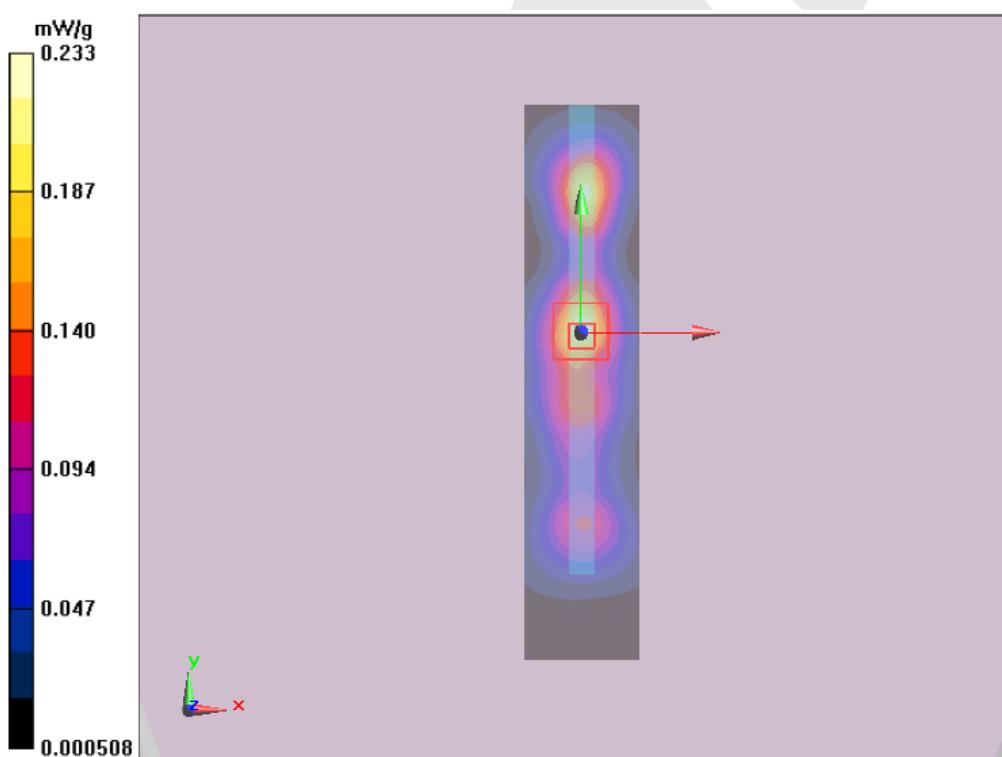
Position 3 Low /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.1 V/m; Power Drift = -0.055 dB

Peak SAR (extrapolated) = 0.429 W/kg

SAR(1 g) = 0.207 mW/g; SAR(10 g) = 0.101 mW/g

Maximum value of SAR (measured) = 0.233 mW/g

**802.11b Test Position 3 Channel 1**

APPENDIX IV: PROBE CALIBRATION CERTIFICATE

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



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C Service suisse d'étalonnage
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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: **ES3-3189_Jun12**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3189**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4**
Calibration procedure for dosimetric E-field probes

Calibration date: **June 22, 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293B74	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: S5066 (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

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

Issued: June 22, 2012

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



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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	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., $\theta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ 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.
- 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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 $f \leq 800$ 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.

ES3DV3 – SN:3189

June 22, 2013

Probe ES3DV3

SN:3189

Manufactured: March 25, 2008
Calibrated: June 22, 2013

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

ES3DV3- SN:3189

June 22, 2013

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.32	1.35	1.05	$\pm 10.1\%$
DCP (mV) ^B	99.5	100.6	100.2	

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	160.3	$\pm 3.8\%$
			Y	0.00	0.00	1.00	164.9	
			Z	0.00	0.00	1.00	182.0	

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.

ES3DV3- SN:3189

June 22, 2013

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189**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)
300	45.3	0.87	6.83	6.83	6.83	0.25	1.06	± 13.4 %
450	43.5	0.87	6.37	6.37	6.37	0.14	1.67	± 13.4 %
835	41.5	0.90	5.81	5.81	5.81	0.63	1.24	± 12.0 %
1750	40.1	1.37	4.90	4.90	4.90	0.80	1.14	± 12.0 %
1900	40.0	1.40	4.69	4.69	4.69	0.62	1.31	± 12.0 %
2450	39.2	1.80	4.14	4.14	4.14	0.65	1.36	± 12.0 %

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

ES3DV3- SN:3189

June 22, 2013

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189**Calibration Parameter Determined in Body Tissue Simulating Media**

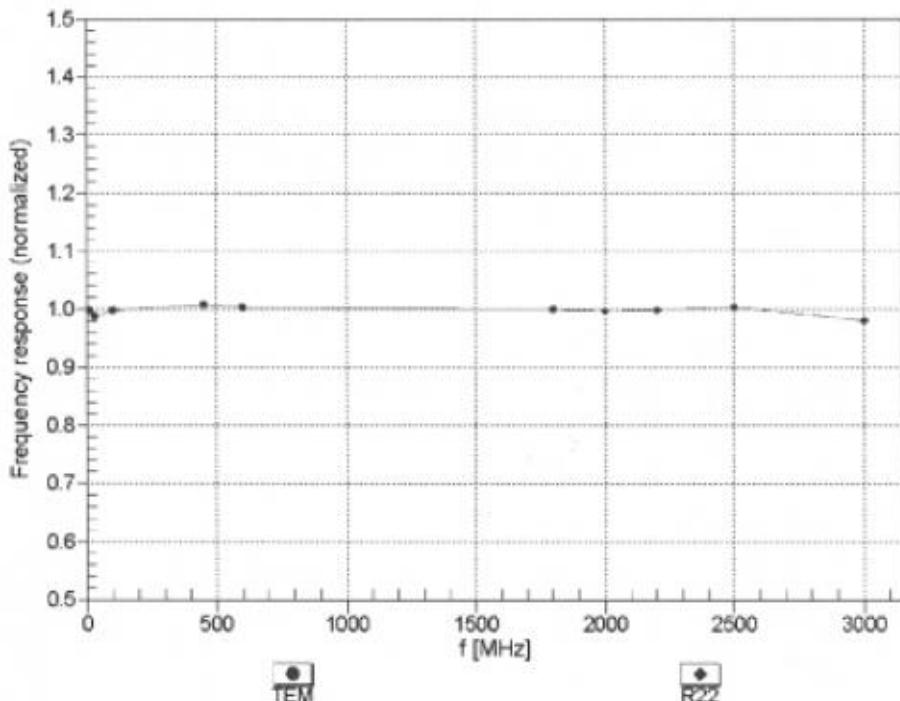
f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	6.53	6.53	6.53	0.23	1.90	± 13.4 %
450	56.7	0.94	6.73	6.73	6.73	0.10	1.00	± 13.4 %
835	55.2	0.97	5.81	5.81	5.81	0.54	1.33	± 12.0 %
1750	53.4	1.49	4.65	4.65	4.65	0.67	1.38	± 12.0 %
1900	53.3	1.52	4.36	4.36	4.36	0.62	1.40	± 12.0 %
2450	52.7	1.95	3.96	3.96	3.96	0.64	0.99	± 12.0 %

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

ES3DV3- SN:3189

June 22, 2013

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



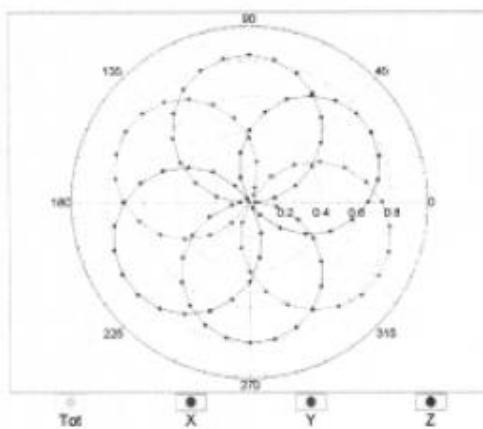
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

ES3DV3- SN:3189

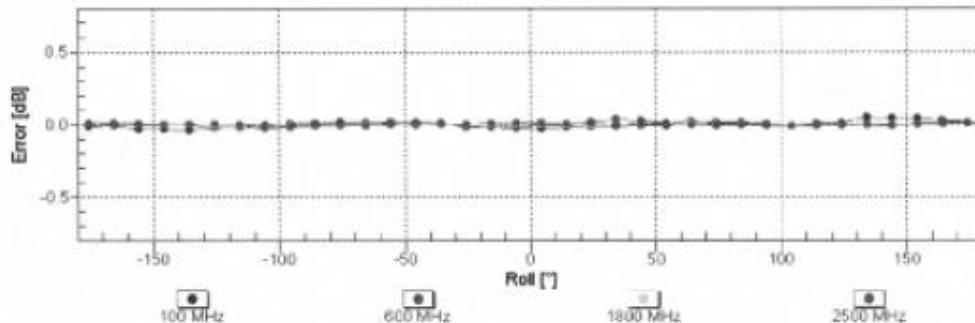
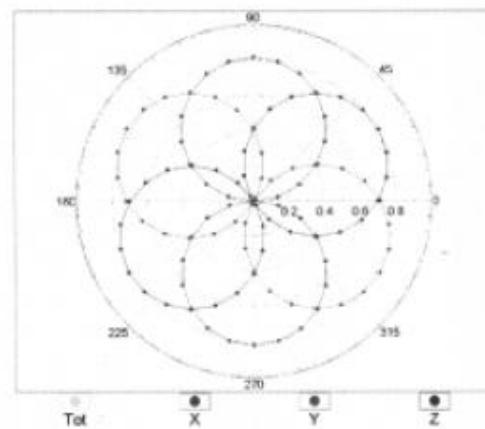
June 22, 2013

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

f=600 MHz, TEM

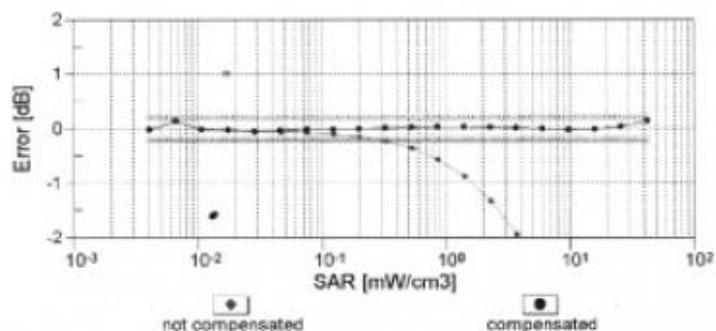
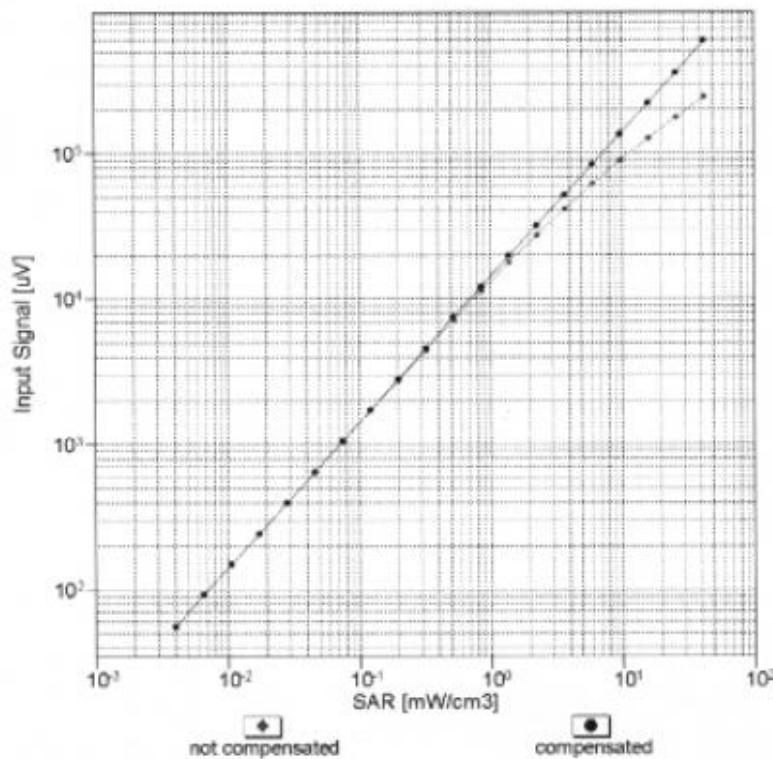


f=1800 MHz, R22

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

ES3DV3- SN:3189

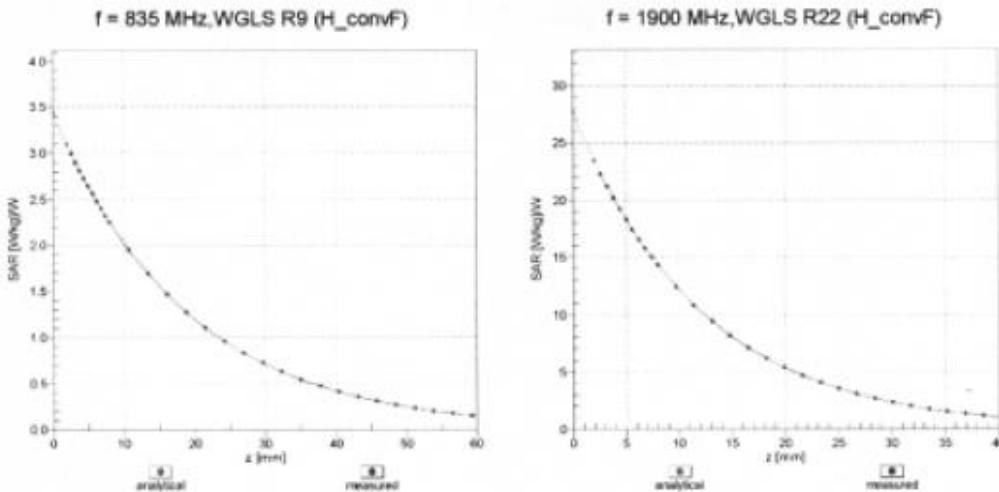
June 22, 2013

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

ES3DV3-SN:3189

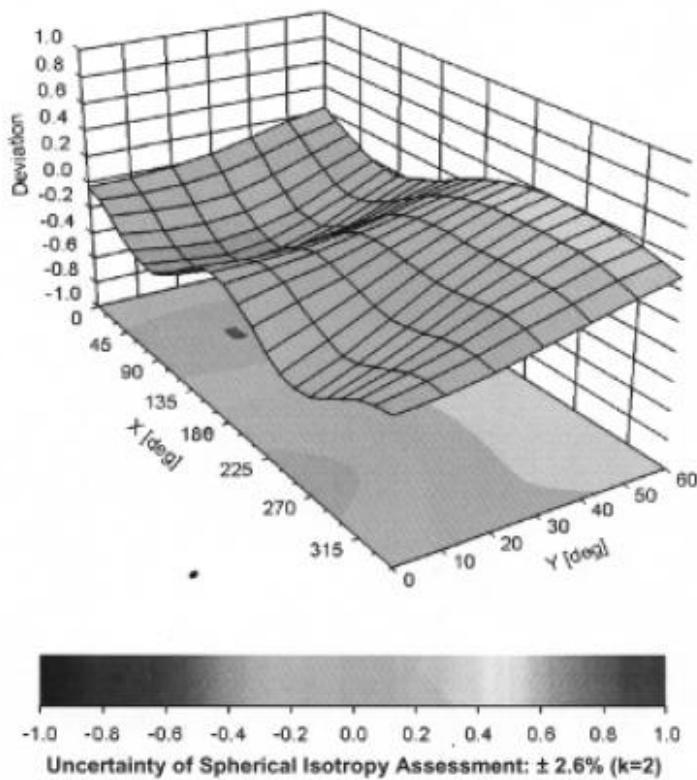
June 22, 2013

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900$ MHz



ES3DV3- SN:3189

June 22, 2013

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3189**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	54.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

APPENDIX V: D2450V2 DIPOLE CALIBRATION CERTIFICATE

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



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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

Calibrated by:	Name	Function	Signature
	Dimce Iliev	Laboratory Technician	

Approved by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	

Issued: August 29, 2011

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6.2
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)

Appendix**Antenna Parameters with Head TSL**

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.4 Ω + 3.5 $\mu\Omega$
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:

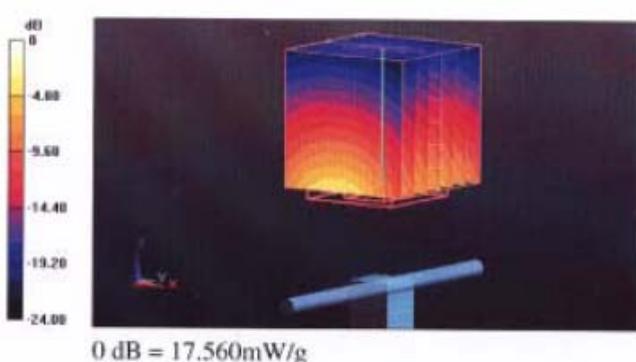
Measurement grid: dx=5mm, dy=5mm, dz=5mm

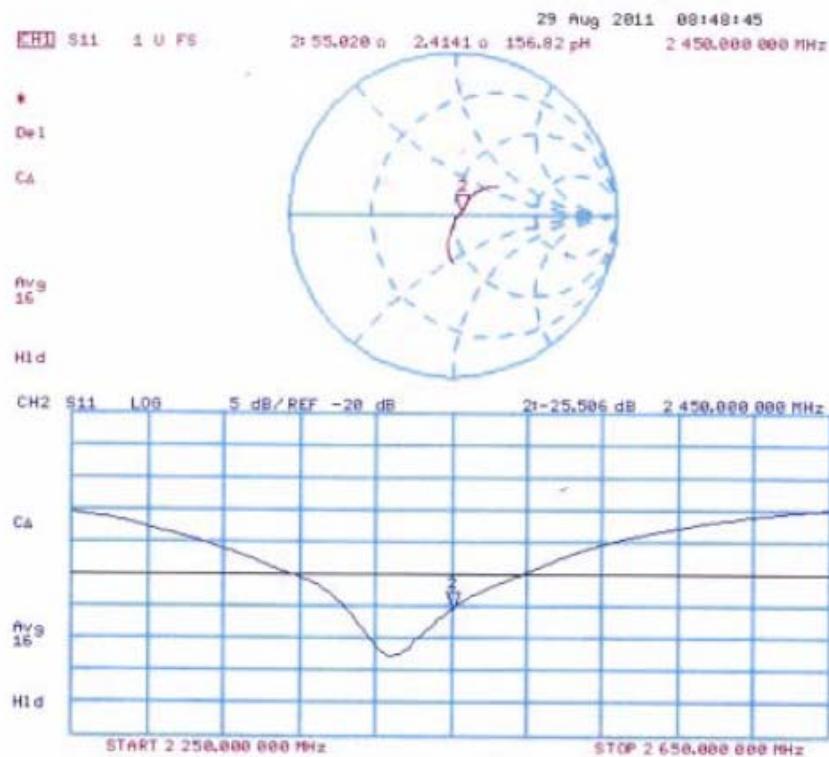
Reference Value = 101.5 V/m; Power Drift = 0.06 dB

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:

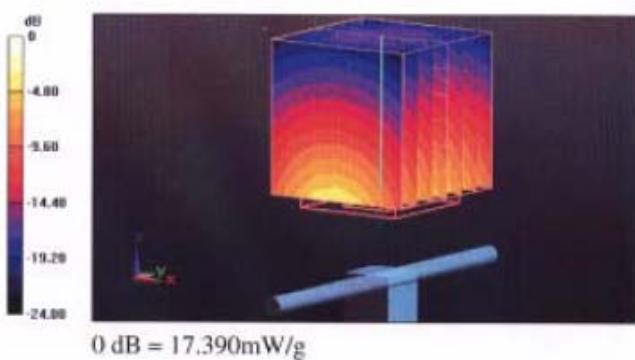
Measurement grid: dx=5mm, dy=5mm, dz=5mm

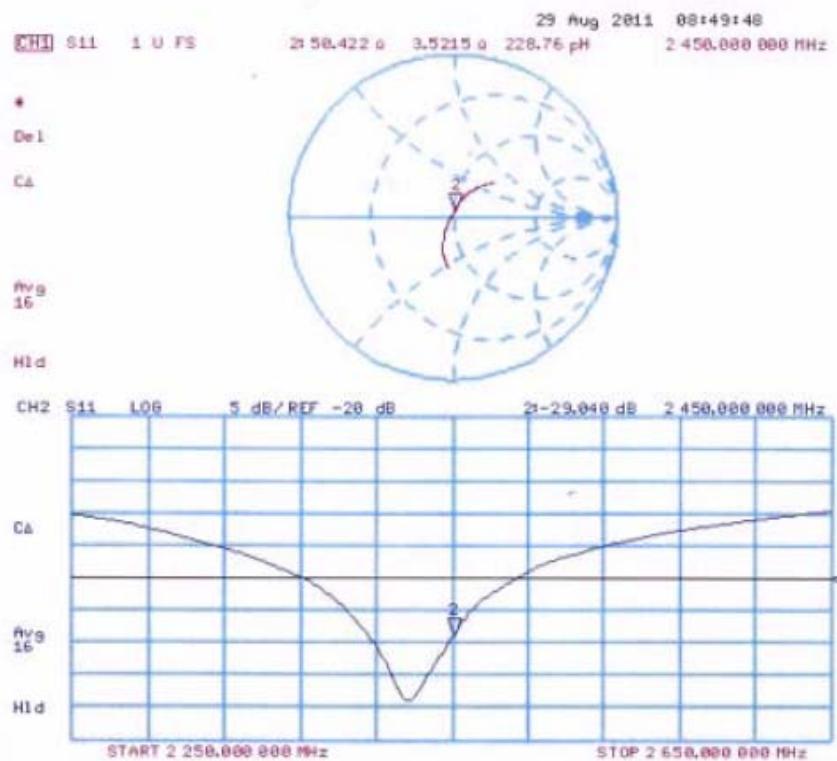
Reference Value = 96.118 V/m; Power Drift = 0.0072 dB

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



Impedance Measurement Plot for Body TSL

APPENDIX V: DAE4 CALIBRATION CERTIFICATE

Calibration Laboratory of
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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 Calibrator Box V2.1	SE UWS 053 AA 1001 SE UMS 006 AA 1002	07-Jan-13 (in house check) 07-Jan-13 (in house check)	In house check: Jan-14 In house check: Jan-14

Calibrated by: **Name: R.Mayoraz** **Function: Technician** **Signature:**

Approved by: **Name: Fin Bornholt** **Function: Deputy Technical Manager** **Signature:**

Issued: January 25, 2013

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Schmid & Partner
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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.

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	$404.011 \pm 0.02\% \text{ (k=2)}$	$404.006 \pm 0.02\% \text{ (k=2)}$	$403.901 \pm 0.02\% \text{ (k=2)}$
Low Range	$3.98819 \pm 1.55\% \text{ (k=2)}$	$3.99805 \pm 1.55\% \text{ (k=2)}$	$3.98192 \pm 1.55\% \text{ (k=2)}$

Connector Angle

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

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

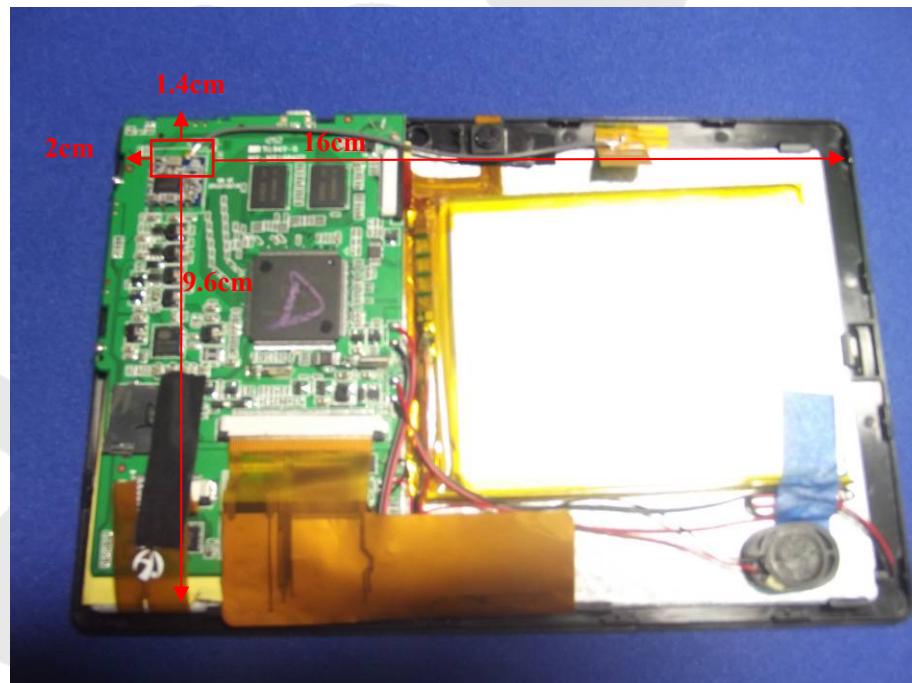
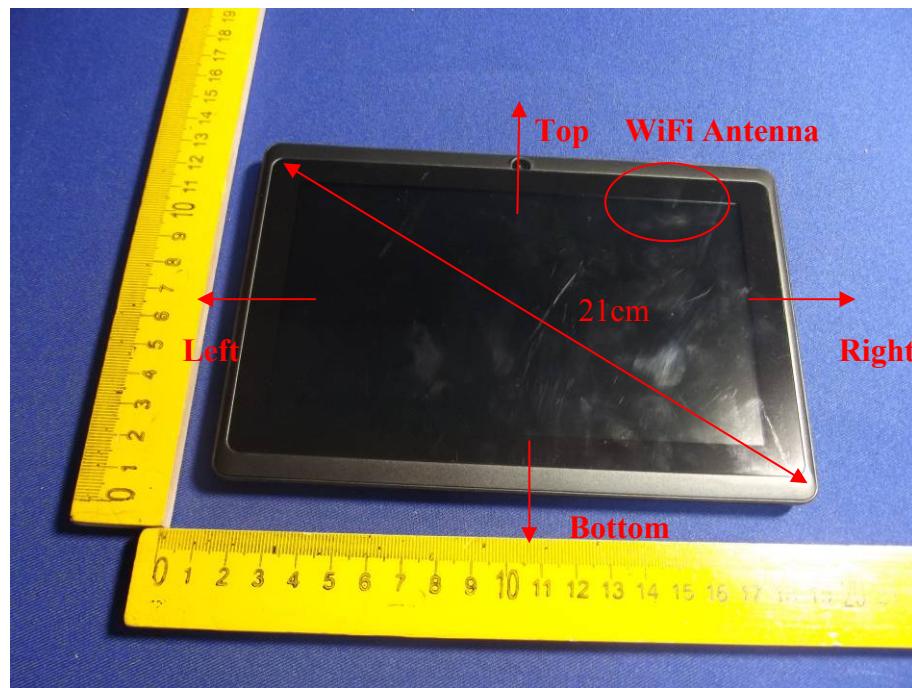
8. Low Battery Alarm Voltage (Typical values for information)

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

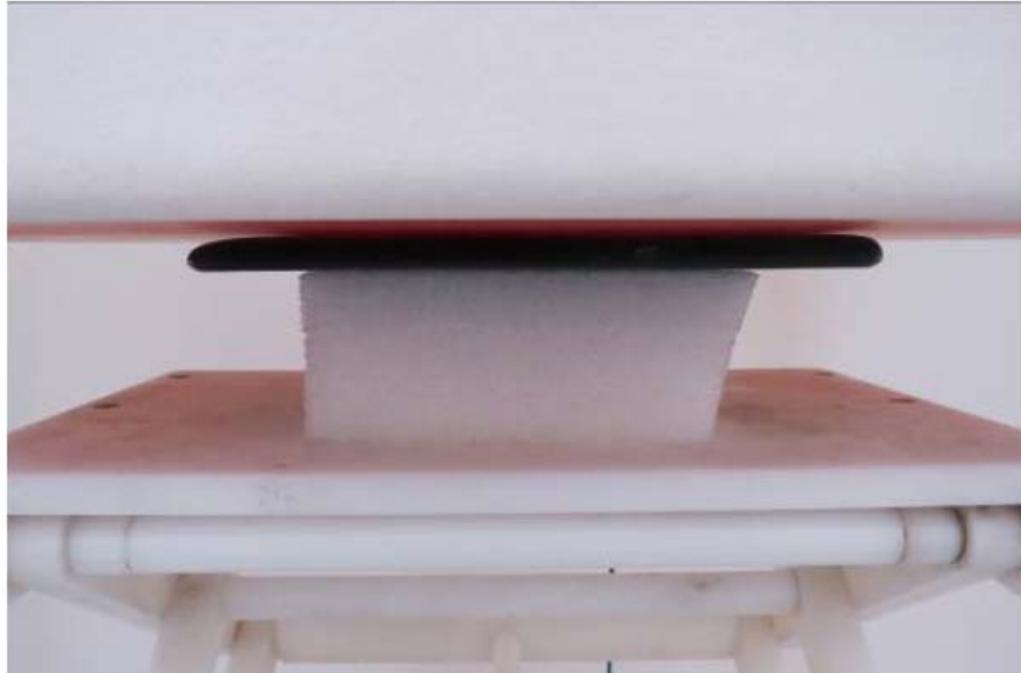
9. Power Consumption (Typical values for information)

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

APPENDIX III: PHOTOS OF EUT AND TEST CONFIGURATION



Test Position 1:



Test Position 3:

