SGS-CSTC Standards Technical Services Co., Ltd.

No. 1 Workshop, M-10, Middle section, Science & Technology Park,
Nanshan District, Shenzhen, Guangdong, China 518057
Telephone: +86 (0) 755 2601 2053
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FCC SAR TEST REPORT

Application No.:	SZEM1211006284RF
Applicant:	IRIVER Ltd
Product Name:	EBOOK
Model No.(EUT):	EB12
Standards:	IEEE Std C95; IEEE1528;OET Bulletin No. 65, Supplement C
Date of Receipt:	2012-12-13
Date of Test:	2012-12-13 to 2012-12-13
Date of Issue:	2012-12-28
Test Result :	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.
If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

2 Test Summary

Frequency Band	Test position	Test mode	Test Ch. /Freq.	Max average SAR1-g(W/kg)	Conducted power(dBm)	SAR limit (W/kg)	verdict
WIFI	Body	802.11b	11/2462	1.39	14.08	1.6	PASS

Remark: The maximum SAR value of **Body** is **1.39**W/kg

3 Contents

4 General Information

4.1 Details of Applicant

Name:	IRIVER Ltd
Address:	902-5 iriver house, Bangbaedong, Seocho-gu, Seoul, Korea
Telephone:	+82230197542
Contact:	Woo suk Kim
Email:	kimmy.kim@iriver.com

4.2 General Description of EUT

Product Name	EBOOK		
Model Name	EB12		
Hardware Version	V1.1		
Software Version	V1.0		
Normal Voltage	3.7V		
Low Voltage	3.0V		
High Voltage	4.2		
Battery Type	Lithium-ion battery		
Antenna Type	Inner Antenna		
GSM Frequency Bands	Band	T x (MHz)	Rx (MHz)
	WIFI	2400-2483.5	2400-2483.5
Modulation Mode	BPSK		
Serial Number	NA		

4.3 Description of Support Units

The EUT has been tested independently.

4.4 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab
No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China 518057
Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

- **CNAS (No. CNAS L2929)**
  CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.
- **VCCI**
  The 3m Semi-anechoic chamber, Full-anechoic Chamber and Shielded Room (7.5m x 4.0m x 3.0m) of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2197, G-416, T-1153 and C-2383 respectively.
- **FCC – Registration No.: 556682**
  SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen 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 No.: 556682.
- **Industry Canada (IC)**
  The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

4.8 Other Information Requested by the Customer

None

4.9 Test Standards

Identity	Document Title
IEEE Std C95.1 – 1991	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
IEEE 1528-2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
OET Bulletin No. 65, Supplement C– 2001	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
Canada's Safety Code 6	Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz (99-EHD-237)
RSS-102	Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Bands (Issue 4 of March 2010)
KDB447498 D01	Mobile Portable RF Exposure v04
KDB 248227 D01	SAR meas for 802 11 a b g v01r02

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain)	**1.60 mW/g**	8.00 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g	0.40 mW/g
Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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

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

4.10 Measurement Uncertainty

Measurements and results are all in compliance with the standards listed in section 12 of this report. All measurements and results are recorded and maintained at the laboratory performing the tests and measurement uncertainties are taken into account when comparing measurements to pass/ fail criteria. The Expanded uncertainty(95% CONFIDENCE INTERVAL) is **20.86%**.

A	b1	c	d	e = f(d,k)	g	i = C*g/e	k
Uncertainty Component	Section in P1528	Tol (%)	Prob . Dist.	Div.	Ci (1g)	1g ui (%)	Vi (Veff)
Probe calibration	E.2.1	6.3	N	1	1	6.3	∞
Axial isotropy	E.2.2	0.5	R	$\sqrt{3}$	$(1-Cp)^{1/2}$	0.20	∞
hemispherical isotropy	E.2.2	2.6	R	$\sqrt{3}$	$\sqrt{Cp}$	1.06	∞
Boundary effect	E.2.3	0.8	R	$\sqrt{3}$	1	0.46	∞
Linearity	E.2.4	0.6	R	$\sqrt{3}$	1	0.35	∞
System detection limit	E.2.5	0.25	R	$\sqrt{3}$	1	0.15	∞
Readout electronics	E.2.6	0.3	N	1	1	0.3	∞
Response time	E.2.7	0	R	$\sqrt{3}$	1	0	∞
Integration time	E.2.8	2.6	R	$\sqrt{3}$	1	1.5	∞
RF ambient Condition –Noise	E.6.1	3	R	$\sqrt{3}$	1	1.73	∞
RF ambient Condition - reflections	E.6.1	3	R	$\sqrt{3}$	1	1.73	∞
Probe positioning- mechanical tolerance	E.6.2	1.5	R	$\sqrt{3}$	1	0.87	∞
Probe positioning- with respect to phantom	E.6.3	2.9	R	$\sqrt{3}$	1	1.67	∞
Max. SAR evaluation	E.5.2	1	R	$\sqrt{3}$	1	0.58	∞
Test sample positioning	E.4.2	4	N	1	1	3.7	9
Device holder uncertainty	E.4.1	3.6	N	1	1	3.6	∞
Output power variation –SAR drift measurement	6.62	5	R	$\sqrt{3}$	1	2.89	∞
Phantom uncertainty (shape and thickness tolerances)	E.3.1	4	R	$\sqrt{3}$	1	2.31	∞
Liquid conductivity - deviation from target values	E.3.2	5	R	$\sqrt{3}$	0.64	1.85	∞
Liquid conductivity	E.3.2	4	N	1	0.64	2.56	5

- measurement uncertainty							
Liquid permittivity - deviation from target values	E.3.3	5	R	$\sqrt{3}$	0.6	1.73	∞
Liquid permittivity - measurement uncertainty	E.3.3	4	N	1	0.6	2.40	5
Combined standard uncertainty				RSS		10.43	430
Expanded uncertainty (95% CONFIDENCE INTERVAL)				K=2		**20.86**	

Table 1： Measurement Uncertainty

5 Equipments Used during Test

5.1 SPEAG DASY4

Test Platform	SPEAG DASY4 Professional
Location	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab
Manufacture	SPEAG
Description	SAR Test System (Frequency range 300MHz-3GHz) 835, 900, 1800, 1900, 2000, 2450 frequency band
Software Reference	DASY4: V4.7 Build 80 SEMCAD: V1.8 Build 186

Hardware Reference

	Model	Equipment	Serial Number	Calibration Date	Due date of calibration
☒	Robot	RX90L	F03/5V32A1/A01	n/a	n/a
☒	Twin Phantom	SAM 1	TP-1283	n/a	n/a
☒	Flat Phantom	ELI 5.0	1128	n/a	n/a
☒	DAE	DAE4	679	2011-12-23	2012-12-22
☒	E-Field Probe	ES3DV3	3071	2012-06-22	2013-06-21
☒	Validation Kits	D2450V2	735	2012-06-15	2013-06-14
☒	Agilent Network Analyzer	E5071B	MY42100549	2012-04-12	2013-04-11
☒	RF Bi-Directional Coupler	ZABDC20-252H-N+	n/a	2012-03-15	2013-03-14
☒	Agilent Signal Generator	E4438C	MY42082326	2012-04-12	2013-04-11
☒	Mini-Circuits Preamplifier	ZHL-42	D041905	2012-04-12	2013-04-11
☒	Agilent Power Meter	E4416A	GB41292095	2012-03-18	2013-03-17
☒	Agilent Power Sensor	8481H	MY41091234	2012-03-15	2013-03-14
☒	R&S Power Sensor	NRP-Z92	100025	2012-03-18	2013-03-17
☒	R&S Universal Radio Communication Tester	CMU200	103633	2012-03-15	2013-03-14

5.2 The SAR Measurement System

A photograph of the SAR measurement System is given in F-1.

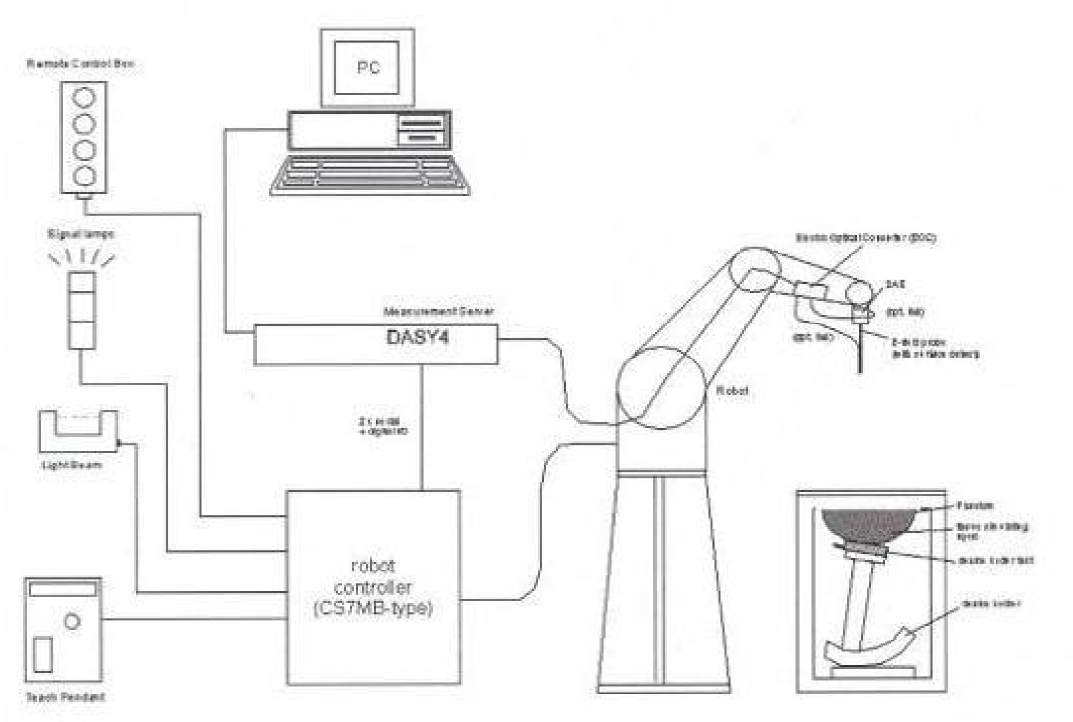
This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (Speag Dasy 4 professional system). A Model ES3DV3 3088 E-field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= σ (|Ei|2)/ ρ where σ and ρ are the conductivity and mass density of the tissue-Simulate.

The DASY4 system for performing compliance tests consists of the following items:
A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software. An arm extension for accommodation 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 electronics (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.

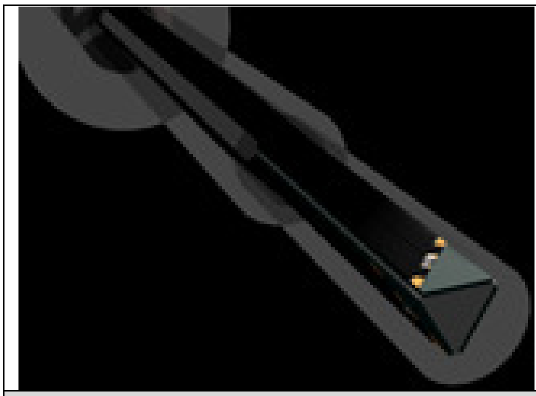
The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.



F-1. SAR System Configuration

- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand, right-hand and BodyWorn usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validating the proper functioning of the system.

5.3 Isotropic E-field Probe ES3DV3

	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 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 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
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

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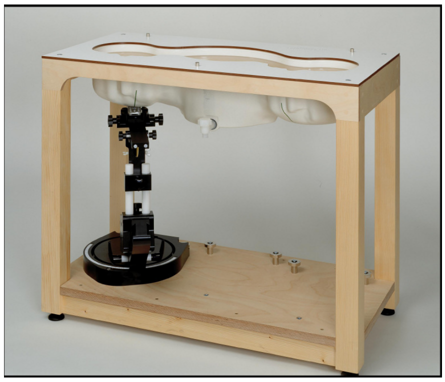
5.4 SAM Twin Phantom

Material	Vinylester, glass fiber reinforced (VE-GF)	
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions **(incl. Wooden Support)**	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	
Wooden Support	SPEAG standard phantom table	

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.

Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.

5.5 ELI Phantom

Material	Vinylester, glass fiber reinforced (VE-GF)	
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	
Wooden Support	SPEAG standard phantom table	

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

ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure.

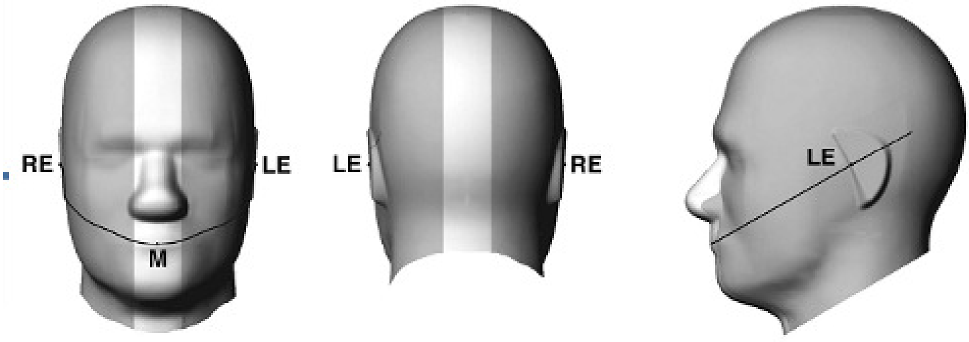
5.6 Device Holder for Transmitters

F-2. Device Holder for Transmitters

- The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.
- The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centres for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.
- The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent δ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

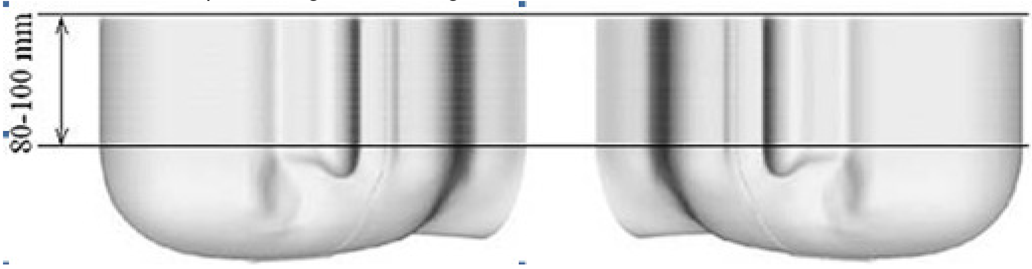
6 Description of Test Position

6.1 SAM Phantom Shape

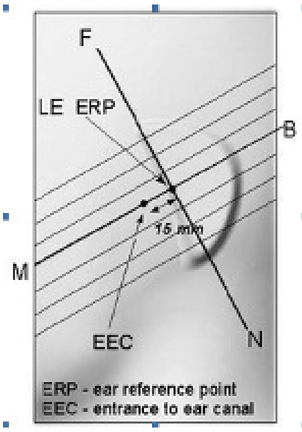


F-3. Front, back, and side views of SAM (model for the phantom shell). Full-head model is for illustration purposes only-procedures in this recommended practice are intended primarily for the phantom setup.

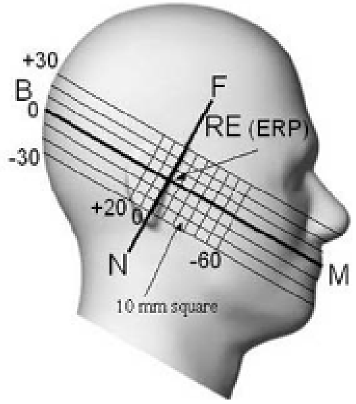
Note: The centre strip including the nose region has a different thickness tolerance.



F-4. Sagittally bisected phantom with extended perimeter (shown placed on its side as used for SAR measurements)

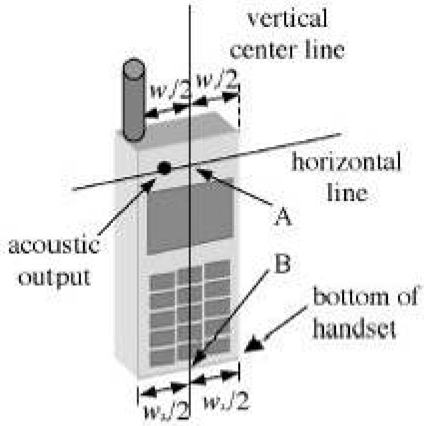


F-5. Close-up side view of phantom ,showing the ear region, N-F and B-M lines, and seven cross-sectional plane locations

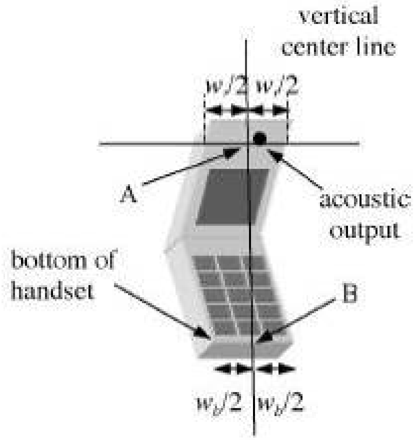


F-6. Side view of the phantom showing relevant markings and seven cross-sectional plane locations

6.2 EUT constructions



F-7. Handset vertical and horizontal reference lines- "fixed case"



F-8. Handset vertical and horizontal reference lines- "clam-shell case"

6.3 Definition of the "cheek" position

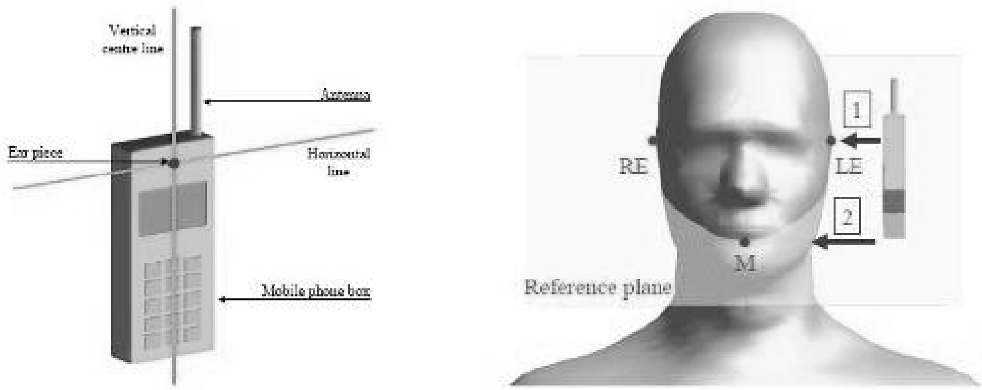
a) Position the device with the vertical centre line of the body of the device and the horizontal line crossing the centre of the ear piece in a plane parallel to the sagittal plane of the phantom ("initial position"). While maintaining the device in this plane, align the vertical centre line with the reference plane containing the three ear and mouth reference points (M, RE and LE) and align the centre of the ear piece with the line RE-LE;

b) Translate the mobile phone box towards the phantom with the ear piece aligned with the line LE-RE until telephone touches the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the box until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.

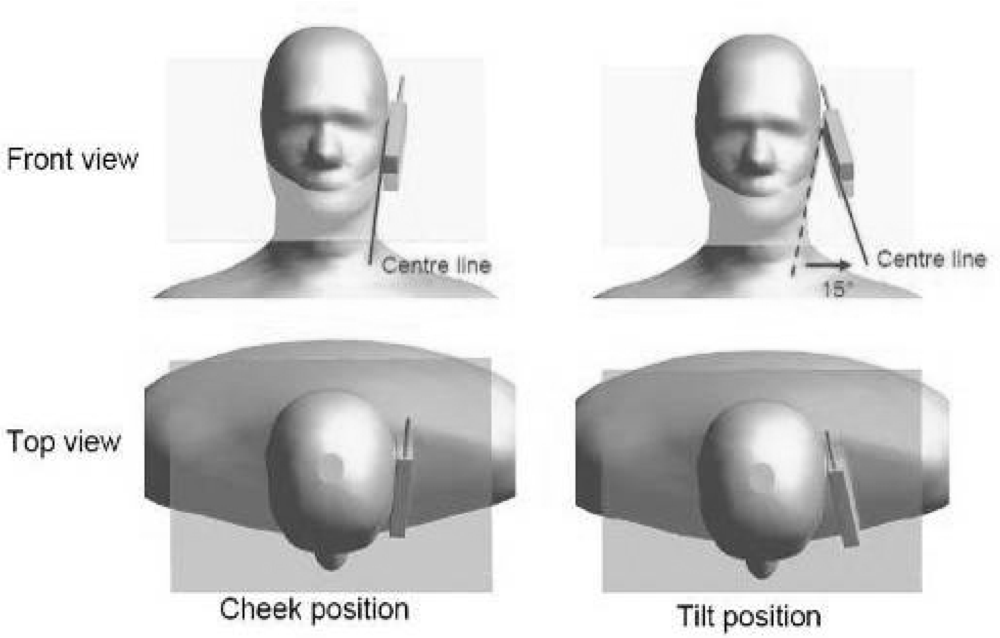
6.4 Definition of the "tilted" position

a) Position the device in the "cheek" position described above;

b) While maintaining the device in the reference plane described above and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost.



F-9. Definition of the reference lines and points, on the phone and on the phantom and initial position



F-10. "Cheek" and "tilt" positions of the mobile phone on the left side

7 SAR System Verification Procedure

7.1 Tissue Simulate Liquid

7.1.1 Recipes for Tissue Simulate Liquid

The bellowing tables give the recipes for tissue simulating liquids to be used in different frequency bands

Frequency (MHz)	835		900		1800-2000	
Tissue Type	Head	Body	Head	Body	Head	Body
Ingredient (% by weight)						
Water	40.30	50.75	40.30	50.75	55.24	70.17
Salt (NaCl)	1.38	0.94	1.38	0.94	0.31	0.39
Sucrose	57.90	48.21	57.90	48.21	0	0
HEC	0.24	0	0.24	0	0	0
Bactericide	0.18	0.10	0.10	0.10	0	0
DGBE	0	0	0	0	44.45	29.44
Measurement dielectric parameters						
Dielectric Constant	41.9	55.0	41.1	54.5	39.2	53.2
Conductivity (S/m)	0.93	0.97	1.04	1.06	1.45	1.59
Target values						
Dielectric Constant	41.5	55.2	41.5	55.0	40.0	53.3
Conductivity (S/m)	0.90	0.97	0.97	1.05	1.40	1.52
Salt: 99^{+}% Pure Sodium Chloride				Sucrose: 98^{+}% Pure Sucrose		
Water: De-ionized, 16 $M\Omega^{+}$ resistivity				HEC: Hydroxyethyl Cellulose		
DGBE: 99^{+}% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]						

Table 2： Recipe of Tissue Simulate Liquid

7.1.2 Measurement for Tissue Simulate Liquid

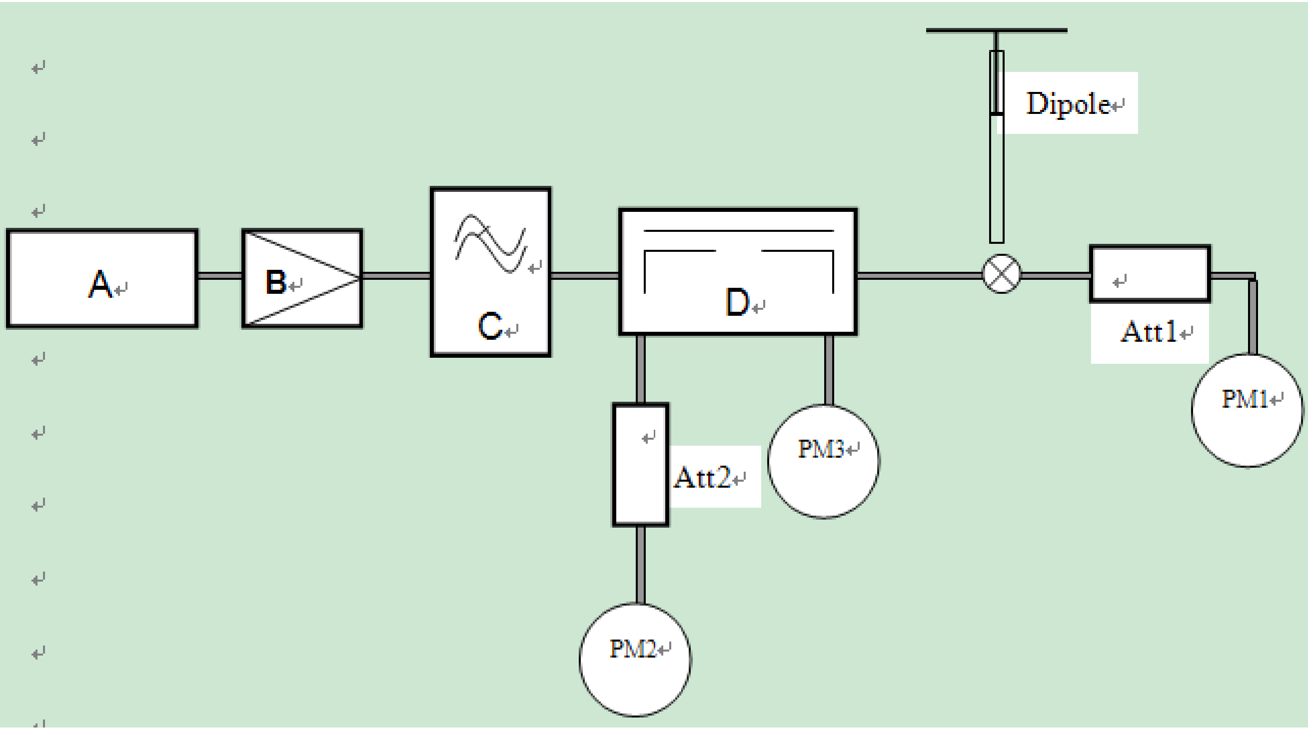
The dielectric properties for this Tissue Simulate Liquids were measured by using the Agilent Model 85070D Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Agilent E5071B Network Analyzer (300 KHz-8500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For the SAR measurement given in this report. The temperature variation of the Tissue Simulate Liquids was 22±2℃.

Target Frequency (MHz)	Target Tissue Body (±5)		Measured Tissue Body		Liquid Temp. ℃	Measured Date
	εr	σ(S/m)	εr	σ(S/m)		
2450	52.7 (50.07~55.34)	1.95 (1.85~2.05)	52.7	1.99	22	2012-12-3

Table 3： Measurement result of Tissue electric parameters

7.2 SAR System Validation

The microwave circuit arrangement for system verification is sketched in F-11. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the table C-1 (A power level of 250mw was input to the dipole antenna). During the tests, the ambient temperature of the laboratory was in the range 22℃, the relative humidity was in the range 60% and the liquid depth above the ear reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



F-11. the microwave circuit arrangement used for SAR system verification

A. Agilent E4438C Signal Generator

B. Mini-Circuit ZHL-42 Preamplifier

C. Mini-Circuit VLF-2500+ Low Pass Filter

D. Mini-Circuits ZABDC20-252H-N+ Bi-DIR Coupling

PM1. Power Sensor NRP-Z92

PM2. Agilent Model E4416A Power Meter

PM3. Power Sensor NRP-Z92

7.2.1 Summary System Validation Result(s)

Validation Kit		Target SAR (normalized to 1w) (±10%)		Measured SAR (normalized to 1w)		Measured date	Liquid Temp. (℃)
		1-g(W/kg)	10-g(W/kg)	1-g(W/kg)	10-g(W/kg)		
D2450V2	Body	50.6 (45.54~55.66)	23.9 (21.51~26.29)	54.00	24.64	2012-12-3	22

Table 4： SAR System Validation Result

7.2.2 Detailed System Validation Results

Date/Time: 2012-12-3 11:27:03

Test Laboratory: SGS-SAR Lab

System Performance Check 2450MHz Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 735

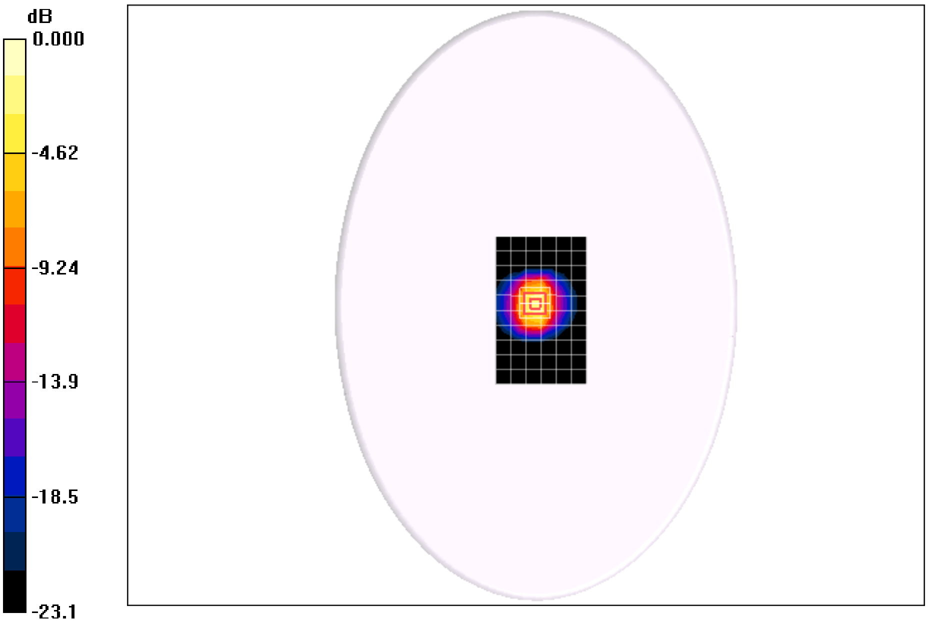
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(3.87, 3.87, 3.87); Calibrated: 2012-6-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2011-12-23
- Phantom: ELI V5.0; Type: ELI; Serial: 1128
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.2 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.0 V/m; Power Drift = 0.128 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.16 mW/g
Maximum value of SAR (measured) = 16.2 mW/g



0 dB = 16.2mW/g

8 Test results and Measurement Data

8.1 Operation Configurations

8.1.1 WiFi Test Configuration

For the 802.11b/g SAR tests, a communication link is set up with the test mode software for Wi-Fi mode test. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 1, 6 and 11 respectively in the case of 2450 MHz 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.
802.11b/g operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g modes are tested on channel 1, 6, 11; however if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

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.

Mode	GHz	Channel	Turbo Channel	"Default Test Channels"			
				§15.247		UNII	
				802.11b	802.11g		
802.11 b/g	2.412	1#		√	∇		
	2.437	6	6	√	∇		
	2.462	11#		√	∇		

8.2 Measurement procedure

8.2.1 Scanning procedure

Step 1: Power reference measurement

The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

Step 2: *Area scan*

The SAR distribution at the exposed side of the head was measured at a distance of 4mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm*15mm or 10mm*10mm.Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

Step 3: *Zoom scan*

Around this point, a volume of 30mm*30mm*30mm (fine resolution volume scan, zoom scan) was assessed by measuring 7*7*7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the centre of the dipoles is 2.0mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. (This can be variable. Refer to the probe specification).The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The volume was integrated with the trapezoidal algorithm. One thousand points (10*10*10) were interpolated to calculate the average. All neighbouring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Power reference measurement (drift)

The SAR value at the same location as in step 1 was again measured. (If the value changed by more than 5%, the evaluation should be done repeatedly)

8.2.2 Data Storage

The DASY4 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 ".DAE3". 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], [m W/g], [m W/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.

8.2.3 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	$Norm_i$, 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	ε
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY4 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.

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

with
SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ε = 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.

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

with
P_{pwe} = equivalent power density of a plane wave in mW/cm^2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

8.3 Measurement of RF conducted Power

8.3.1 Conducted Power Of WIFI

WIFI Conducted Average Power (dBm)				
Channel		1CH	6CH	11CH
802.11b	1Mbps	13.98	13.94	**14.08**
	2Mbps	13.92	13.90	14.04
	5.5Mbps	13.91	13.88	14.01
	11Mbps	13.87	13.85	14.00
802.11g	6Mbps	9.30	9.37	9.44
	9Mbps	9.30	9.35	9.43
	12Mbps	9.28	9.34	9.39
	8Mbps	9.26	9.32	9.41
	24Mbps	9.24	9.31	9.39
	36Mbps	9.22	9.34	9.40
	48Mbps	9.25	9.31	9.41
	54Mbps	9.23	9.31	9.38
802.11n （HT20）	6.5Mbps	9.62	9.68	9.76
	13Mbps	9.53	9.65	9.75
	19.5Mbps	9.52	9.67	9.76
	26Mbps	9.52	9.63	9.73
	39Mbps	9.51	9.61	9.73
	52Mbps	9.49	9.64	9.74
	58.5Mbps	9.53	9.61	9.75
	65Mbps	9.54	9.66	9.76
Channel		1CH	4CH	7CH
802.11n （HT40）	13.5Mbps	10.01	10.02	10.00
	27Mbps	9.86	9.84	9.87
	40.5Mbps	9.73	9.77	9.80
	54Mbps	9.67	9.77	9.83
	81Mbps	9.66	9.76	9.81
	108Mbps	9.64	9.75	9.82
	121.5Mbps	9.66	9.70	9.79
	135Mbps	9.69	9.74	9.80

Table 5： Conducted Power Of WIFI

8.4 Measurement of SAR average value

8.4.1 SAR Result Of WIFI

Test position		Test mode	Test Ch./Freq.	SAR (W/kg)		Power drifit (dB)	SAR limit (W/kg)	Liquid Temp. (℃)
				1-g	10-g			
Body	Back side 0mm	802.11b	1/2412	0.956	0.442	-0.013	1.6	21.6
	Back side 0mm	802.11b	6/2437	1.120	0.459	-0.043	1.6	21.6
	Back side 0mm	802.11b	11/2462	**1.390**	0.520	-0.042	1.6	21.6
	Right side 0mm	802.11b	11/2462	0.124	0.057	-0.089	1.6	21.6
	Top side 0mm	802.11b	11/2462	0.710	0.255	0.042	1.6	21.6

Table 6： SAR of WIFI for Body

Note:

①Test positions of EUT(the distance between the EUT and the phantom is 0mm for all sides)

②If the SAR measured at the middle of channel for each test configurations is at least 3dB lower than the SAR limit ,test at the high and low channel is optional

③The maximum SAR value is marked in **bold**

④Per KDB 447498 D01, For it is not the most conservative antenna-to-user distance at edge mode, so the Front, Bottom and Left sides do not need to be tested.

8.5 Multiple Transmitter Evaluation

These procedures were followed according to FCC "KDB648474 D01 SAR Handsets Multi Xmiter and Ant, v01r05", Sept 2008. The procedures are applicable to phones with built-in unlicensed transmitters, such as 802.11 a/b/g and Bluetooth devices.

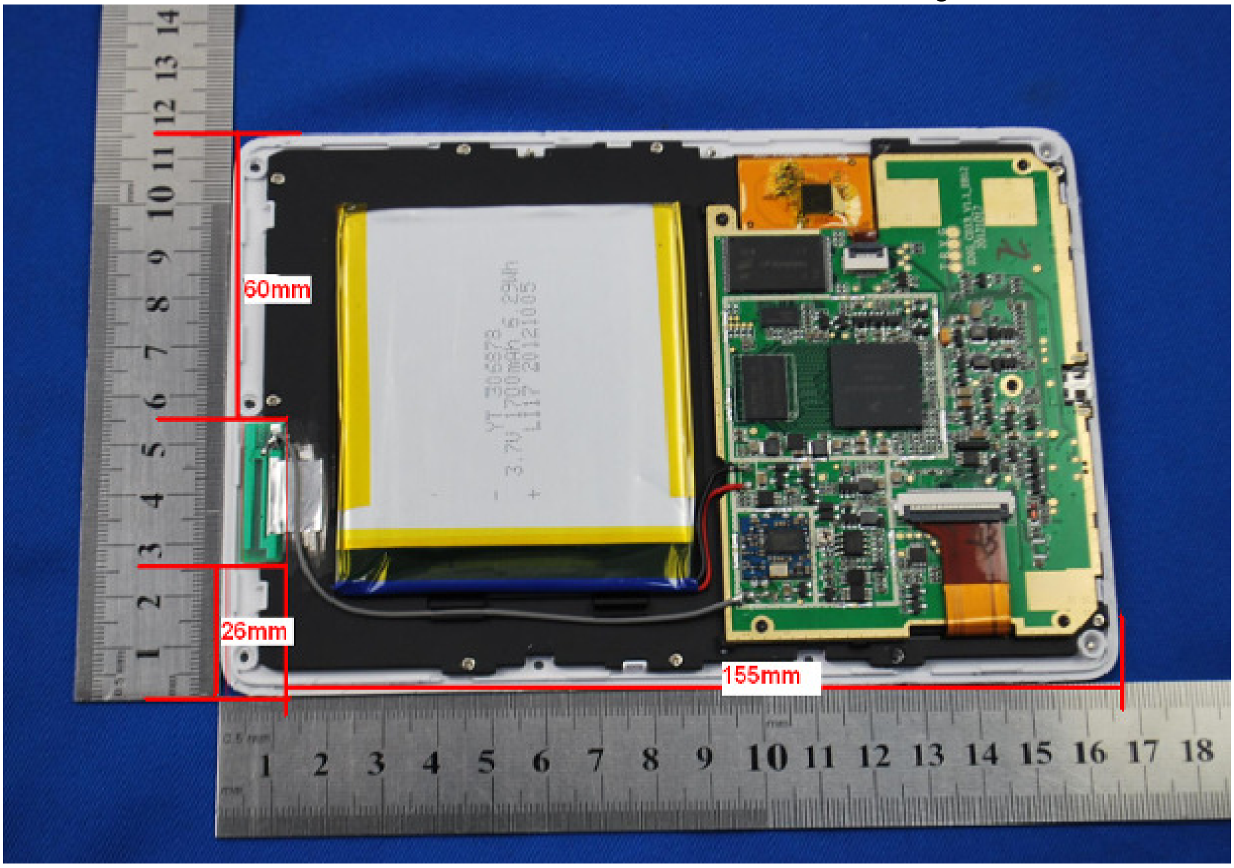
-

	2.45	5.15 - 5.35	5.47 - 5.85	GHz
P_{Ref}	12	6	5	mW
Device output power should be rounded to the nearest mW to compare with values specified in this table.				

Output Power Thresholds for Unlicensed Transmitters

	Individual Transmitter	Simultaneous Transmission
Licensed Transmitters	Routine evaluation required	SAR not required: Unlicensed only ○ when stand-alone 1-g SAR is not required and antenna is $\geq$ 5 cm from other antennas Licensed & Unlicensed ○ when the sum of the 1-g SAR is $<$ 1.6 W/kg for all simultaneous transmitting antennas ○ when SAR to peak location separation ratio of simultaneous transmitting antenna pair is $<$ 0.3 SAR required: Licensed & Unlicensed antenna pairs with SAR to peak location separation ratio $\geq$ 0.3; test is only required for the configuration that results in the highest SAR in stand-alone configuration for each wireless mode and exposure condition Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply
Unlicensed Transmitters	When there is no simultaneous transmission – ○ output $\leq$ 60/f: SAR not required ○ output $>$ 60/f: stand-alone SAR required When there is simultaneous transmission – Stand-alone SAR not required when ○ output $\leq 2 \cdot P_{Ref}$ and antenna is $\geq$ 5.0 cm from other antennas ○ output $\leq P_{Ref}$ and antenna is $\geq$ 2.5 cm from other antennas ○ output $\leq P_{Ref}$ and antenna is $<$ 2.5 cm from other antennas, each with either output power $\leq P_{Ref}$ or 1-g SAR $<$ 1.2 W/kg Otherwise stand-alone SAR is required When stand-alone SAR is required ○ test SAR on highest output channel for each wireless mode and exposure condition ○ if SAR for highest output channel is $>$ 50% of SAR limit, evaluate all channels according to normal procedures	

The location of the antennas inside E-BOOK is shown as below picture:



Stand-alone SAR

According to the output power measurement results and the distance between BT/Wi-Fi antenna and GSM/WCDMA antenna we can draw the conclusion that:

Stand-alone SAR evaluation is required for Wi-Fi, because the output power of Wi-Fi unlicensed transmitter is 14.08dBm ≥ 24mW (13.8dBm).

8.6 Detailed Test Results

Date/Time: 2012-12-3 14:26:14

Test Laboratory: SGS-SAR Lab

EB12 WiFi 802.11b 1CH Back Side 0mm

DUT: EB12; Type: E-BOOK; Serial: NA

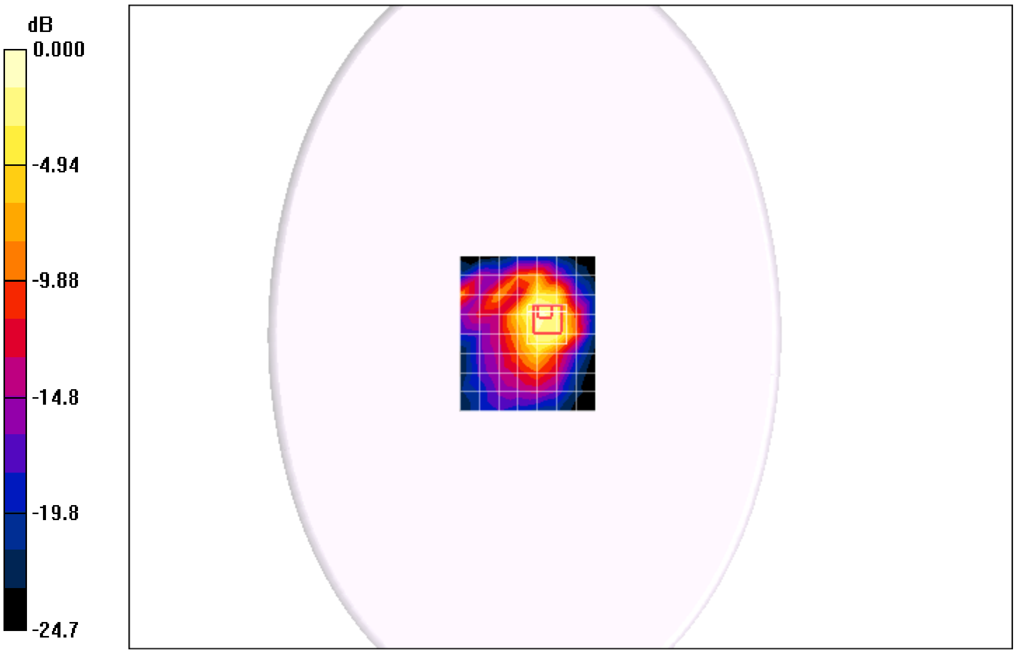
Communication System: 802.11b/g; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: f = 2412 MHz; σ = 1.96 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(3.87, 3.87, 3.87); Calibrated: 2012-6-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2011-12-23
- Phantom: ELI V5.0; Type: ELI; Serial: 1128
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.878 mW/g

Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.9 V/m; Power Drift = -0.013 dB
Peak SAR (extrapolated) = 2.68 W/kg
SAR(1 g) = 0.956 mW/g; SAR(10 g) = 0.442 mW/g
Maximum value of SAR (measured) = 1.07 mW/g



0 dB = 1.07mW/g

Date/Time: 2012-12-3 15:58:15

Test Laboratory: SGS-SAR Lab

EB12 WiFi 802.11b 6CH Back Side 0mm

DUT: EB12; Type: E-BOOK; Serial: NA

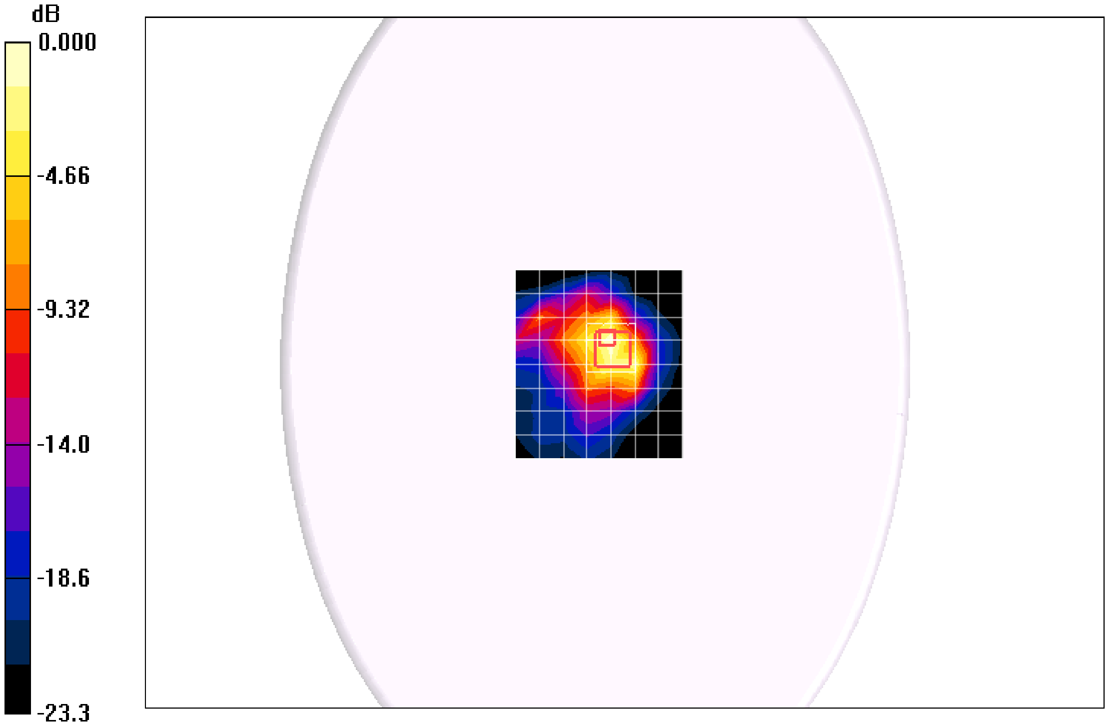
Communication System: 802.11b/g; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: f = 2437 MHz; σ = 1.97 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(3.87, 3.87, 3.87); Calibrated: 2012-6-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2011-12-23
- Phantom: ELI V5.0; Type: ELI; Serial: 1128
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.19 mW/g

Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.4 V/m; Power Drift = -0.043 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 1.12 mW/g; SAR(10 g) = 0.459 mW/g
Maximum value of SAR (measured) = 1.23 mW/g



0 dB = 1.23mW/g

Date/Time: 2012-12-3 16:26:45

Test Laboratory: SGS-SAR Lab

EB12 WiFi 802.11b 11CH Back Side 0mm

DUT: EB12; Type: E-BOOK; Serial: NA

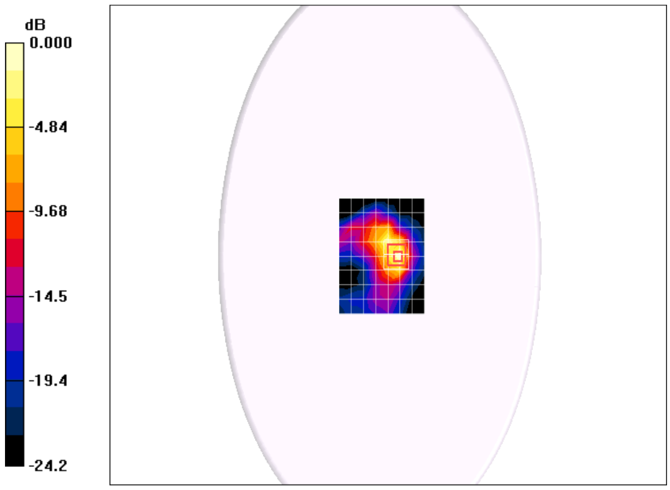
Communication System: 802.11b/g; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

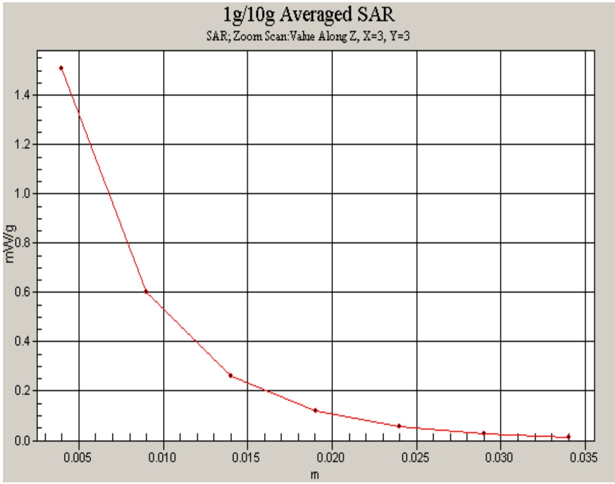
DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(3.87, 3.87, 3.87); Calibrated: 2012-6-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2011-12-23
- Phantom: ELI V5.0; Type: ELI; Serial: 1128
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.57 mW/g

Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.8 V/m; Power Drift = -0.042 dB
Peak SAR (extrapolated) = 4.28 W/kg
SAR(1 g) = 1.39 mW/g; SAR(10 g) = 0.520 mW/g
Maximum value of SAR (measured) = 1.51 mW/g





0 dB = 1.51mW/g

Test Laboratory: SGS-SAR Lab

EB12 WiFi 802.11b 11CH Right Side 0mm

DUT: EB12; Type: E-BOOK; Serial: NA

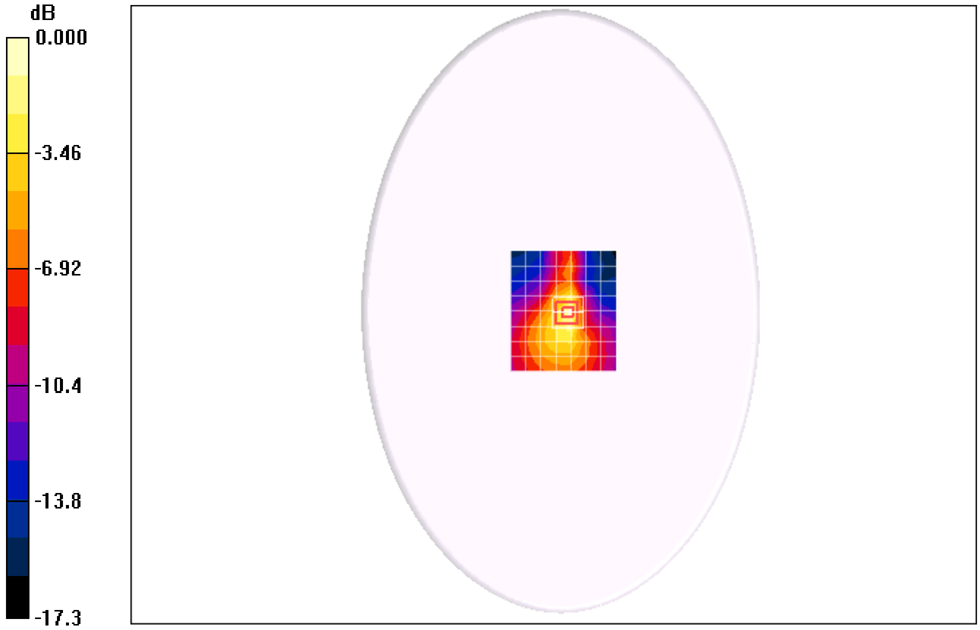
Communication System: 802.11b/g; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(3.87, 3.87, 3.87); Calibrated: 2012-6-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2011-12-23
- Phantom: ELI V5.0; Type: ELI; Serial: 1128
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.130 mW/g

Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.87 V/m; Power Drift = -0.089 dB
Peak SAR (extrapolated) = 0.282 W/kg
SAR(1 g) = 0.124 mW/g; SAR(10 g) = 0.057 mW/g
Maximum value of SAR (measured) = 0.141 mW/g



0 dB = 0.141mW/g

Date/Time: 2012-12-3 17:27:31

Test Laboratory: SGS-SAR Lab

EB12 WiFi 802.11b 11CH Top Side 0mm

DUT: EB12; Type: E-BOOK; Serial: NA

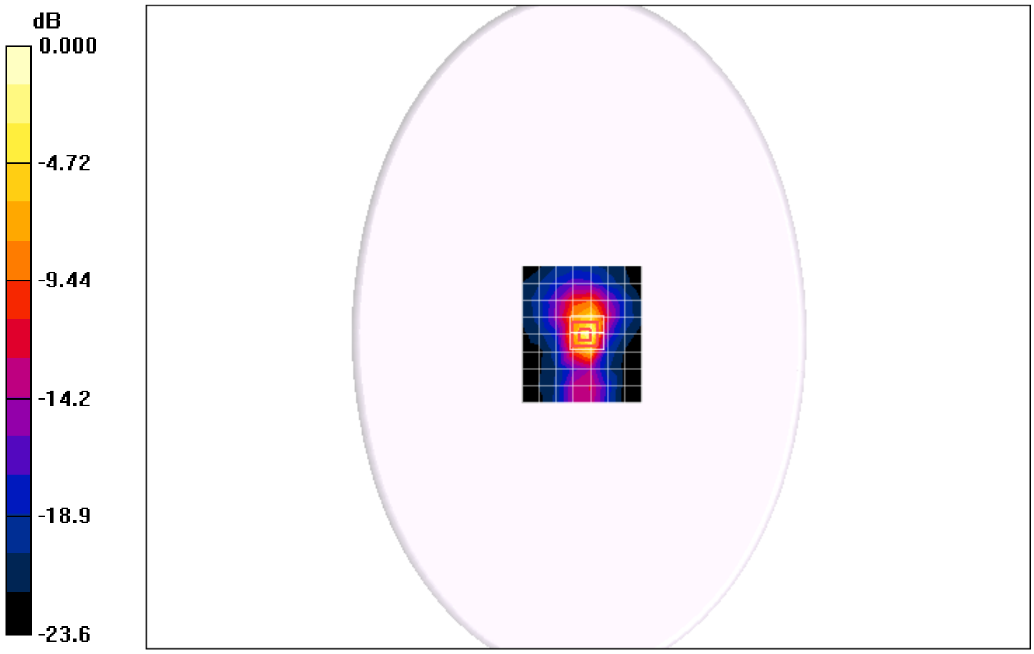
Communication System: 802.11b/g; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: f = 2462 MHz; σ = 2.01 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3071; ConvF(3.87, 3.87, 3.87); Calibrated: 2012-6-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn679; Calibrated: 2011-12-23
- Phantom: ELI V5.0; Type: ELI; Serial: 1128
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.637 mW/g

Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.4 V/m; Power Drift = 0.042 dB
Peak SAR (extrapolated) = 1.94 W/kg
SAR(1 g) = 0.710 mW/g; SAR(10 g) = 0.255 mW/g
Maximum value of SAR (measured) = 0.835 mW/g



0 dB = 0.835mW/g

9 Photographs

9.1 EUT Test Setup

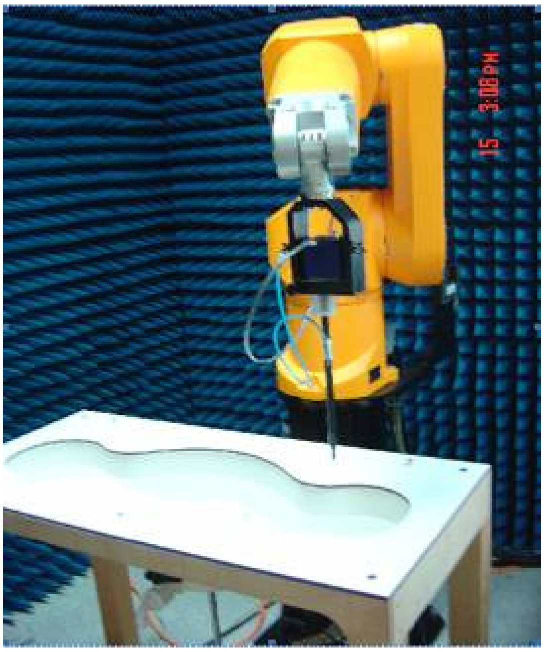


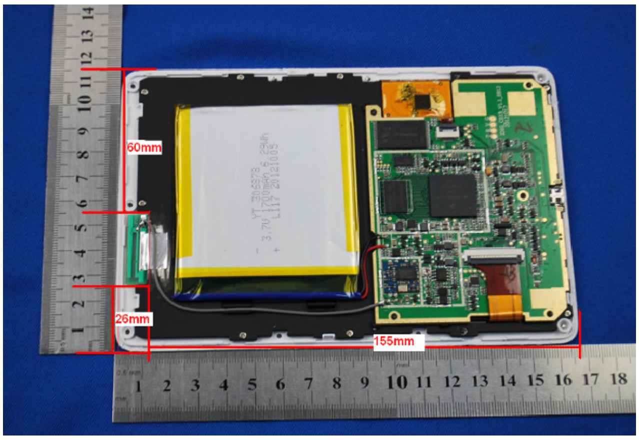
Photo 1: SAR measurement System

9.2 Photographs of EUT

Photo 2: Front View	Photo 3: Back View
	

Photo 4: Accessory

Photo 5: location of antenna(s)



9.3 Photographs of EUT test position

Photo 6: Back side 0mm

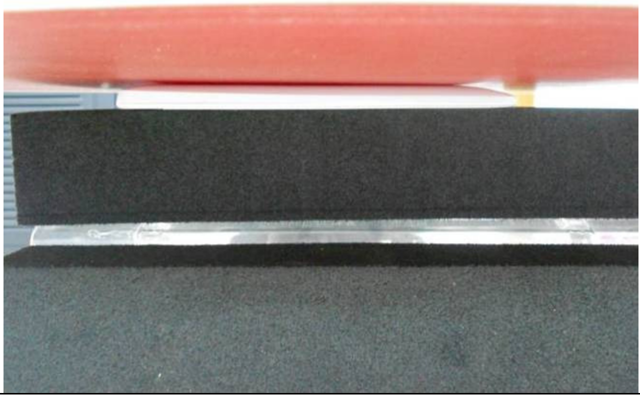


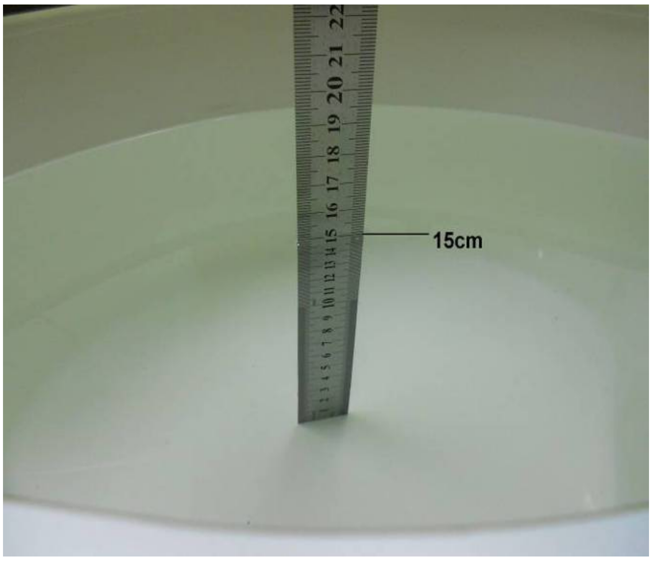
Photo 7: Right side 0mm

Photo 8: Top side 0mm

NA

NA

9.4 Photographs of Tissue Simulate Liquid

Photo 9: Tissue Simulate Liquid for Body 2450（15cm）	NA
	NA

9.5 EUT Constructional Details

Refer to Report No. SZEM121100628401 for EUT external and internal photos.

10 Calibration certificate

10.1 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: ES3-3071_Jun12

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3071

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

Calibration date: June 22, 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:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 22, 2012

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Certificate No: ES3-3071_Jun12 Page 1 of 11

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

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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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3071

Manufactured: December 14, 2004
Calibrated: June 22, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3071

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.12	1.22	0.96	± 10.1 %
DCP (mV)[B]	101.5	99.2	99.2	

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	107.3	±3.3 %
			Y	0.00	0.00	1.00	108.0	
			Z	0.00	0.00	1.00	99.5	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3071

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	5.91	5.91	5.91	0.37	1.63	± 12.0 %
835	41.5	0.90	5.68	5.68	5.68	0.77	1.14	± 12.0 %
900	41.5	0.97	5.57	5.57	5.57	0.48	1.40	± 12.0 %
1450	40.5	1.20	5.00	5.00	5.00	0.32	1.98	± 12.0 %
1750	40.1	1.37	4.89	4.89	4.89	0.80	1.25	± 12.0 %
1900	40.0	1.40	4.66	4.66	4.66	0.80	1.20	± 12.0 %
2000	40.0	1.40	4.63	4.63	4.63	0.80	1.24	± 12.0 %
2450	39.2	1.80	4.08	4.08	4.08	0.80	1.28	± 12.0 %

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3071

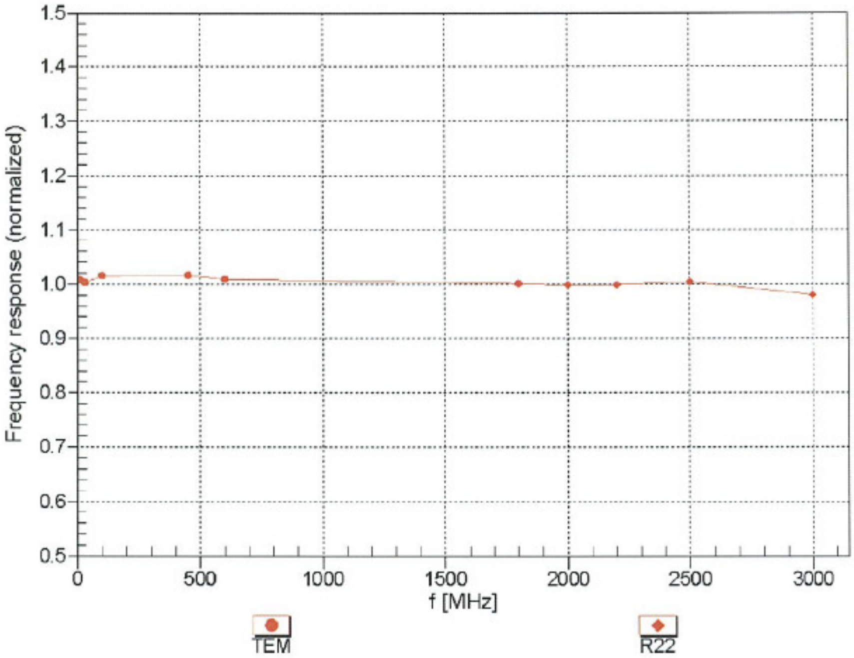
Calibration Parameter Determined in Body Tissue Simulating Media

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	5.78	5.78	5.78	0.65	1.24	± 12.0 %
835	55.2	0.97	5.69	5.69	5.69	0.36	1.76	± 12.0 %
900	55.0	1.05	5.62	5.62	5.62	0.67	1.27	± 12.0 %
1450	54.0	1.30	5.04	5.04	5.04	0.66	1.31	± 12.0 %
1750	53.4	1.49	4.50	4.50	4.50	0.74	1.29	± 12.0 %
1900	53.3	1.52	4.29	4.29	4.29	0.60	1.44	± 12.0 %
2000	53.3	1.52	4.37	4.37	4.37	0.62	1.46	± 12.0 %
2450	52.7	1.95	3.87	3.87	3.87	0.80	1.08	± 12.0 %

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

Frequency Response of E-Field

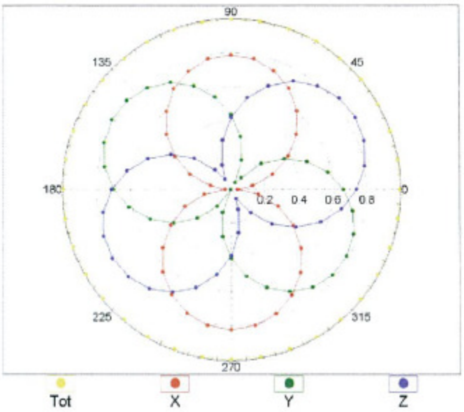
(TEM-Cell:ifi110 EXX, Waveguide: R22)



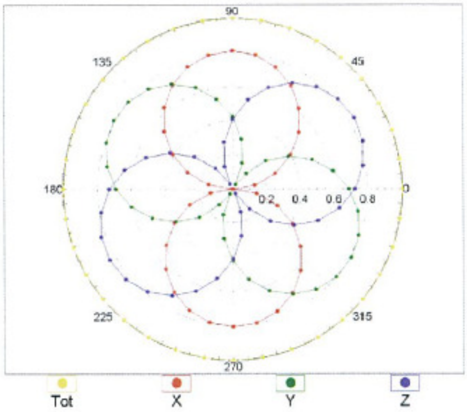
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

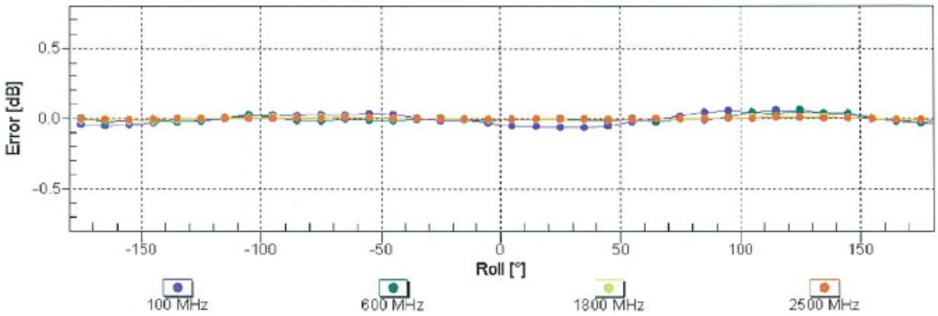
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



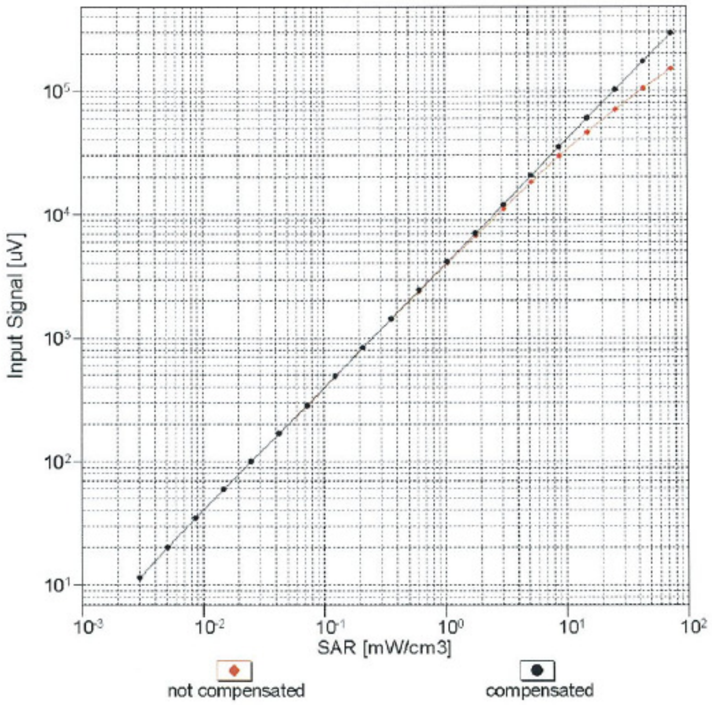
f=1800 MHz,R22

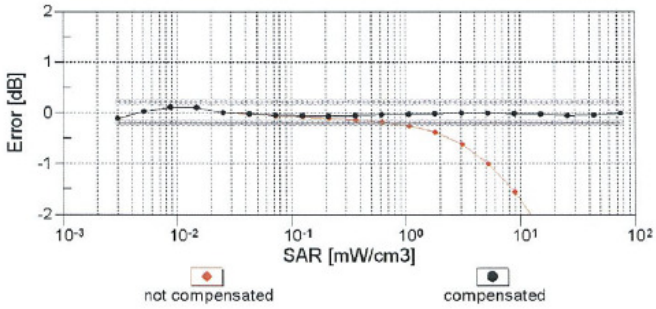




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

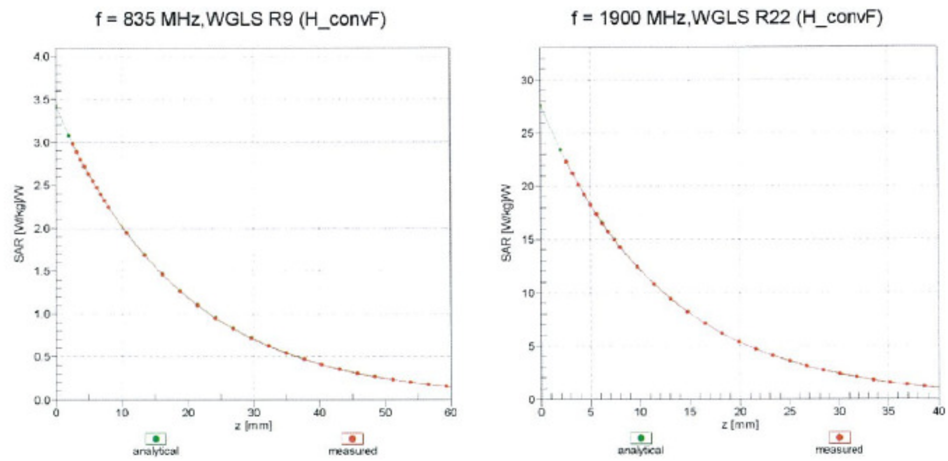
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)





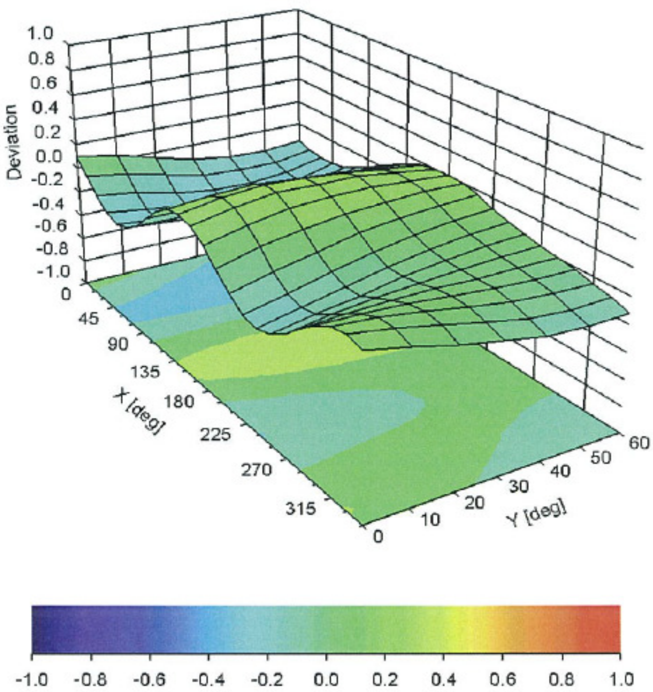
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3071

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	64.9
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

10.2 DAE Calibration certification

Schmid & Partner Engineering AG

s p e a g

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info@speag.com, http://www.speag.com

IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

TN_BR040315AD DAE4.doc 11.12.2009

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Accreditation No.: SCS 108

Client **Auden**

Certificate No: **DAE4-679_Dec11**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 679
Calibration procedure(s)	QA CAL-06.v23 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	December 23, 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
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-11 (No:11450)	Sep-12
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	08-Jun-11 (in house check)	In house check: Jun-12

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

Issued: December 23, 2011

Calibration Laboratory of
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Glossary

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

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The 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	404.434 ± 0.1% (k=2)	404.874 ± 0.1% (k=2)	404.999 ± 0.1% (k=2)
Low Range	3.98146 ± 0.7% (k=2)	3.95999 ± 0.7% (k=2)	3.96124 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	292.5 ° ± 1 °

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Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200011.4	1.78	0.00
Channel X	+ Input	20001.27	1.97	0.01
Channel X	- Input	-19996.81	2.69	-0.01
Channel Y	+ Input	200005.3	-2.82	-0.00
Channel Y	+ Input	19999.74	-0.66	-0.00
Channel Y	- Input	-20000.10	-0.80	0.00
Channel Z	+ Input	199997.0	-0.42	-0.00
Channel Z	+ Input	20000.35	0.15	0.00
Channel Z	- Input	-19999.31	0.09	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.0	0.14	0.01
Channel X	+ Input	200.98	0.88	0.44
Channel X	- Input	-199.82	0.08	-0.04
Channel Y	+ Input	2001.4	1.19	0.06
Channel Y	+ Input	199.96	-0.04	-0.02
Channel Y	- Input	-201.74	-1.64	0.82
Channel Z	+ Input	2000.4	0.49	0.02
Channel Z	+ Input	198.91	-0.99	-0.49
Channel Z	- Input	-201.11	-1.01	0.50

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	6.37	5.14
	- 200	-3.81	-5.64
Channel Y	200	5.30	4.78
	- 200	-5.58	-5.98
Channel Z	200	-4.73	-4.25
	- 200	2.52	2.87

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	2.66	0.14
Channel Y	200	2.69	-	2.08
Channel Z	200	2.06	-0.85	-

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	16151	16811
Channel Y	15474	16237
Channel Z	16067	17164

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	1.51	0.18	4.84	0.54
Channel Y	-0.19	-1.83	1.38	0.67
Channel Z	-2.62	-3.37	-1.87	0.34

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

10.3 Dipole Calibration certification

10.3.1 D2450V2

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Accreditation No.: **SCS 108**

Client: Auden

Certificate No: D2450V2-735_Jun12

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 735
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	June 15, 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 EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-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-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: June 18, 2012

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Certificate No: D2450V2-735_Jun12 Page 1 of 8

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**52.7 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.27 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.8 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	51.6 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**50.6 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.03 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**23.9 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.6 Ω + 4.5 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.4 Ω + 5.9 jΩ
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	May 07, 2003

DASY5 Validation Report for Head TSL

Date: 15.06.2012

Test Laboratory: SPEAG, Zurich, Switzerland

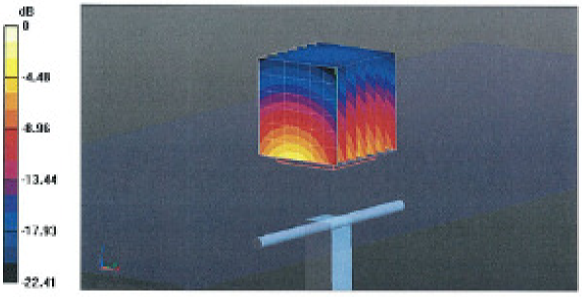
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 735

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

DASY52 Configuration:

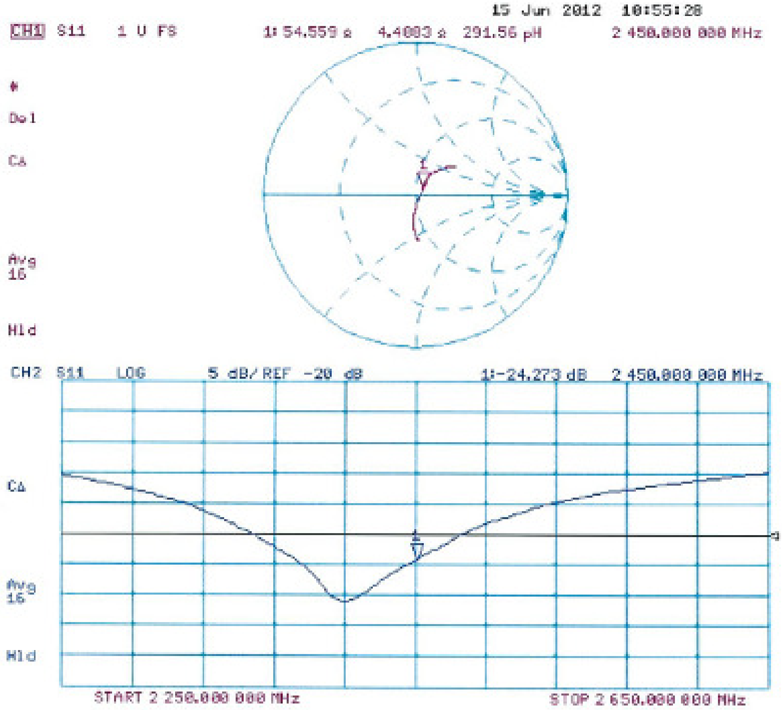
- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

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 = 99.721 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 27.562 mW/g
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.27 mW/g
Maximum value of SAR (measured) = 17.1 mW/g



0 dB = 17.1 mW/g = 24.66 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.06.2012

Test Laboratory: SPEAG, Zurich, Switzerland

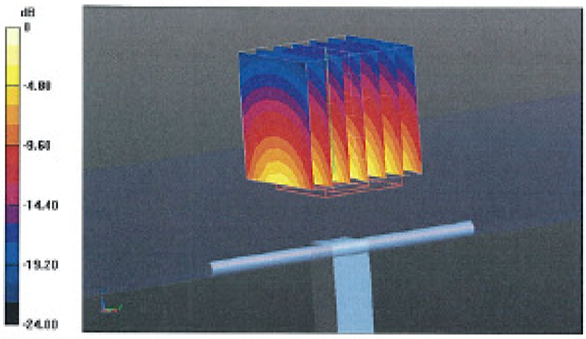
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 735

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 2.01$ mho/m; $\varepsilon_r = 51.6$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

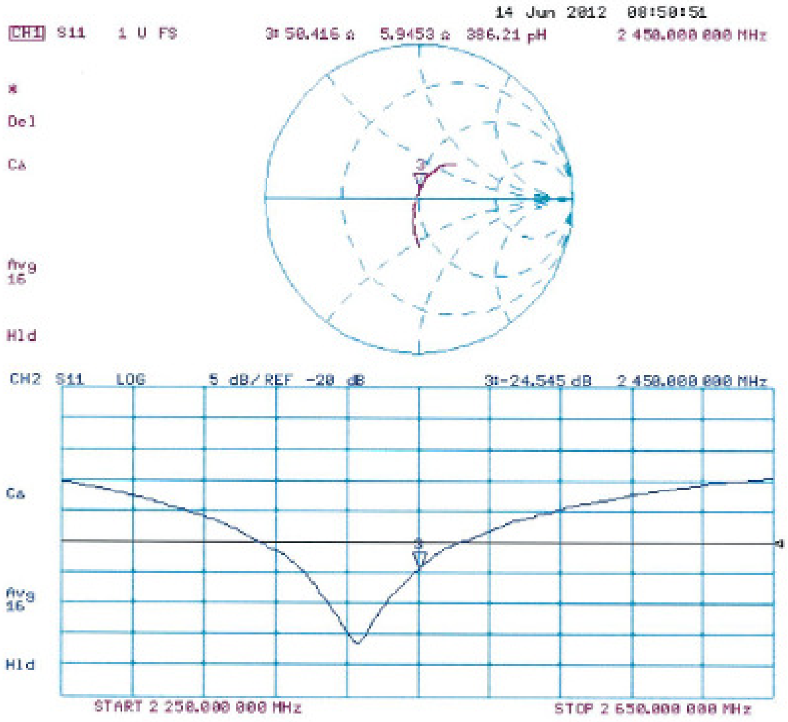
- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

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 = 95.125 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.372 mW/g
SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6.03 mW/g
Maximum value of SAR (measured) = 16.9 mW/g



0 dB = 16.9 mW/g = 24.56 dB mW/g

Impedance Measurement Plot for Body TSL



END OF REPORT