Full SAR Test Report

Applicant Name: Hansong(Nanjing) Technology Ltd
Applicant Address: 8th Kangping Road, Jiangning Economy and Technology Development Zone,Nanjing,201106,China

The following samples were submitted and identified on behalf of the client as:

Sample Description	wireless audio system
Brand Name	NAD
Model Number	Wireless USB DAC 1
Final Hardware Version Tested	VM1.0
Final Software Version Tested	V1.00_02
FCC ID	XCO-HSP80D81
Date Initial Sample Received	07-26,2011
Testing Start Date	07-29,2011
Testing End Date	07-29,2011

According to:

FCC 47CFR § 2.1093, IEEE Std C95.1-2005

IEEE1528-2003, OET Bulletin 65 Supplement C，RSS-102-2010

Comments/ Conclusion:
The configuration tested complied to the certification requirements specified in this report.

Signed for on behalf of SGS

willam

Prepared

David lee

approved

SHEMC

SGS-CSTC Standards Technical Services(Shanghai) Co, Ltd..
Testing Center-EMC Laboratory

3rd Building, No. 889, Yishan Road, Shanghai, China 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 ww.cn.sgs.com
中国•上海•徐汇区宜山路 889 号 3 号楼 邮编: 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 e sgs.china@sgs.com

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Change History

Version	Change Contents	Author	Date
V1.0	First edition	Willam Wang	08-11, 2011
V2.0	Add peak power，delete annex D description of position	Willam Wang	10-19, 2011
V3.0	Change Peak Power, Add KDB 447498 D01	Willam Wang	12-05, 2011
V4.0	Change model name	Willam Wang	12-06, 2011

1. Report Overview

This report details the results of testing carried out on the samples listed in section 17, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this test report is used in any configuration other than that detailed in the test report, the manufacturer must ensure the new configuration complies with all relevant standards and certification requirements. Any mention of SGS Shanghai EMC lab or testing done by SGS Shanghai EMC lab made in connection with the distribution or use of the tested product must be approved in writing by SGS Shanghai EMC lab.

2. Test Lab Declaration or Comments

None

3. Applicant Declaration or Comments

None

4. Full Test Report

A full test report contains, within the results section, all the applicable test cases from the certification requirements of the permanent reference documents of the listed certification bodies.

5. Partial Test Report

A partial test report contains within the results section a sub-set of all the applicable test cases from the certification requirements of the permanent reference documents of the listed certification bodies.

6. 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.

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Testing Center-EMC Laboratory
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A	b1	c	d	e = f(d,k)	g	i = cxg/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	$\sqrt{3}$	$(1-c_p)^{1/2}$	0.20	∞
hemispherical isotropy	E.2.2	2.6	R	$\sqrt{3}$	$\sqrt{c_p}$	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 - measurement uncertainty	E.3.2	4	N	1	0.64	2.56	5
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		10.71	430
Expanded uncertainty (95% CONFIDENCE INTERVAL)				K=2		21.43	

7. Testing Environment

Normal Temperature	+20 to +24 °C
Relative Humidity	35 to 60 %

8. Primary Test Laboratory

Name:	EMC Laboratory SGS-CSTC Standards Technical Services(Shanghai) Co., Ltd
Address:	9F, 3rd Building, No.889, Yishan Rd, Xuhui District, Shanghai, China 200233
Telephone:	+86 (0) 21 6107 2777
Fax:	+86 (0) 21 5450 0149
Internet:	http://www.cn.sgs.com
Contact:	Mr. David Lee
Email:	david-jc.lee@sgs.com

9. Details of Applicant

Name:	Hansong(Nanjing) Technology Ltd.
Address:	8th Kangping Road, Jiangning Economy and Technology Development Zone,Nanjing,201106,China
Telephone:	0086-025-66604212
Fax	0086-025-66612098
Contact:	Elina Zhong
Email:	elina.zhong@hansong-china.com

10. Details of Manufacturer

Name:	Hansong(Nanjing) Technology Ltd.
Address:	8th Kangping Road, Jiangning Economy and Technology Development Zone,Nanjing,201106,China
Telephone:	0086-025-66604212
Fax	0086-025-66612098
Contact:	Elina Zhong
Email:	elina.zhong@hansong-china.com

11. Other testing Locations

Name:	Not Required
Address:	--
Telephone:	--
Contact:	--
Fax	--

Email:	--

12. Referenced Documents

The Equipment under Test (EUT) has been tested at SGS's (own or subcontracted) laboratories according to

FCC 47CFR § 2.1093, IEEE Std C95.1-2005, IEEE1528-2003, OET Bulletin 65 Supplement C,RSS-102-2010

The following table summarizes the specific reference documents such as harmonized standards or test specifications which were used for testing as SGS's (own or subcontracted) laboratories.

Identity	Document Title	Version
FCC 47CFR § 2.1093	Radiofrequency radiation exposure evaluation: portable devices	2001
IEEE Std C95.1-2005	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.	2005
IEEE1528-2003	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	2003
OET Bulletin 65 Supplement C	Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions	2001
KDB 447498 D01	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Polices	2009
RSS-102	Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)	2010

Human Exposure	Uncontrolled Environment General Population
Spatial Peak SAR	1.60 W/kg (averaged over a mass of 1g)

Table 12-1 RF Exposure Limits

Notes:

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

13. Primary Laboratory Accreditation Details

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(No. CNAS L0599)

China National Accreditation Service for Conformity Assessment has accredited

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.
Testing Center
1/4/6/7/8/9/10F., No.3 Building, Qilai Industry City,
No.889, Yishan Road, Shanghai, China

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.*

The scope of accreditation is detailed in the attached schedule bearing the same accreditation number as above. The schedule forms an integral part of this certificate.

Date of Issue: 2009-08-31
Date of Expiry: 2011-07-29
Date of Initial Accreditation: 2003-08-01

Signed on behalf of China National Accreditation Service for Conformity Assessment

China National Accreditation Service for Conformity Assessment(CNAS) is authorized by Certification and Accreditation Administration of the People's Republic of China (CNCA) to operate the national accreditation systems for conformity assessment. CNAS is the signatory to International Laboratory Accreditation Cooperation Multilateral Recognition Arrangement (ILAC MRA), and the signatory to Asia Pacific Laboratory Accreditation Cooperation Multilateral Recognition Arrangement (APLAC MRA).

14. SGS Shanghai EMC lab, Personnel

SGS EMC Shanghai Project Management Team and list of approved Testers for SGS EMC Shanghai.

Surname	Forename	Initials
CAI	CAI	CAICAI
Xu	Jim	JimXu
Pan	Tino	Tino
Hailiang	Cai	HAILIANG
Nie	Neo	Neo
Xu	Jesse	Jesse
Wang	Willam	Willam
Lee	David	David
Liu	Magi	Magi

Version 2011-01-01

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Testing Center-EMC Laboratory
3rd Building, No. 889, Yishan Road, Shanghai, China 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 ww.cn.sgs.com
中国•上海•徐汇区宜山路 889 号 3 号楼 邮编: 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 e sgs.china@sgs.com

15. Test Equipment Information

15.1 SPEAG DASY4

Test Platform	SPEAG DASY4 Professional			
Location	SGS SH Lab #8			
Manufacture	SPEAG			
Description	SAR Test System (Frequency range 300MHz-3GHz) 835, 900, 1800, 1900, 2000, 2450 frequency band HAC Extension			
Software Reference	DASY4: V4.7 Build 80 SEMCAD: V1.8 Build 186			
Hardware Reference				
Equipment	Model	Serial Number	Calibration Date	Due date of calibration
Robot	RX90L	F03/5V32A1/A01	n/a	n/a
Phantom	SAM 12	TP-1283	n/a	n/a
DAE	DAE3	569	2010-11-22	2011-11-21
E-Field Probe	ES3DV3	3088	2010-11-23	2011-11-22
Validation Kits	D835V2	4d070	2010-11-19	2011-11-18
Validation Kits	D1900V2	5d028	2010-11-25	2011-11-24
Validation Kits	D2450V2	733	2010-11-25	2011-11-24
Agilent Network Analyzer	E5071B	MY42100549	2010-11-24	2011-11-23
RF Bi-Directional Coupler	ZABDC20-252H	n/a	2011-05-18	2012-05-17
Agilent Signal Generator	E4438C	14438CATO-19719	2010-11-01	2011-10-31
Mini-Circuits Preamplifier	ZHL-42	D041905	2010-11-01	2011-10-31
Agilent Power Meter	E4416A	GB41292095	2010-11-01	2011-10-31
Agilent Power Sensor	8481H	MY41091234	2010-11-01	2011-10-31
R&S Power Sensor	NRP-Z92	100025	2011-04-12	2012-04-11
R&S Universal Radio Communication Tester	CMU200	103633	2010-11-01	2011-10-31
AVG Power Sensor	NRP-Z22	1137	2011-05-07	2012-05-06
Passive USB adapter cable	NRP-Z4	--	2011-05-07	2012-05-06

15.2 The SAR Measurement System

A photograph of the SAR measurement System is given in Fig. 15-1.

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-simulant.

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 is 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.

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.

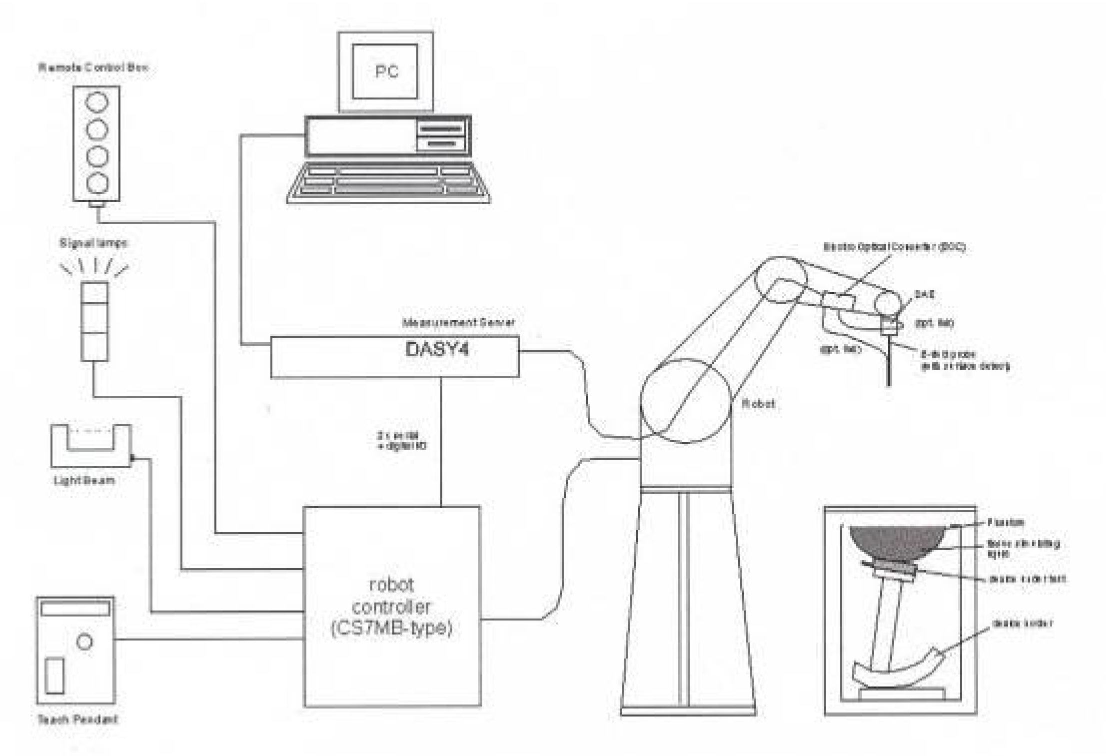

Fig. 15-1 SAR System Configuration

Ÿ 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.

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

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Testing Center-EMC Laboratory
3rd Building, No. 889, Yishan Road, Shanghai, China 200233 t (86-21) 61402666*2736 f (86-21) 54500149 ww.cn.sgs.com
中国•上海•徐汇区宜山路 889 号 3 号楼 邮编: 200233 t (86-21) 61402666*2736 f (86-21) 54500149 e sgs.china@sgs.com

15.3 Isotropic E-field Probe ES3DV3

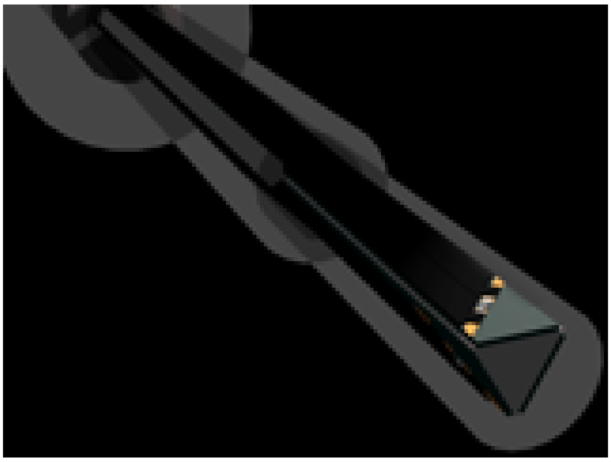

Fig. 15-2 E-field Probe

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	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 900 and HSL 1810 Additional CF for other liquids and frequencies upon request
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: 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

15.4 SAM Twin Phantom

Fig. 15-3 SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- Left hand
- Right hand
- Flat phantom

A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible.

On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

Phantom specification:

Description	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. 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.
Shell Thickness	2+0.2mm, Center ear point: 6+0.2mm
Filling Volume	Approx.25 liters
Dimensions	Length: 1000mm, Width: 500mm, Height: 850mm

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3rd Building, No. 889, Yishan Road, Shanghai, China 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 ww.cn.sgs.com
中国•上海•徐汇区宜山路 889 号 3 号楼 邮编: 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 e sgs.china@sgs.com

15.5 Device Holder for Transmitters

Fig. 15-4 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 centers 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 "=3 and loss tangent _=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.

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16. Detailed Test Results

16.1 Summary of Results

16.1.1 Measurement of RF conducted Power

Unit:dBm

Band	Channel	Peak power(dBm)	Average power(dBm)
2450	1	18.05	15.49
	2	18.06	14.87
	3	17.08	14.13

16.1.2 Measurement of SAR average value

Band	EUT Position	Mode	Test Configuration	Averaged SAR over 1g (W/kg)			SAR limit 1g (W/kg))	Verdict
				CH1	CH2	CH3		
				2412MHz	2437MHz	2462MHz		
2450	Body Worn	--	Back of EUT facing phantom	0.092	0.094	0.096	1.6	Passed
			Front of EUT facing phantom	--	0.036	--	1.6	Passed
			Top of EUT facing phantom	--	0.064	--	1.6	Passed
			Left of EUT facing phantom	--	0.040	--	1.6	Passed
			Right of EUT facing phantom	--	0.015	--	1.6	Passed

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16.2 Maximum Results

The maximum measured SAR values for Head configuration and BodyWorn configuration are given in section 16.2.1.

16.2.1 BodyWorn Configuration

Frequency Band	EUT Position	Conducted Power (dBm)	SAR, Averaged over 1g (W/kg)	Power Drift (dB)	SAR limit (W/kg)	Verdict
2450MHz	Back of EUT facing phantom/High	14.13	0.096	-0.062	1.6	Passed

16.2.2 Maximum Drift

Maximum Drift during measurement	0.203

16.2.3 Measurement Uncertainty

Extended Uncertainty (k=2) 95%	21.43%

16.3 Operation Configurations

The EUT is measured using chipset based test mode software to ensure the results are consistent and reliable, during tests.

1. The EUT is tested at 1,2,3 channels.

2. The EUT is at the lowest data rate during test.

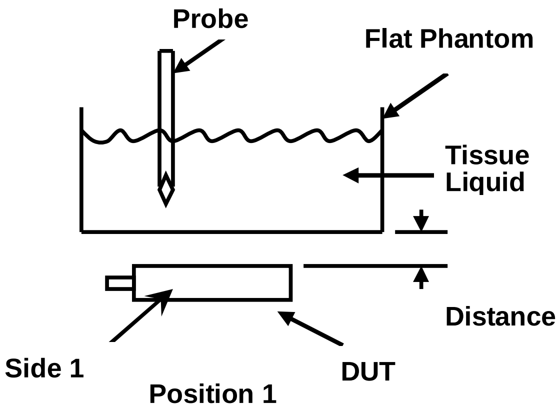
3. Test reduction has been adopted according to conducted output power and produced SAR level:

Low and High channel SAR are optional if SAR value produced in the middle channel is 3dB lower than the applicable SAR limit;

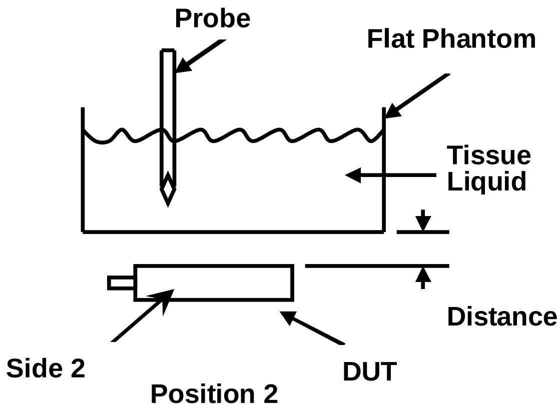
4. The (max. cube) labeling indicates that during the grid scanning an additional peak was found which within 2dB of the highest peak

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

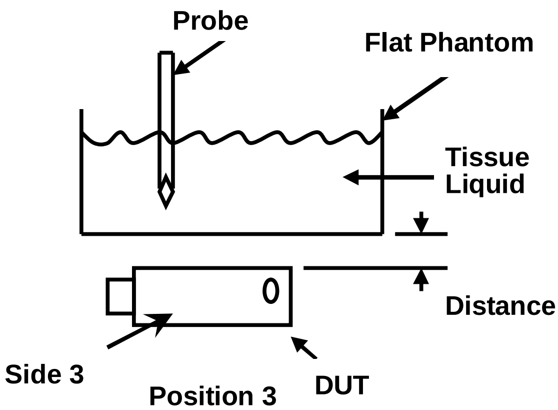
Note: P is abbreviation of position specified above.



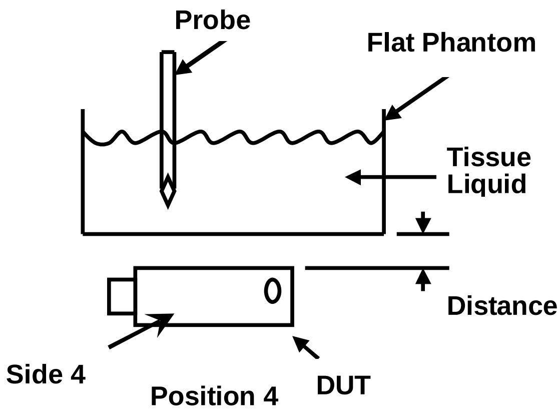
Position 1



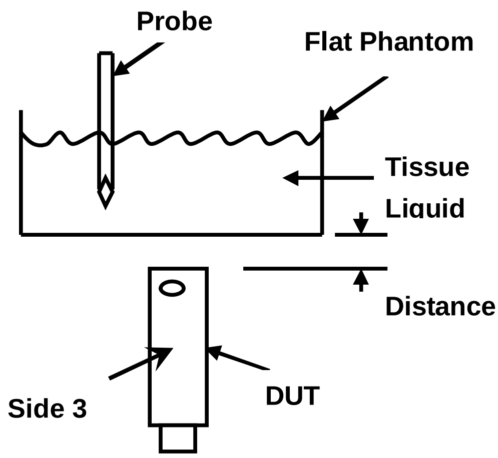
Position 2



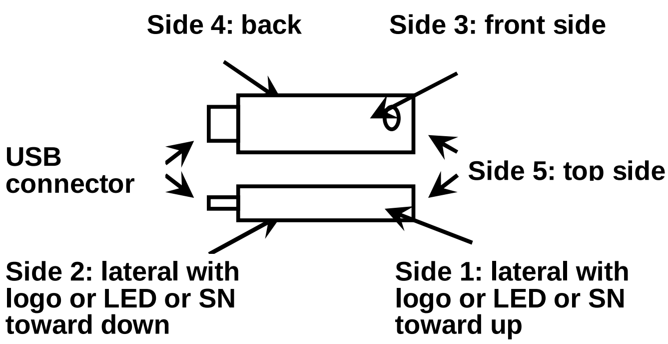
Position 3



Position 4



Position 5



Definition of EUT

16.4 Measurement 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 center 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 neighboring 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)

SGS-CSTC Standards Technical Services(Shanghai) Co, Ltd..
Testing Center-EMC Laboratory
3rd Building, No. 889, Yishan Road, Shanghai, China 200233 t (86-21) 61402666*2736 f (86-21) 54500149 ww.cn.sgs.com
中国•上海•徐汇区宜山路 889 号 3 号楼 邮编: 200233 t (86-21) 61402666*2736 f (86-21) 54500149 e sgs.china@sgs.com

16.5 Detailed Test Results

16.5.1 2450-BackSide-Middle

Date/Time: 2011-7-29 16:33:18

Test Laboratory: SGS-GSM

Wireless USB DAC 1 With IBM R400 Back Side Middle

DUT: Wireless USB DAC 1; Type: /; Serial: SIO49412

Communication System: (2450); Frequency: 2438 MHz;Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: f = 2438 MHz; σ = 1.96 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Middle/Area Scan (51x101x1): **Measurement grid: dx=10mm, dy=10mm**

Maximum value of SAR (interpolated) = 0.111 mW/g

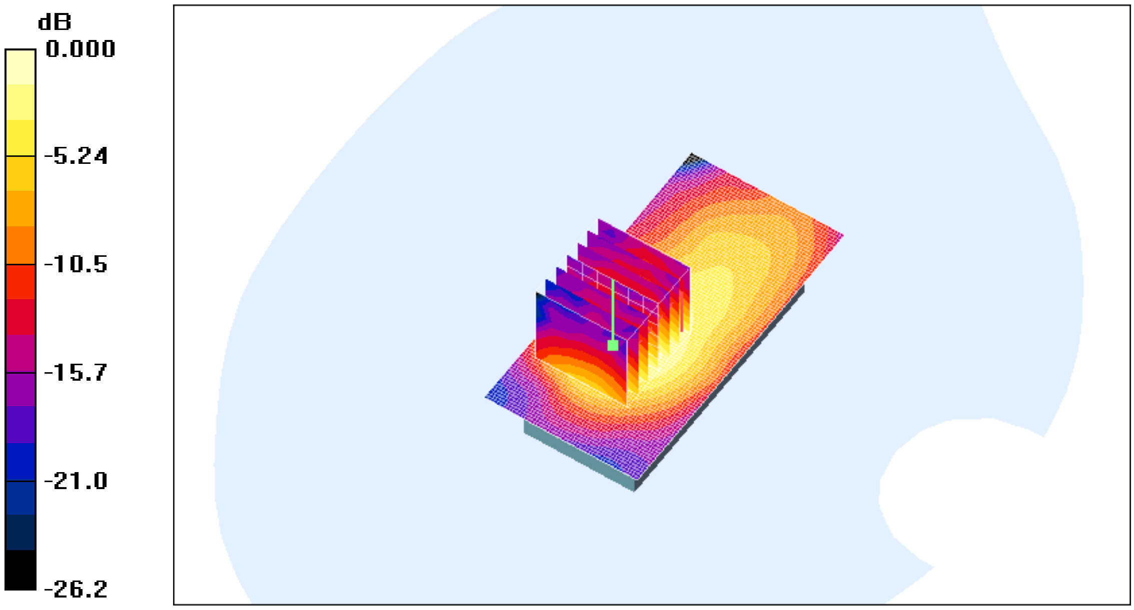
Middle/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 5.89 V/m; Power Drift = 0.203 dB

Peak SAR (extrapolated) = 0.187 W/kg

SAR(1 g) = 0.094 mW/g; SAR(10 g) = 0.047 mW/g

Maximum value of SAR (measured) = 0.101 mW/g



0 dB = 0.101mW/g

16.5.2 2450-FrontSide-Middle

Date/Time: 2011-7-29 17:02:55

Test Laboratory: SGS-GSM

Wireless USB DAC 1 With IBM R400 Front Side Middle

DUT: Wireless USB DAC 1; Type: /; Serial: SIO49412

Communication System: (2450); Frequency: 2438 MHz;Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: f = 2438 MHz; σ = 1.96 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Middle/Area Scan (51x101x1): **Measurement grid: dx=10mm, dy=10mm**

Maximum value of SAR (interpolated) = 0.042 mW/g

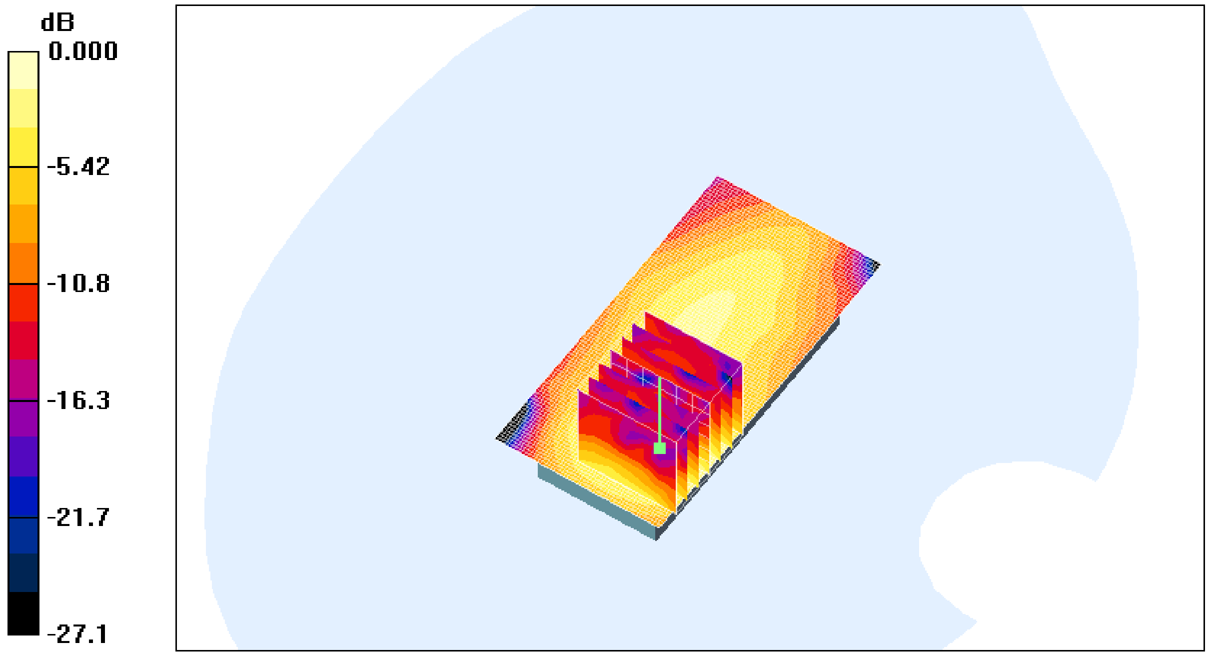
Middle/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 3.40 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.069 W/kg

SAR(1 g) = 0.036 mW/g; SAR(10 g) = 0.019 mW/g

Maximum value of SAR (measured) = 0.040 mW/g



0 dB = 0.040mW/g

16.5.3 2450-TopSide-Middle

Date/Time: 2011-7-29 17:44:15

Test Laboratory: SGS-GSM

Wireless USB DAC 1 With IBM R400 Top Side Middle

DUT: Wireless USB DAC 1; Type: /; Serial: SIO49412

Communication System: (2450); Frequency: 2438 MHz;Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: f = 2438 MHz; σ = 1.96 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Middle/Area Scan (51x71x1): **Measurement grid: dx=10mm, dy=10mm**

Maximum value of SAR (interpolated) = 0.068 mW/g

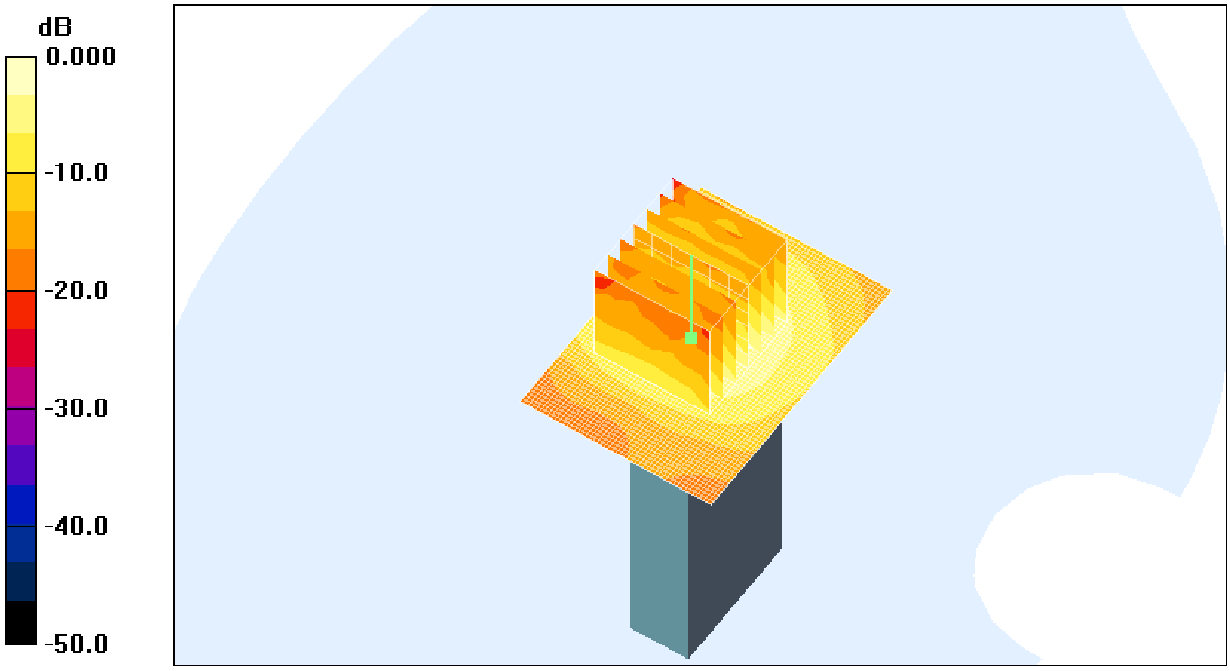
Middle/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 5.64 V/m; Power Drift = -0.011 dB

Peak SAR (extrapolated) = 0.128 W/kg

SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.031 mW/g

Maximum value of SAR (measured) = 0.072 mW/g



0 dB = 0.072mW/g

16.5.4 2450-LeftSide-Middle

Date/Time: 2011-7-29 18:30:49

Test Laboratory: SGS-GSM

Wireless USB DAC 1 With IBM R400 Left Side Middle

DUT: Wireless USB DAC 1; Type: /; Serial: SIO49412

Communication System: (2450); Frequency: 2438 MHz;Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: f = 2438 MHz; σ = 1.96 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Middle/Area Scan (51x101x1): **Measurement grid: dx=10mm, dy=10mm**

Maximum value of SAR (interpolated) = 0.049 mW/g

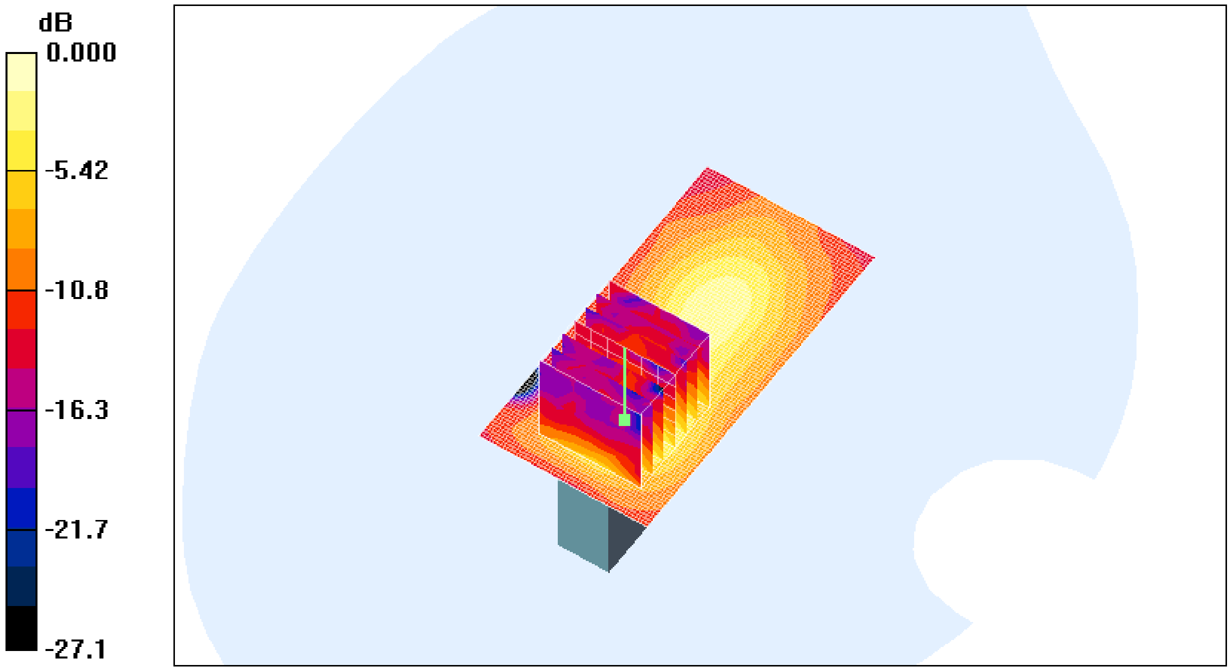
Middle/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 3.25 V/m; Power Drift = 0.098 dB

Peak SAR (extrapolated) = 0.084 W/kg

SAR(1 g) = 0.040 mW/g; SAR(10 g) = 0.018 mW/g

Maximum value of SAR (measured) = 0.045 mW/g



0 dB = 0.045mW/g

16.5.5 2450-RightSide-Middle

Date/Time: 2011-7-29 19:18:35

Test Laboratory: SGS-GSM

Wireless USB DAC 1 With IBM R400 Right Side Middle

DUT: Wireless USB DAC 1; Type: /; Serial: SIO49412

Communication System: (2450); Frequency: 2438 MHz;Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: f = 2438 MHz; σ = 1.96 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Middle/Area Scan (51x101x1): **Measurement grid: dx=10mm, dy=10mm**

Maximum value of SAR (interpolated) = 0.017 mW/g

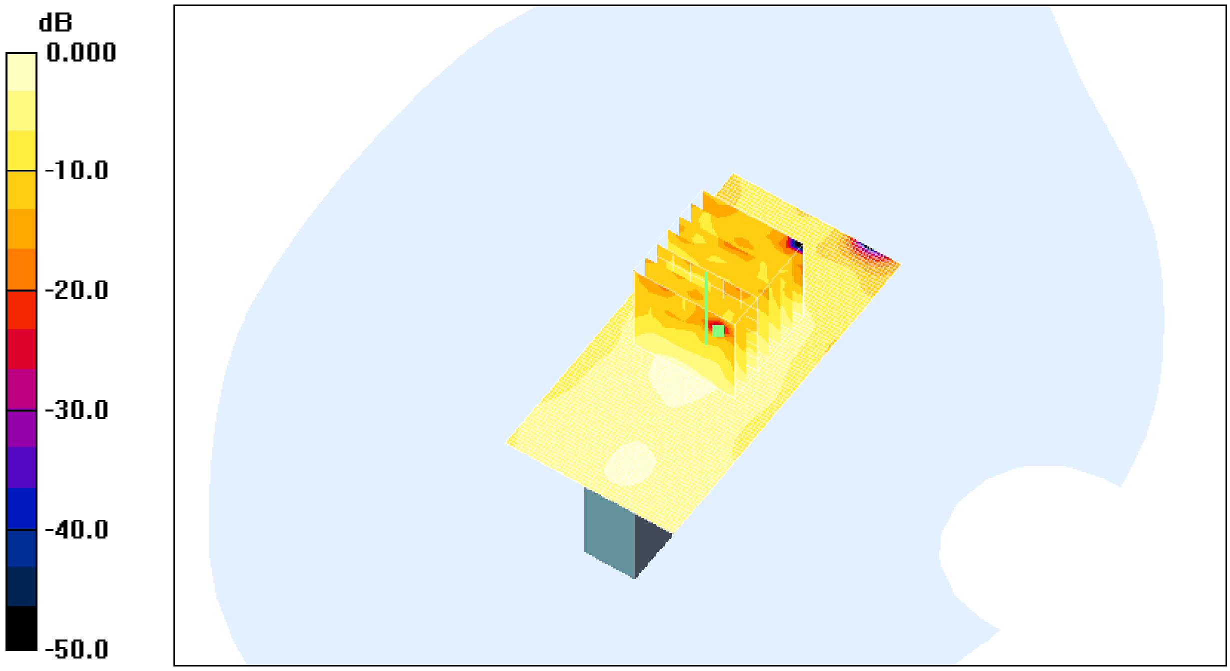
Middle/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 2.93 V/m; Power Drift = -0.162 dB

Peak SAR (extrapolated) = 0.035 W/kg

SAR(1 g) = 0.015 mW/g; SAR(10 g) = 0.00786 mW/g

Maximum value of SAR (measured) = 0.017 mW/g



0 dB = 0.017mW/g

16.5.6 2450-BackSide-High

Date/Time: 2011-7-29 19:54:05

Test Laboratory: SGS-GSM

Wireless USB DAC 1 With IBM R400 Back Side High

DUT: Wireless USB DAC 1; Type: /; Serial: SIO49412

Communication System: (2450); Frequency: 2464 MHz;Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: f = 2464 MHz; σ = 1.99 mho/m; ε_r = 51.8; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

High/Area Scan (51x101x1): **Measurement grid: dx=10mm, dy=10mm**

Maximum value of SAR (interpolated) = 0.114 mW/g

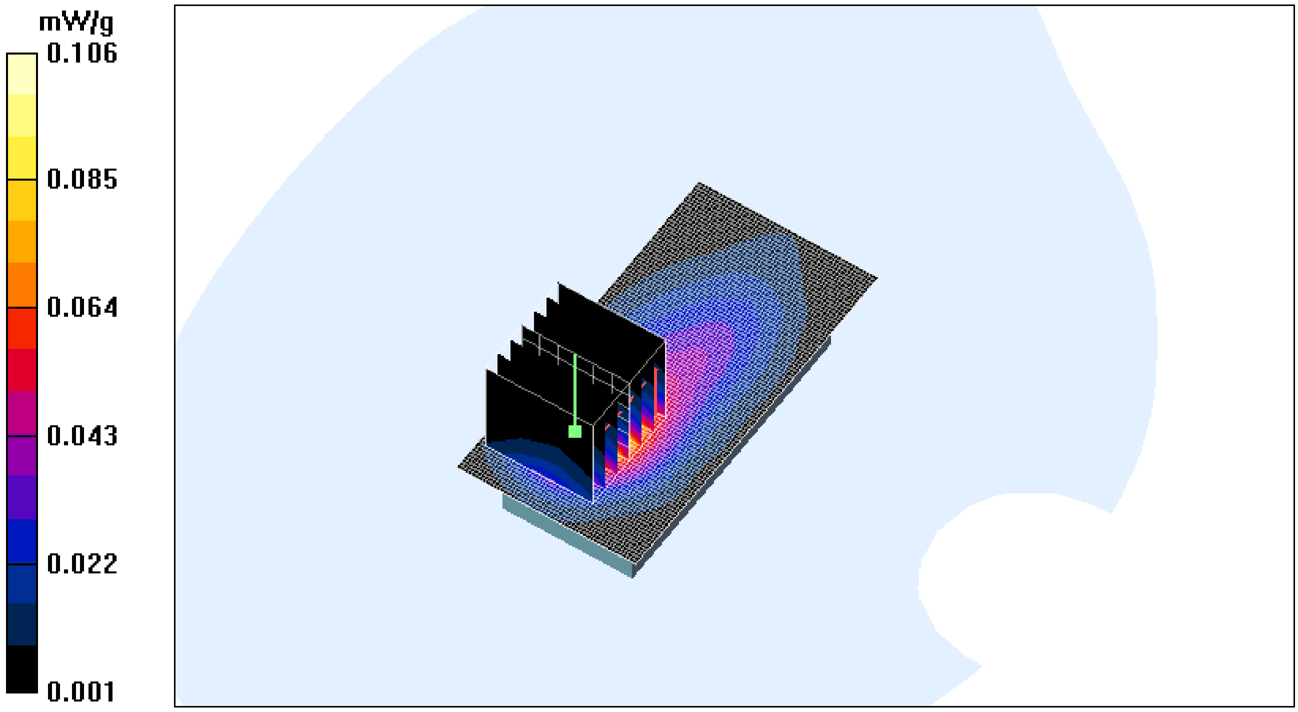
High/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

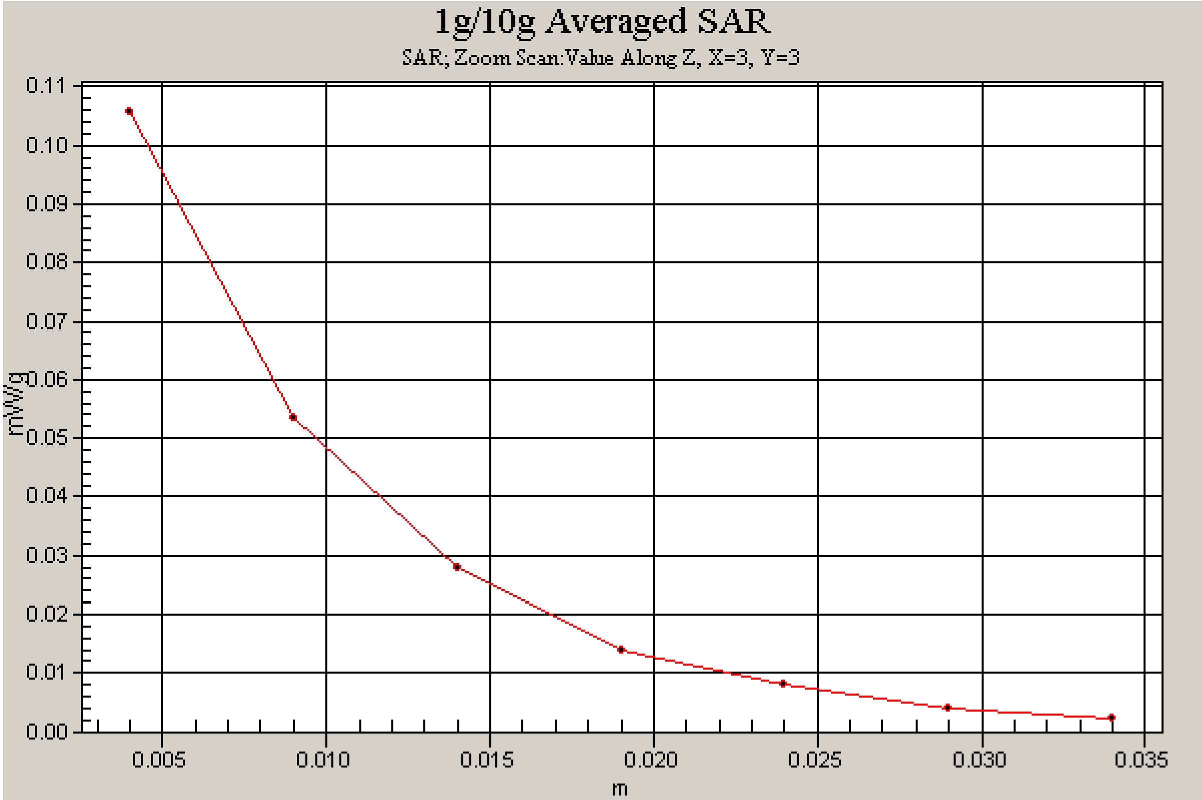
Reference Value = 4.90 V/m; Power Drift = -0.062 dB

Peak SAR (extrapolated) = 0.190 W/kg

SAR(1 g) = 0.096 mW/g; SAR(10 g) = 0.049 mW/g

Maximum value of SAR (measured) = 0.106 mW/g




1g/10g Averaged SAR
SAR; Zoom Scan:Value Along Z, X=3, Y=3
mW/g
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

16.5.7 2450-BackSide-Low

Date/Time: 2011-7-29 20:29:01

Test Laboratory: SGS-GSM

Wireless USB DAC 1 With IBM R400 Back Side Low

DUT: Wireless USB DAC 1; Type: /; Serial: SIO49412

Communication System: (2450); Frequency: 2412 MHz;Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: f = 2412 MHz; σ = 1.93 mho/m; ε_r = 52; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Low/Area Scan (51x101x1): **Measurement grid: dx=10mm, dy=10mm**

Maximum value of SAR (interpolated) = 0.109 mW/g

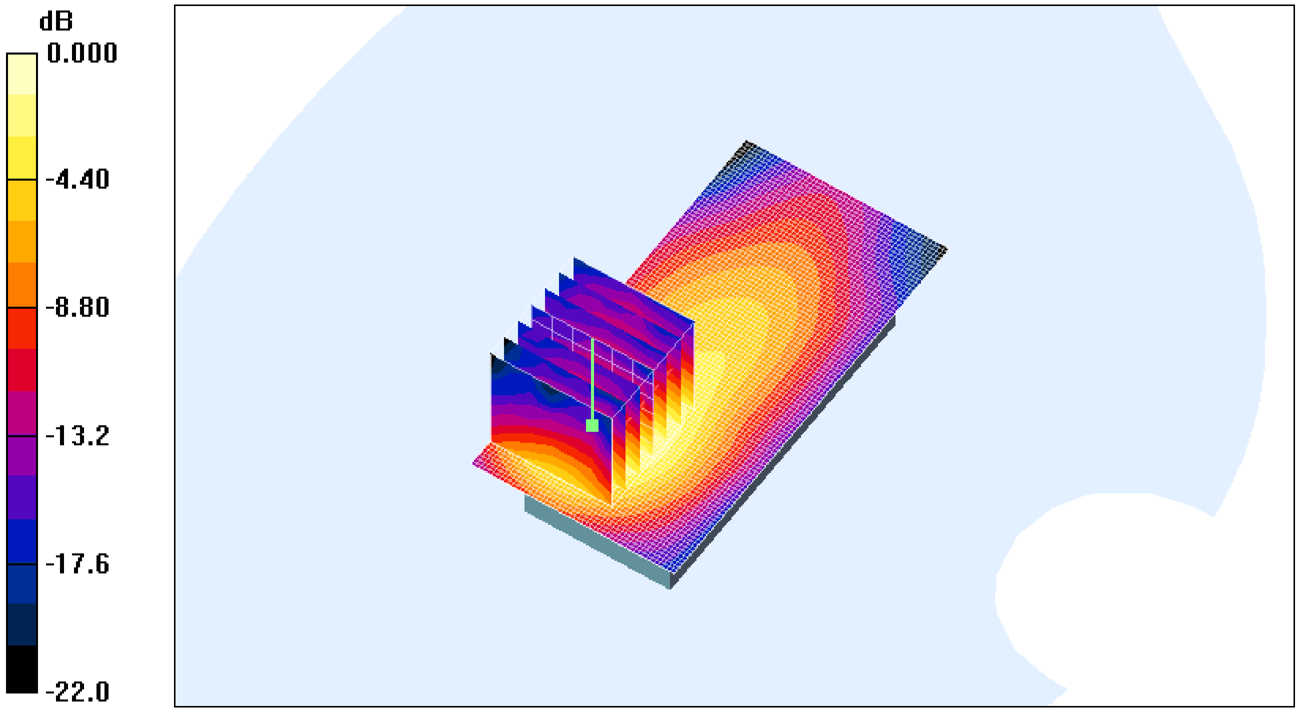
Low/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 4.53 V/m; Power Drift = 0.169 dB

Peak SAR (extrapolated) = 0.182 W/kg

SAR(1 g) = 0.092 mW/g; SAR(10 g) = 0.047 mW/g

Maximum value of SAR (measured) = 0.101 mW/g



0 dB = 0.101mW/g

17. Identification of Samples

Product Name	Wireless USB DAC 1
Mode Name	Wireless USB DAC 1
Brand Name	NAD
Final Hardware Version	VM1.0
Final Software Version	V1.00_02
Product Definition	Production Unit
Normal Voltage	5V
Antenna Type	Inner antenna
Device Type	Portable
Limit Type	General Population/Uncontrolled
WLAN Frequency Bands	Tx/Rx: 2.412~2.464GHz
Modulation Mode	QPSK
Serial:	**SIO49412**
Date of receipt	07-26,2011
Date of Testing Start	07-29,2011
Date of Testing End	07-29,2011

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Testing Center-EMC Laboratory
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中国•上海•徐汇区宜山路 889 号 3 号楼 邮编: 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 e sgs.china@sgs.com

18. Photographs of EUT

Fig.18-1 Front View

Fig.18-2 Back View

Fig.18-3 Receiving Machine

Fig.18-4 Receiving Machine (Back)

Annex A Photographs of Test Setup

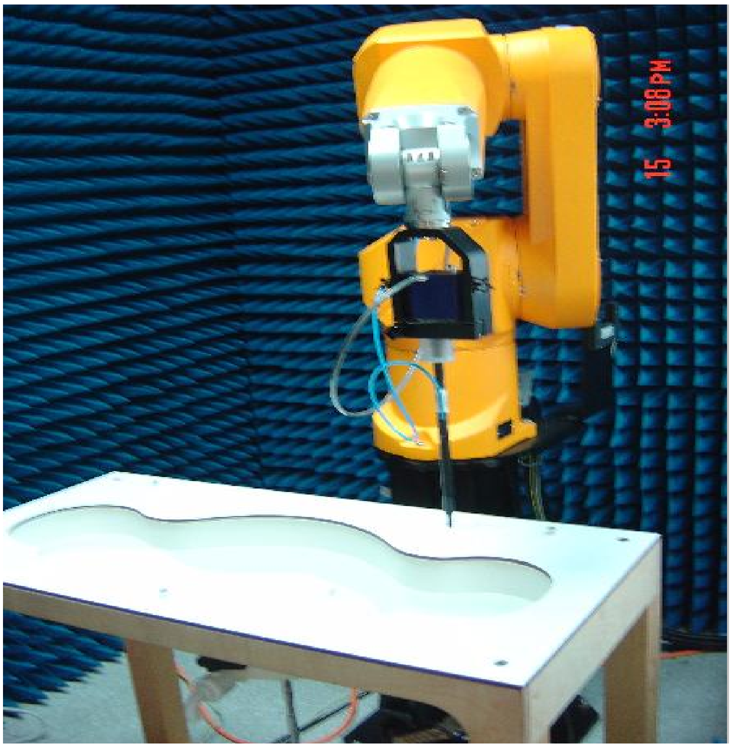

Fig.A-1 Photograph of the SAR measurement System

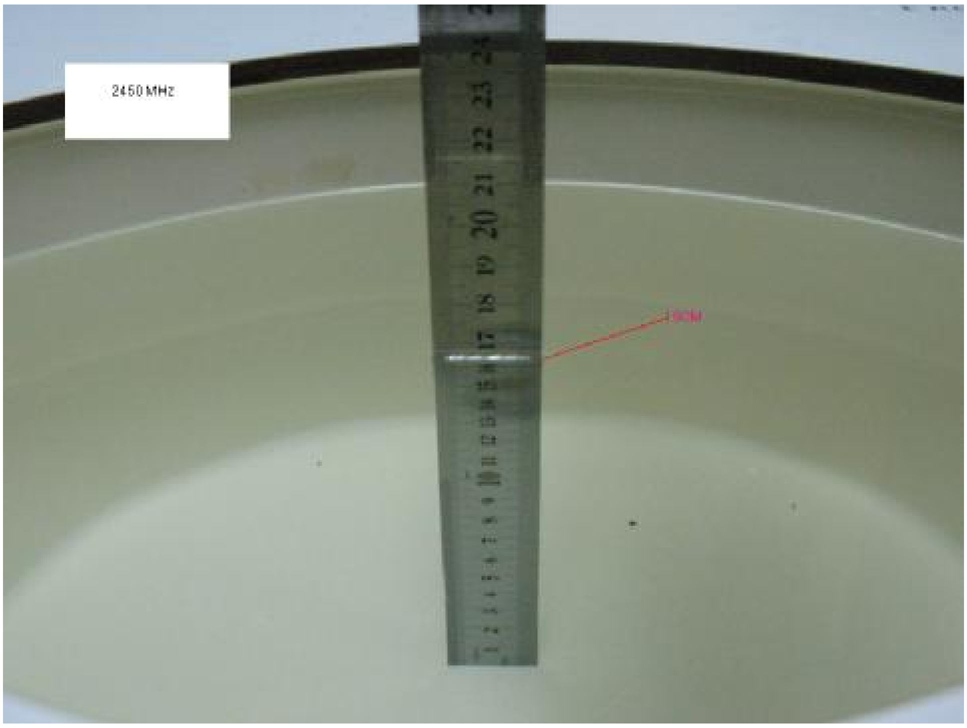

Fig.A-2c Photograph of the Tissue Simulant
Liquid depth 15cm for Body Worn

Fig.A-3a Photograph of Back side of the EUT status

Fig.A-3b Photograph of Front side of the EUT status

Fig.A-3c Photograph of Left side of the EUT status

Fig.A-3d Photograph of Right side of the EUT status

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Fig.A-3e Photograph of Top side of the EUT status

Annex B Tissue Simulant Liquid

Annex B.1 Recipes for Tissue Simulant Liquid

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

Frequency (MHz)	835		900		1800-2000		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body
Ingredient (% by weight)								
Water	40.30	50.75	40.30	50.75	55.24	70.17	62.7	73.26
Salt (NaCl)	1.38	0.94	1.38	0.94	0.31	0.39	0.5	0.04
Sucrose	57.90	48.21	57.90	48.21	0	0	0	0
HEC	0.24	0	0.24	0	0	0	0	0
Bactericide	0.18	0.10	0.10	0.10	0	0	0	0
DGBE	0	0	0	0	44.45	29.44	36.8	26.7
Measurement dielectric parameters								
Dielectric Constant	41.9	55.0	41.1	54.5	39.2	53.2	39.8	52.5
Conductivity (S/m)	0.93	0.97	1.04	1.06	1.45	1.59	1.88	1.78
Target values								
Dielectric Constant	41.5	55.2	41.5	55.0	40.0	53.3	39.2	52.7
Conductivity (S/m)	0.90	0.97	0.97	1.05	1.40	1.52	1.80	1.95
Salt: 99+% Pure Sodium Chloride; Sucrose: 98+% Pure Sucrose; Water: De-ionized, 16 MW+ resistivity; HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]								

Table B-1 Recipe of Tissue Simulat Liquid

Annex B.2 Measurement for Tissue Simulant Liquid

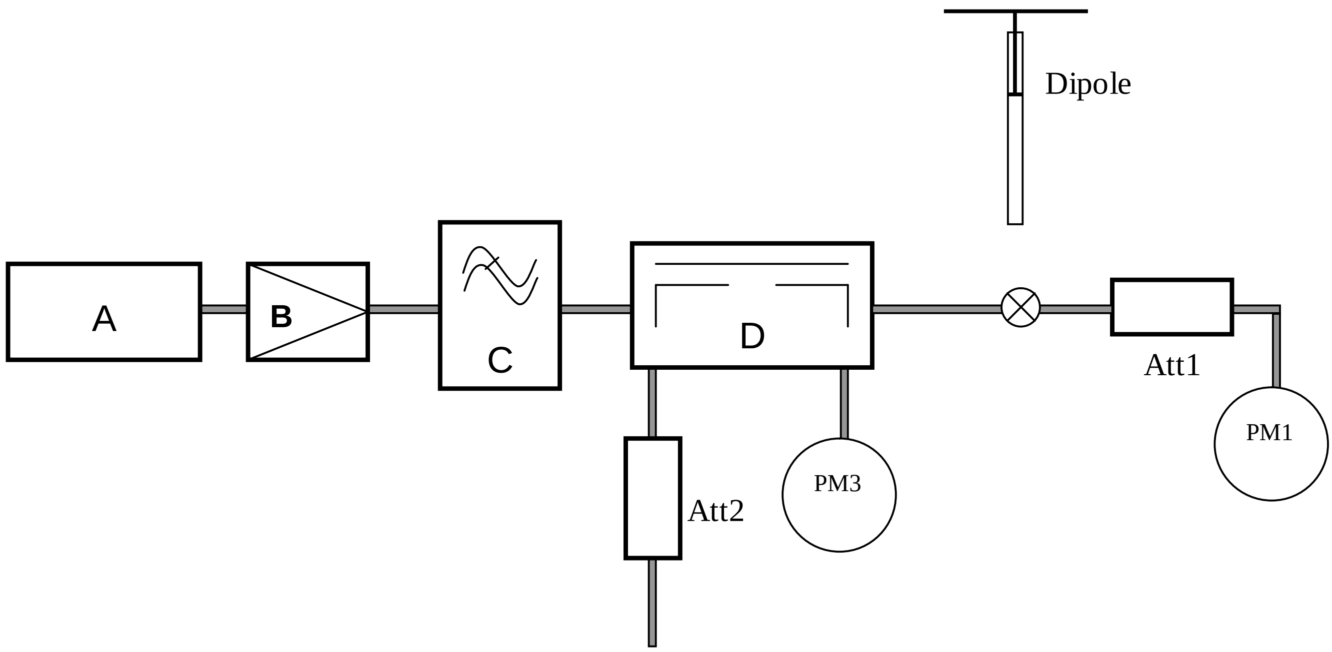
The dielectric properties for this Tissue Simulant Liquids were measured by using the Agilent Model 85070D Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Agilent E5071B Network Analyzer (300 KHz-8500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For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

Frequency (MHz)	Tissue Type	Limit/Measured	Permittivity (ρ)	Conductivity (σ)	Temp (°C)
2450	Body	Recommended Limit	52.7±5% (50.07~55.34)	1.95±5% (1.85~2.05)	22±2
		Measured, 07-29,2011	51.9	1.98	21.5

Table B-2 Measurement result of Tissue electric parameters

Annex C SAR System Validation

The microwave circuit arrangement for system verification is sketched in Fig. C-1. 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. These tests were done at 835&1900MHz. 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°C, 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.



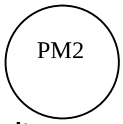


Fig. C-1 the microwave circuit arrangement used for SAR system verification

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

Validation Kit	**Frequency (MHz)**	**Tissue Type**	**Limit/Measurement**		
			Condition	Recommended/Measured	**1g**
D2450V2	2450	Body	Nomalized to 1mW(for nominal Head TSL parameters)	Recommended Limit	53.6±10% (48.24-58.96)
			Nomalized to 1W(for nominal Head TSL parameters)	-	**52.8**
			250mW input power	Measured, 07-29, 2011	**13.2**

Table C-1 SAR System Validation Result

System Validation for 2450MHz-Body

Date/Time: 2011-7-29 13:25:25

Test Laboratory: SGS-GSM

System Performance Check at 2450MHz

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:733

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

Medium: HSL2450-Body Medium parameters used: f = 2450 MHz; σ = 1.98 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.34, 4.34, 4.34); Calibrated: 2010-11-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2010-11-22
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (61x101x1): **Measurement grid: dx=15mm, dy=15mm**

Maximum value of SAR (interpolated) = 16.4 mW/g

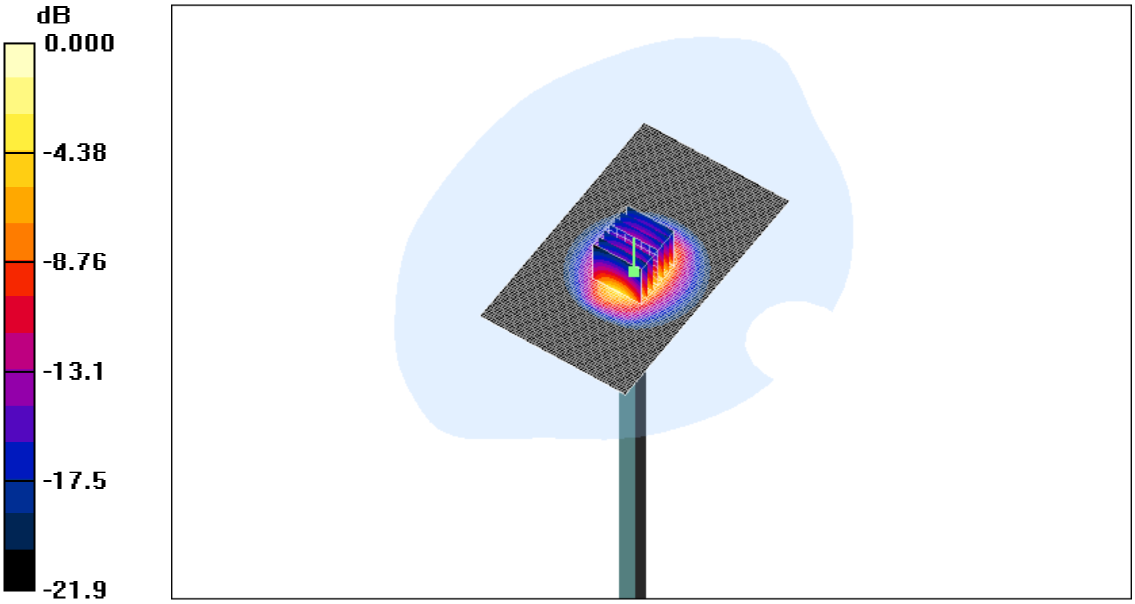
d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 51.7 V/m; Power Drift = -0.021 dB

Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.02 mW/g

Maximum value of SAR (measured) = 15.1 mW/g



0 dB = 15.1mW/g

Annex D 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: SGS-CH (Auden)

Certificate No: ES3-3088_Nov10

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3088
Calibration procedure(s)	QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	November 23, 2010

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	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: November 23, 2010

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

Certificate No: ES3-3088_Nov10 Page 1 of 11

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中国•上海•徐汇区宜山路 889 号 3 号楼 邮编: 200233 t (86 -21) 61402666*2736 f (86 -21) 54500149 e sgs.china@sgs.com

Calibration Laboratory of
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Engineering AG
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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect 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.
- *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:3088

Manufactured:	July 20, 2005
Last calibrated:	November 19, 2009
Recalibrated:	November 23, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY - Parameters of Probe: ES3DV3 SN:3088

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.32	1.27	1.26	± 10.1%
DCP (mV)[B]	100.0	99.9	100.2	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	156.3	± 3.4 %
			Y	0.00	0.00	1.00	152.0	
			Z	0.00	0.00	1.00	147.1	

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 maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 SN:3088

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.07	6.07	6.07	0.99	1.03 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	5.97	5.97	5.97	0.99	1.02 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.23	5.23	5.23	0.59	1.38 ± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.14	5.14	5.14	0.51	1.51 ± 11.0%
2000	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.07	5.07	5.07	0.51	1.54 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.56	4.56	4.56	0.45	1.70 ± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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ES3DV3 SN:3088 November 23, 2010

DASY/EASY - Parameters of Probe: ES3DV3 SN:3088

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	5.98	5.98	5.98	0.88	1.13 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	5.85	5.85	5.85	0.76	1.19 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.92	4.92	4.92	0.26	3.77 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.60	4.60	4.60	0.28	2.78 ± 11.0%
2000	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.76	4.76	4.76	0.26	4.52 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.34	4.34	4.34	0.44	1.96 ± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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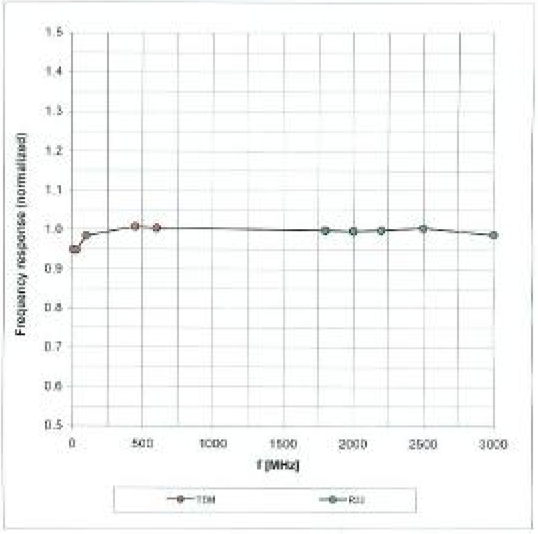
ES3DV3 SN:3088 November 23, 2010

Frequency Response of E-Field

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

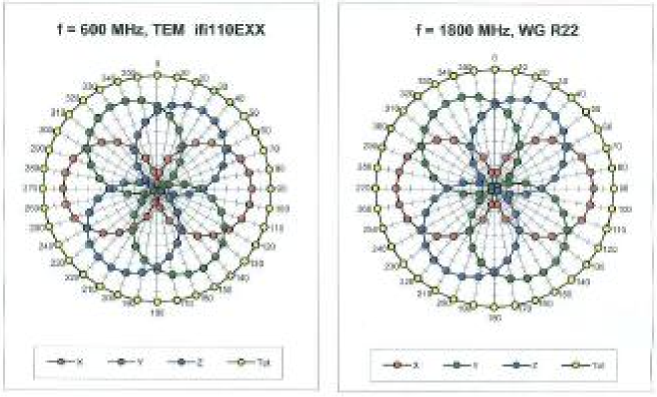


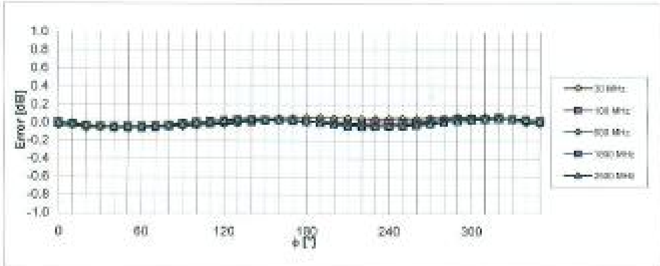
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Certificate No: ES3-3088_Nov10 Page 7 of 11

ES3DV3 SN:3088 November 23, 2010

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





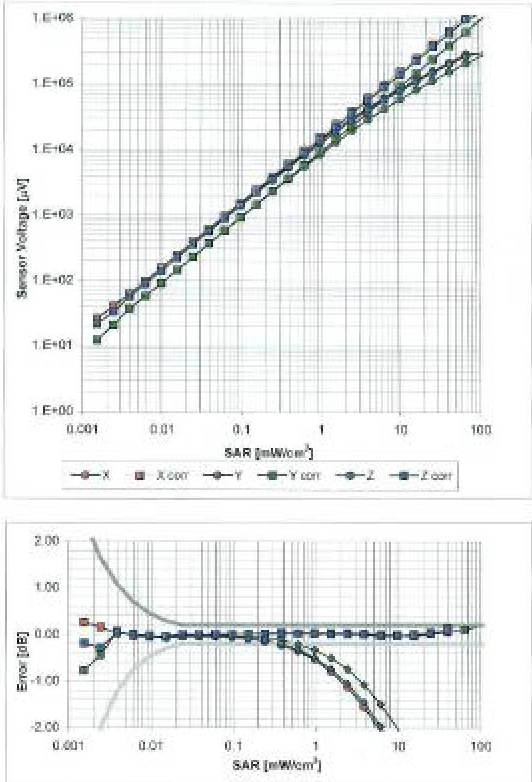
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Certificate No: ES3-3088_Nov10 Page 8 of 11

ES3DV3 SN:3088 November 23, 2010

Dynamic Range f(SAR_{head})

(TEM cell, f = 900 MHz)



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

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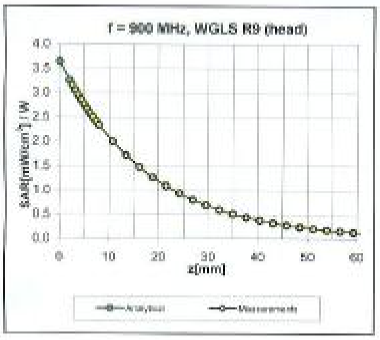
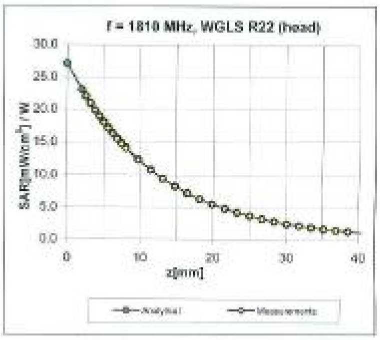
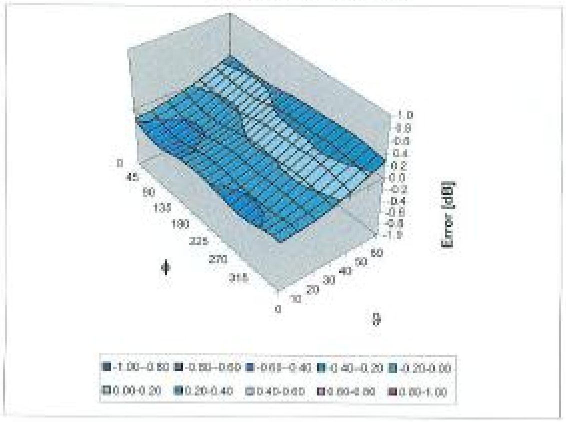
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: ES3-3088_Nov10 Page 10 of 11

ES3DV3 SN:3088 November 23, 2010

Other Probe Parameters

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

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Annex E.2 DAE Calibration certification

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

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Accreditation No.: SCS 108

Client SGS-CH (Auden)

Certificate No: DAE3-569_Nov10

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 569
Calibration procedure(s)	QA CAL-06.v22 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 22, 2010

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-10 (No:10376)	Sep-11
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: November 22, 2010

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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.

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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	402.938 ± 0.1% (k=2)	403.345 ± 0.1% (k=2)	403.529 ± 0.1% (k=2)
Low Range	3.92800 ± 0.7% (k=2)	3.95637 ± 0.7% (k=2)	3.94644 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	263.0 ° ± 1 °

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Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199997.6	0.39	0.00
Channel X	+ Input	19998.27	-1.73	-0.01
Channel X	- Input	-20000.54	-0.84	0.00
Channel Y	+ Input	199999.9	2.71	0.00
Channel Y	+ Input	20000.26	0.06	0.00
Channel Y	- Input	-19999.11	0.59	-0.00
Channel Z	+ Input	199999.2	3.34	0.00
Channel Z	+ Input	19994.29	-5.81	-0.03
Channel Z	- Input	-20000.54	-0.74	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.8	0.76	0.04
Channel X	+ Input	199.37	-0.23	-0.11
Channel X	- Input	-200.61	-0.71	0.35
Channel Y	+ Input	2000.0	-0.01	-0.00
Channel Y	+ Input	198.53	-1.37	-0.69
Channel Y	- Input	-202.14	-1.84	0.92
Channel Z	+ Input	2000.6	0.24	0.01
Channel Z	+ Input	198.39	-1.51	-0.76
Channel Z	- Input	-201.69	-1.99	0.99

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	-0.51	-2.10
	- 200	2.92	2.01
Channel Y	200	4.53	4.19
	- 200	-6.17	-6.12
Channel Z	200	-14.00	-14.37
	- 200	12.62	12.51

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	-	2.31	-2.14
Channel Y	200	2.21	-	3.30
Channel Z	200	0.63	-0.46	-

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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	16227	16350
Channel Y	16585	16231
Channel Z	15827	16157

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	0.17	-1.94	1.97	0.67
Channel Y	-0.86	-2.25	1.36	0.69
Channel Z	-1.20	-2.36	0.46	0.57

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

Annex E.1 Dipole Calibration certification

D2450V2

Calibration Laboratory of
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Accreditation No.: **SCS 108**

Client **SGS-CH (Auden)**

Certificate No: **D2450V2-733_Nov10**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 733
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	November 25, 2010

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: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

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	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 25, 2010

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Certificate No: D2450V2-733_Nov10 Page 1 of 9

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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.

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Measurement Conditions

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

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
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	38.8 ± 6 %	1.72 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.8 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.18 mW / g
SAR normalized	normalized to 1W	24.7 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.9 mW /g ± 16.5 % (k=2)**

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Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	1.92 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.6 mW / g
SAR normalized	normalized to 1W	50.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**50.7 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.82 mW / g
SAR normalized	normalized to 1W	23.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**23.3 mW / g ± 16.5 % (k=2)**

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω + 1.9 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 Ω + 3.7 jΩ
Return Loss	- 28.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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 07, 2003

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DASY5 Validation Report for Head TSL

Date/Time: 25.11.2010 14:35:03

Test Laboratory: SPEAG, Zurich, Switzerland

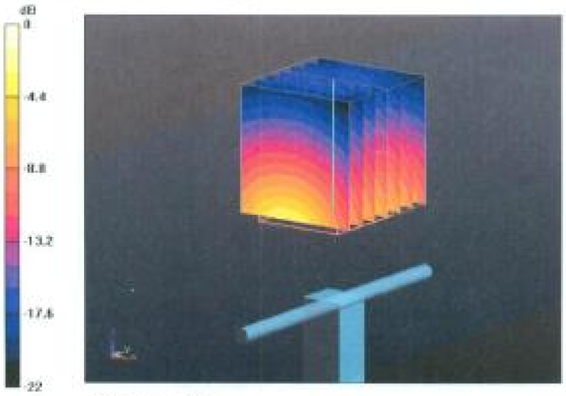
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:733

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.72 mho/m; ε_r = 38.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW/d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.0 V/m; Power Drift = 0.057 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.18 mW/g
Maximum value of SAR (measured) = 16.6 mW/g



0 dB = 16.6mW/g

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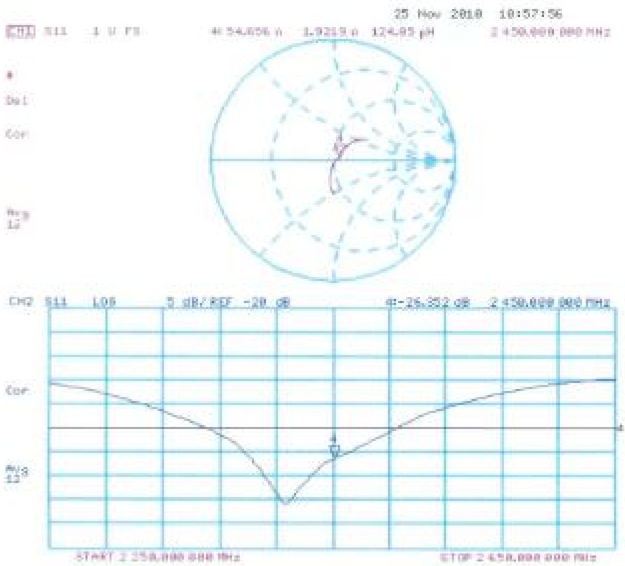
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body

Date/Time: 24.11.2010 13:56:51

Test Laboratory: SPEAG, Zurich, Switzerland

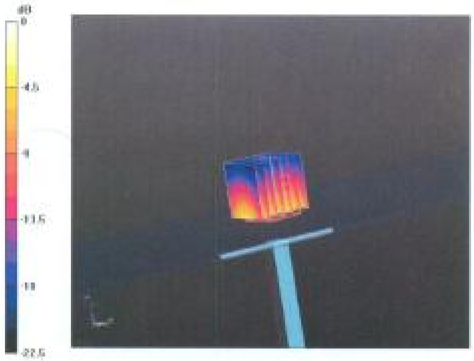
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:733

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.92 mho/m; ε_r = 52.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.8 V/m; Power Drift = 0.027 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 12.6 mW/g; SAR(10 g) = 5.82 mW/g
Maximum value of SAR (measured) = 16.1 mW/g



0 dB = 16.1mW/g

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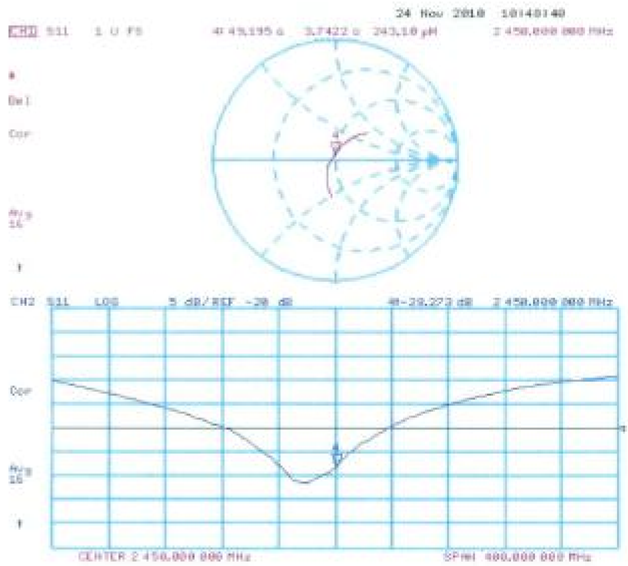
Impedance Measurement Plot for Body TSL



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END OF REPORT