

Report No.: SHEM120200011217
Issue Date: 01-08, 2013
Page 1 of 63

Full SAR Test Report

Applicant Name: Monster, LLC

Applicant Address: 7251 West Lake Mead Blvd Suite 342 Las Vegas, NV 89128

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

Sample Description	StreamCast HD Transmitter
Model Number	MSP STRC USB XMT WW
Market Name	Monster Products
FCC ID:	RJE-178461
IC:	5153A-178461
Test Frequency Band:	2400MHz to 2480MHz
Date Initial Sample Received	Feb. 13, 2012
Testing Start Date	01-07, 2013
Testing End Date	01-07, 2013

According to:

FCC 47CFR § 2.1093, IEEE Std C95.1-1992

IEEE1528-2003, OET Bulletin 65 Supplement C

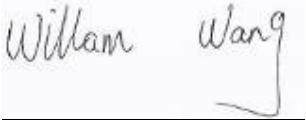
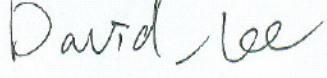
IEC 62209-2:2010

RSS-102 Issue 4 (March 2010), updated December 2010.

Comments/ Conclusion:

The configuration tested complied to the certification requirements specified in this report.

Signed for on behalf of SGS

	
Prepared	approved

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Table of Contents

Change History	3
1. Report Overview.....	4
2. Test Lab Declaration or Comments	4
3. Applicant Declaration or Comments	4
4. Full Test Report	4
5. Partial Test Report.....	4
6. Measurement Uncertainty	4
7. Testing Environment.....	6
8. Primary Test Laboratory	6
9. Details of Applicant.....	6
10. Details of Manufacturer	6
11. EUT Description	7
12. Referenced Documents	7
13. Primary Laboratory Accreditation Details.....	8
14. Test Equipment Information.....	9
14.1 SPEAG DASY4	9
14.2 The SAR Measurement System.....	10
14.3 Isotropic E-field Probe ES3DV3	12
14.4 RAM Twin Phantom.....	13
14.5 Device Holder for Transmitters	14
15. Detailed Test Results	15
15.1 Summary of Results.....	15
15.2 Maximum Results	16
15.3 Operation Configurations	17
15.4 Measurement procedure.....	18
15.5 Detailed Test Results	19
16. Product Information.....	27
17. Identification of Samples.....	28
Annex A Photographs of Test Setup.....	29
Annex B Tissue Simulant Liquid	33
Annex C SAR System Validation	35
Annex D Calibration certificate.....	38
END OF REPORT	63

Change History

Version	Change Contents	Author	Date
V1.0	First edition	Willam Wang	01-08, 2013

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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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A	b1	c	d	e = f(d,k)	g	i = cxg/e	k
Uncertainty Component	Section	Tol	Prob .	Div.	Ci	1g	Vi
	in P1528	(%)	Dist.		(1g)	ui (%)	(Ve _{eff})
Probe calibration	E.2.1	6.3	N	1	1	6.0	∞
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					10.43	430

Expanded uncertainty (95% CONFIDENCE INTERVAL)	K=2	20.86
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7. Testing Environment

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

8. Primary Test Laboratory

Name:	SGS-CSTC Standards Technical Services(Shanghai) Co., Ltd
Address:	No.588, West Jindu Road, Songjiang District, Shanghai, China 201612
Telephone:	+86 (0) 21 6191 5664
Fax:	+86 (0) 21 6191 5678
Internet:	http://www.cn.sgs.com
Contact:	Mr. David.Lee
Email:	David-jc.lee@sgs.com

9. Details of Applicant

Name:	Monster, LLC
Address:	7251 West Lake Mead Blvd Suite 342 Las Vegas, NV 89128
Telephone:	415-840-2000
Fax:	415-468-0311
Contact:	Einstein Galang
Email:	egalang@monstercable.com

10. Details of Manufacturer

Name:	Hansong(Nanjing) Technology Ltd.
Address:	8th Kangping Road, Jiangning Economy and Technology Development Zone, Nanjing, 201106, China
Telephone:	0086-025-66604242
Fax:	0086-025-66612098
Contact:	Carina Zhu
Email:	carina.zhu@hansong-china.com

11. EUT Description

Product Name	StreamCast HD Transmitter
Model No.	MSP STRC USB XMT WW
Brand Name	Monster Products
Frequency Range	2.4GHz: 2412-2464MHz 5.2GHz: 5180-5240MHz 5.8GHz: 5736-5814MHz
Device Category	USB Dongle
RF Exposure Environment	Uncontrolled
Antenna Type	Internal
Peak Antenna Gain	2.0dBi

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, IEC 62209-2

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 C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.	1992
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 Policies	--
KDB 248227 D01	SAR Measurement Procedures for 802.11a/b/g Transmitters	--
IEC 62209-2	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices human models, instrumentation, and procedures—Part2: Procedure to determine the specific absorption rate(SAR) for wireless	2010

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	communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)	
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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

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

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. 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. Date of expiry: 2014-07-26.

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14. Test Equipment Information

14.1 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	2012-12-28	2013-12-27
E-Field Probe	ES3DV3	3088	2012-11-26	2013-11-25
Validation Kits	D2450V2	733	2012-11-26	2013-11-25
Agilent Network Analyzer	E5071B	MY42100549	2012-10-30	2013-10-29
RF Bi-Directional Coupler	ZABDC20-252H	n/a	2012-05-18	2013-05-17
Agilent Signal Generator	E4438C	14438CAT0-19719	2012-10-30	2013-10-29
Mini-Circuits Preamplifier	ZHL-42	D041905	2012-10-30	2013-10-29
Agilent Power Meter	E4416A	GB41292095	2012-10-30	2013-10-29
Agilent Power Sensor	8481H	MY41091234	2012-10-30	2013-10-29
R&S Power Sensor	NRP-Z92	100025	2012-04-13	2013-04-12
R&S Universal Radio Communication Tester	CMU200	103633	2012-10-30	2013-10-29

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14.2 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 $SAR = \sigma (|E_i|^2) / \rho$ where σ and ρ are the conductivity and mass density of the tissue-stimulant.

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 dissymmetric 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.

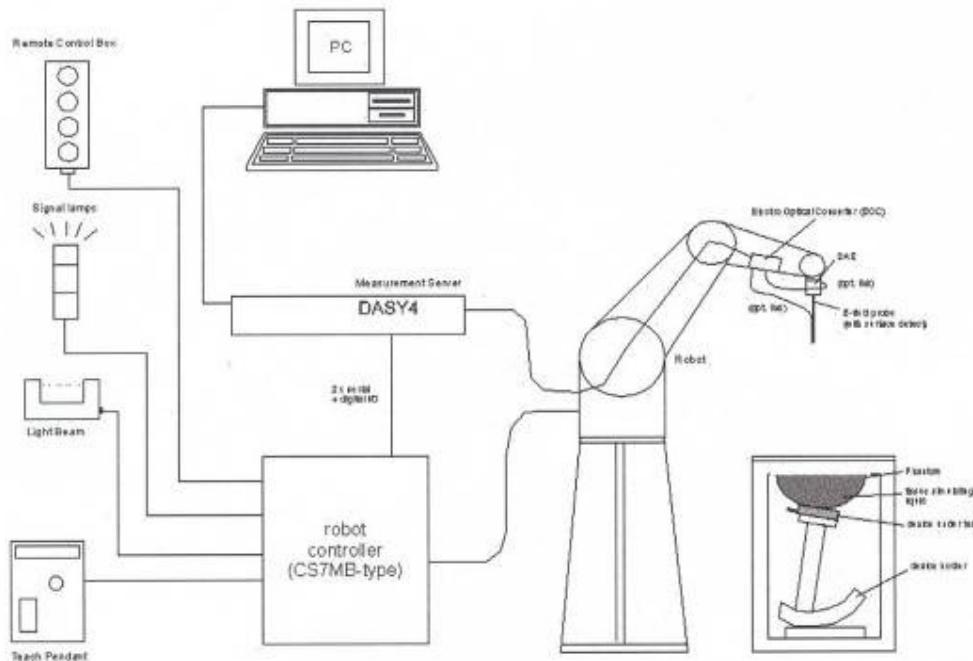


Fig. 14-1 SAR System Configuration

- 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.

14.3 Isotropic E-field Probe ES3DV3

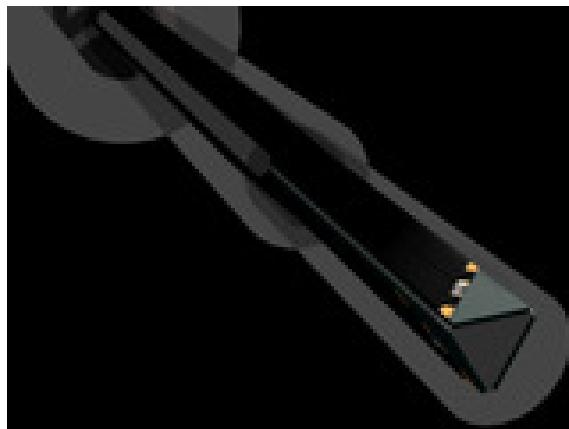


Fig. 14-2 E-field Probe

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 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones

14.4 RAM Twin Phantom



Fig. 14-3 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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14.5 Device Holder for Transmitters



Fig. 14-4 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 $\pm 0.5\text{mm}$ would produce a SAR uncertainty of $\pm 20\%$. 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 $\epsilon_r = 3$ and loss tangent $\tan \delta = 0.02$. 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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15. Detailed Test Results

15.1 Summary of Results

15.1.1 Measurement of RF conducted Power (dBm)

Test Band	Channel	Frequency (MHz)	RMS Power (dBm)
2.4GHz	Low	2412	10.38
	Mid	2438	9.97
	High	2464	9.70
5.2GHz	Low	5180	11.34
	Mid	5210	11.40
	High	5240	11.52
5.8GHz	Low	5736	5.07
	Mid	5762	5.73
	High	5814	4.78

15.1.2 Measurement of SAR average value

Band	EUT Position	Test Configuration	Averaged SAR over 1g (W/kg)			SAR limit 1g (W/kg)	Verdict
			CH1	CH6	CH11		
			2412MHz	2438MHz	2464MHz		
WIFI	Body Worn	Front of EUT facing phantom	0.171	--	--	1.6	Passed
		Back of EUT facing phantom	0.201	--	--	1.6	Passed
		Top of EUT facing phantom	0.342	0.328	0.296	1.6	Passed

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		Left of EUT facing phantom	0.037	--	--	1.6	Passed
		Right of EUT facing phantom	0.066	--	--	1.6	Passed

Note: the SAR test for 5.2GHz band and 5.8GHz band please reference report 125S060R-HP-US-P03V01

15.2 Maximum Results

The maximum measured SAR values for BodyWorn configuration are given in section 15.2.1.

15.2.1 BodyWorn Configuration

Frequency Band	EUT Position	Conducted Power (dBm)	SAR, Averaged over 1g (W/kg)	Power Drift (dB)	SAR limit (W/kg)	Verdict
WIFI	Top of EUT facing phantom/Low	10.38	0.342	-0.159	1.6	Passed

15.2.2 Maximum Drift

Maximum Drift during measurement	-0.199dB
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15.2.3 Measurement Uncertainty

Extended Uncertainty (k=2) 95%	20.86%
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15.3 Operation Configurations

The test positions (the distance between the EUT and the phantom is 5mm for all the sides)

Below show the EUT photo.



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15.4 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)

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15.5 Detailed Test Results

16.5.1 Bodyworn-TopSide-Low

Date/Time: 2013-1-7 11:41:02

Test Laboratory: SGS-EMC

Bodyworn Top side Low

DUT: StreamCast HD Transmitter; Type: MSP STRC USB XMT WW; Serial: ---

Communication System: CW; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: $f = 2412 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 51.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- 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 (41x81x1): **Measurement grid: dx=15mm, dy=15mm**

Maximum value of SAR (interpolated) = 0.406 mW/g

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

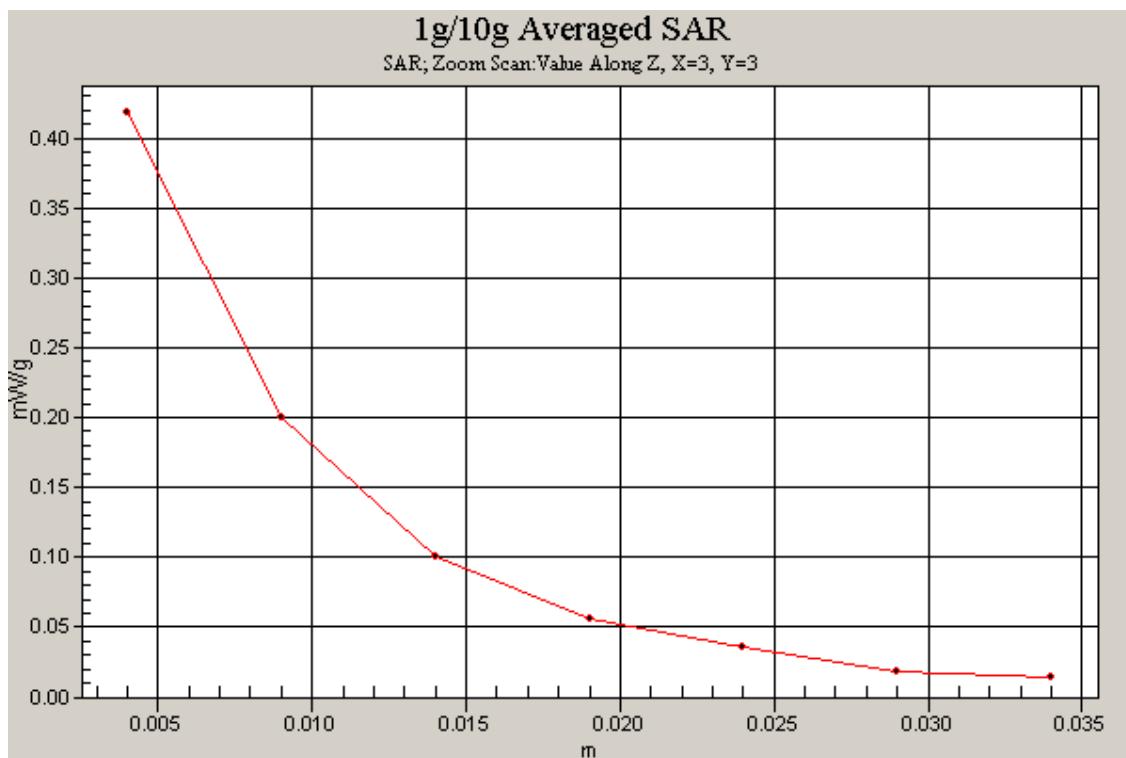
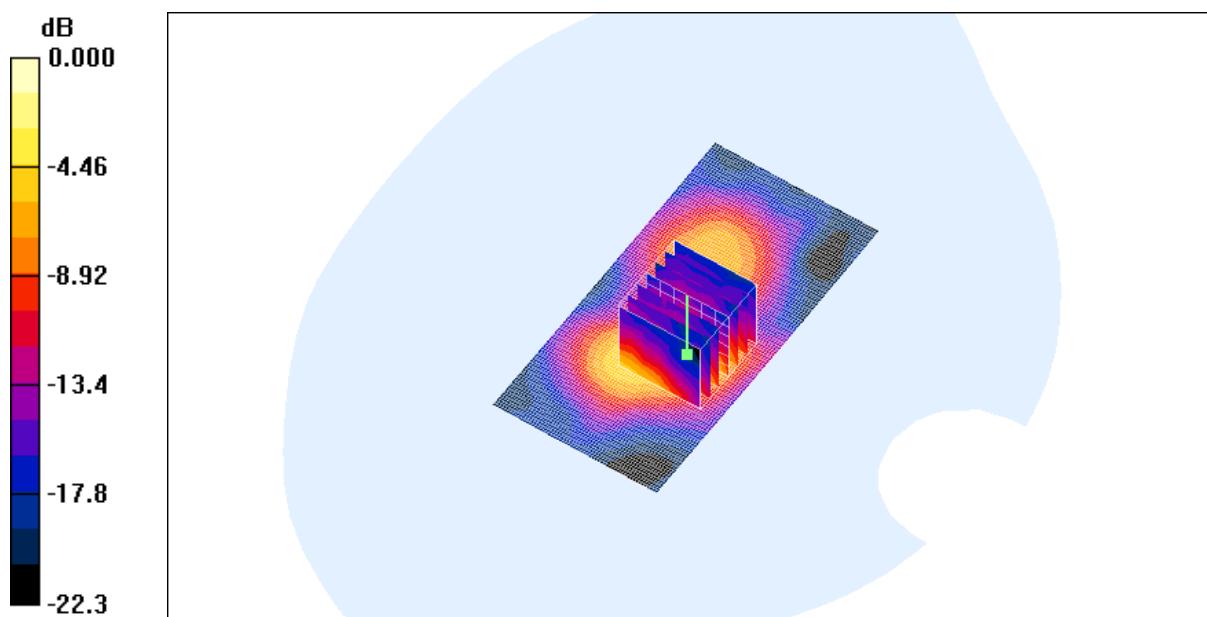
Reference Value = 7.42 V/m; Power Drift = -0.159 dB

Peak SAR (extrapolated) = 0.882 W/kg

SAR(1 g) = 0.342 mW/g; SAR(10 g) = 0.141 mW/g

Maximum value of SAR (measured) = 0.444 mW/g

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16.5.2 Bodyworn-FrontSide-Low

Date/Time: 2013-1-7 12:11:37

Test Laboratory: SGS-EMC

Bodyworn Front side Low

DUT: StreamCast HD Transmitter; Type: MSP STRC USB XMT WW; Serial: ---

Communication System: CW; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: $f = 2412$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- 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 (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.210 mW/g

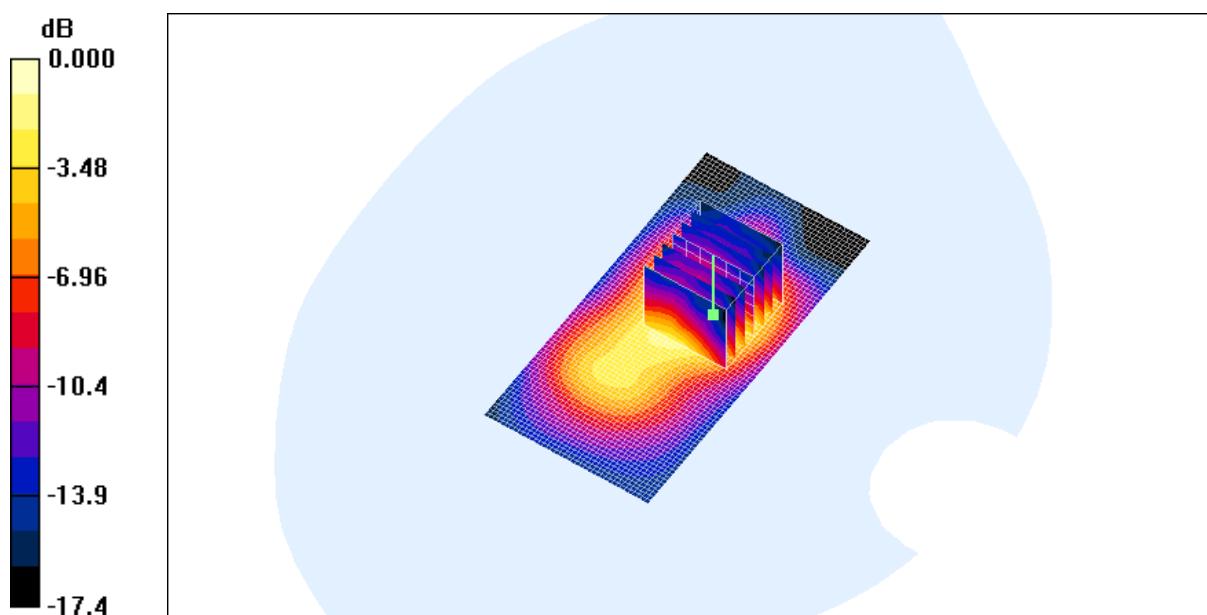
Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.04 V/m; Power Drift = -0.116 dB

Peak SAR (extrapolated) = 0.293 W/kg

SAR(1 g) = 0.171 mW/g; SAR(10 g) = 0.089 mW/g

Maximum value of SAR (measured) = 0.189 mW/g



0 dB = 0.189mW/g

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16.5.3 Bodyworn-BackSide-Low

Date/Time: 2013-1-7 12:35:18

Test Laboratory: SGS-EMC

Bodyworn Back side Low

DUT: StreamCast HD Transmitter; Type: MSP STRC USB XMT WW; Serial: ---

Communication System: CW; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: $f = 2412$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- 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 (41x81x1): **Measurement grid: dx=15mm, dy=15mm**

Maximum value of SAR (interpolated) = 0.236 mW/g

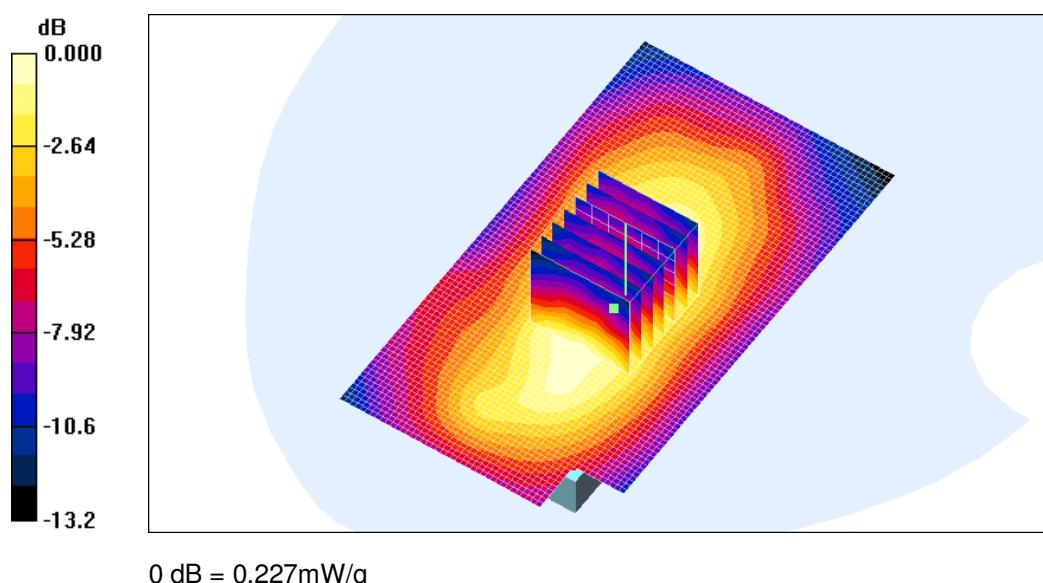
Low/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 6.53 V/m; Power Drift = -0.098 dB

Peak SAR (extrapolated) = 0.242 W/kg

SAR(1 g) = 0.201 mW/g; SAR(10 g) = 0.136 mW/g

Maximum value of SAR (measured) = 0.227 mW/g



16.5.4 Bodyworn-RightSide-Low

Date/Time: 2013-1-7 13:02:25

Test Laboratory: SGS-EMC

Bodyworn Back side Low

DUT: StreamCast HD Transmitter; Type: MSP STRC USB XMT WW; Serial: ---

Communication System: CW; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: $f = 2412 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 51.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- 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 (51x51x1): **Measurement grid: dx=15mm, dy=15mm**

Maximum value of SAR (interpolated) = 0.073 mW/g

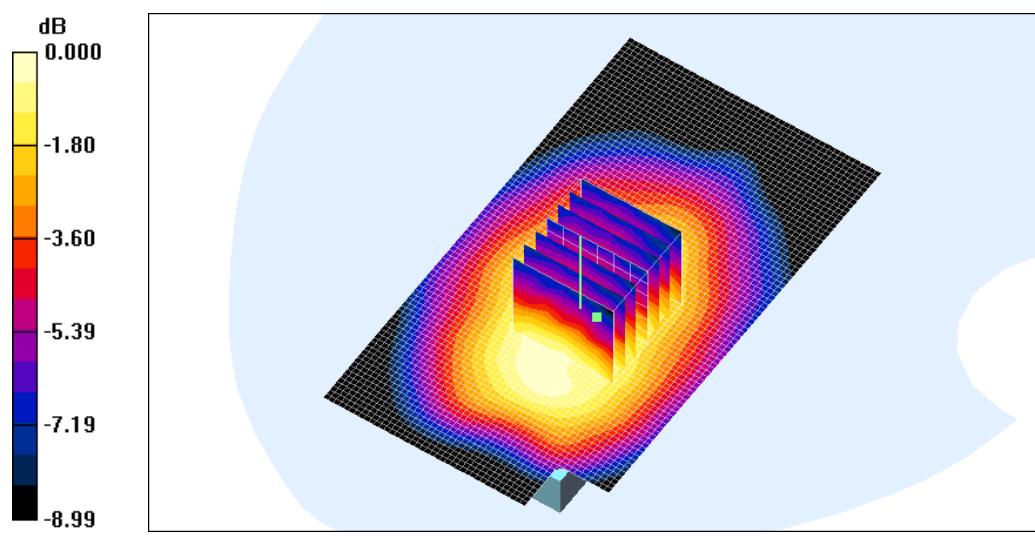
Low/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 2.35 V/m; Power Drift = -0.171 dB

Peak SAR (extrapolated) = 0.075 W/kg

SAR(1 g) = 0.066 mW/g; SAR(10 g) = 0.0050 mW/g

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



0 dB = 0.072mW/g

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16.5.5 Bodyworn-LeftSide-Low

Date/Time: 2012-1-7 13:35:07

Test Laboratory: SGS-EMC

Bodyworn Left side Low

DUT: StreamCast HD Transmitter; Type: MSP STRC USB XMT WW; Serial: ---

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

Medium: HSL2450-Body Medium parameters used: $f = 2412 \text{ MHz}$; $\sigma = 1.96 \text{ mho/m}$; $\epsilon_r = 51.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- 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 (41x81x1): **Measurement grid: dx=15mm, dy=15mm**

Maximum value of SAR (interpolated) = 0.041 mW/g

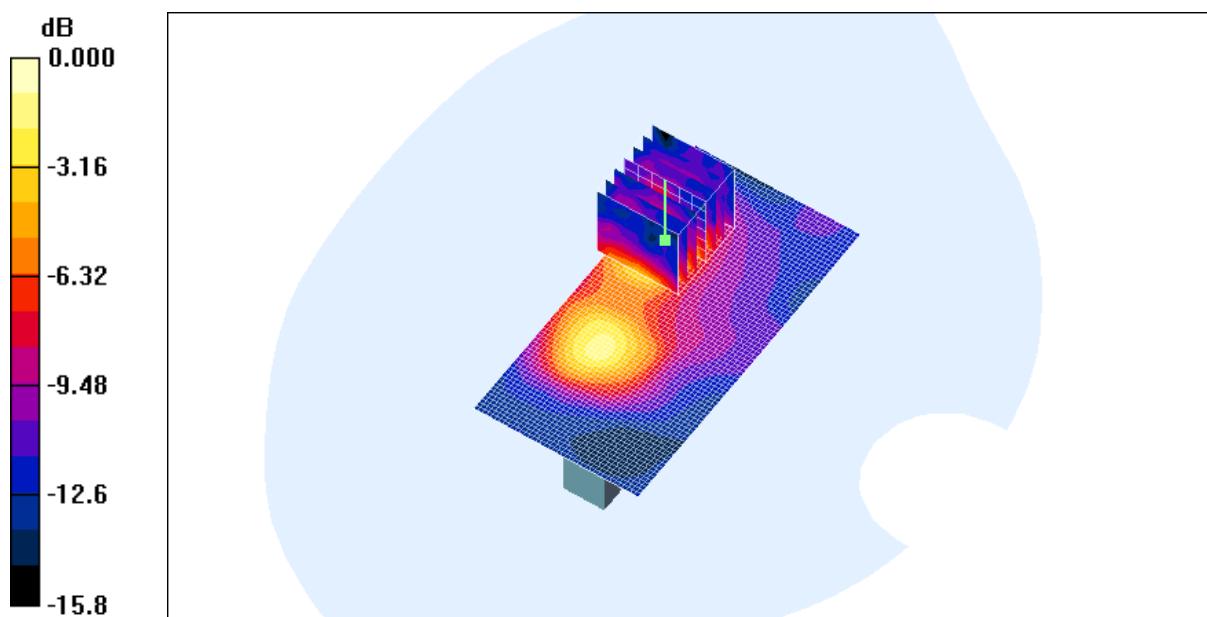
Low/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 2.07 V/m; Power Drift = -0.176 dB

Peak SAR (extrapolated) = 0.067 W/kg

SAR(1 g) = 0.037 mW/g; SAR(10 g) = 0.018 mW/g

Maximum value of SAR (measured) = 0.043 mW/g



0 dB = 0.043mW/g

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16.5.6 Bodyworn-TopSide-Middle

Date/Time: 2013-1-7 14:15:04

Test Laboratory: SGS-EMC

Bodyworn Front side Middle

DUT: StreamCast HD Transmitter; Type: MSP STRC USB XMT WW; Serial: ---

Communication System: CW; Frequency: 2438 MHz; Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: $f = 2438$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- 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 (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.447 mW/g

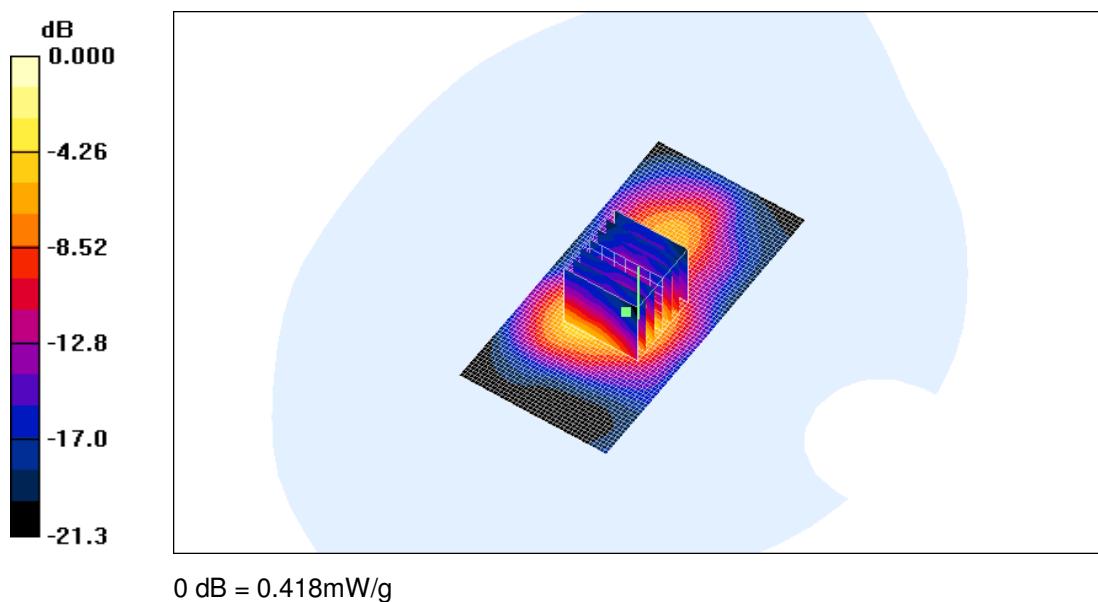
Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.6 V/m; Power Drift = -0.199 dB

Peak SAR (extrapolated) = 0.577 W/kg

SAR(1 g) = 0.328 mW/g; SAR(10 g) = 0.127 mW/g

Maximum value of SAR (measured) = 0.418 mW/g



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16.5.7 Bodyworn-TopSide-High

Date/Time: 2013-1-7 14:38:34

Test Laboratory: SGS-EMC

Bodyworn Top side High

DUT: StreamCast HD Transmitter; Type: MSP STRC USB XMT WW; Serial: ---

Communication System: CW; Frequency: 2464 MHz; Duty Cycle: 1:1

Medium: HSL2450-Body Medium parameters used: $f = 2464 \text{ MHz}$; $\sigma = 2.01 \text{ mho/m}$; $\epsilon_r = 51.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- 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 (41x81x1): **Measurement grid: dx=15mm, dy=15mm**

Maximum value of SAR (interpolated) = 0.389 mW/g

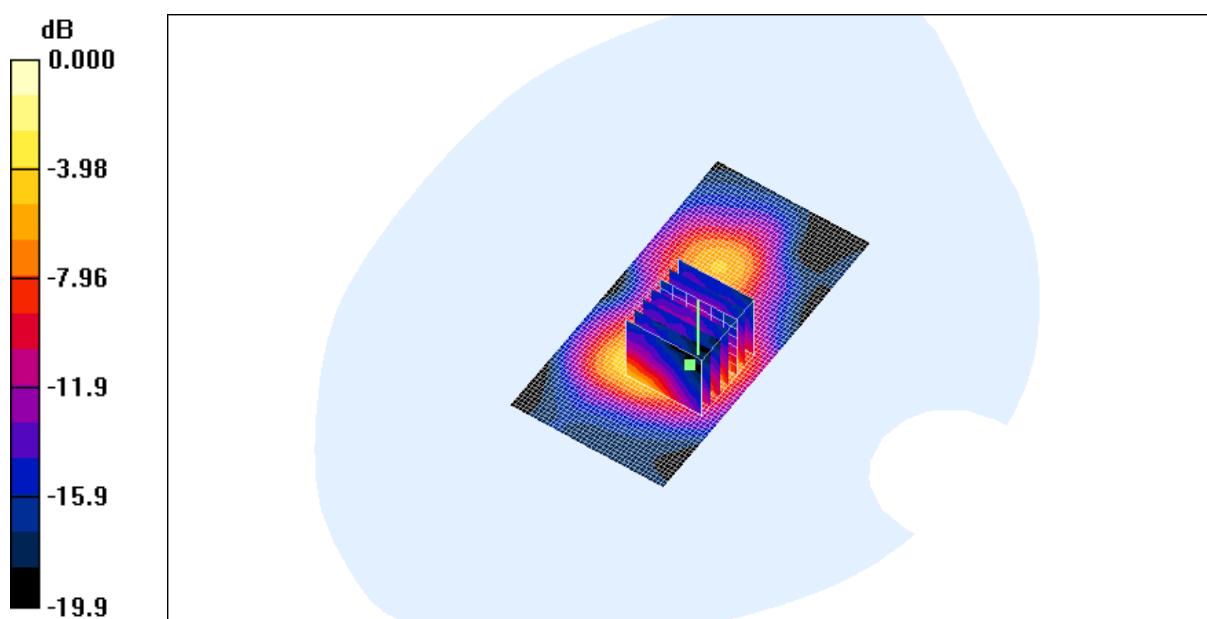
High/Zoom Scan (7x7x7)/Cube 0: **Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 6.21 V/m; Power Drift = -0.119 dB

Peak SAR (extrapolated) = 0.474 W/kg

SAR(1 g) = 0.296 mW/g; SAR(10 g) = 0.112 mW/g

Maximum value of SAR (measured) = 0.343 mW/g



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16. Product Information

Product Definition	StreamCast HD Transmitter	
Device Type	Portable	
Limit Type	General Population/Uncontrolled	
Product Name	StreamCast HD Transmitter	
Brand Name	Monster Products	
Marketing Name	MSP STRC USB XMT WW	
Model Name	MSP STRC USB XMT WW	
Battery Type	N/A	
	N/A	
Antenna Type	Inner antenna	
Frequency Bands	2.4GHz Band	Tx/Rx: 2.412~2.464GHz
	5.2GHz Band	Tx/Rx: 5.180~5.240GHz
	5.8GHz Band	Tx/Rx: 5.736~5.814GHz
Modulation Mode	QPSK	
Date of receipt	02-13, 2012	
Date of Testing Start	01-07, 2013	
Date of Testing End	01-07, 2013	

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17. Identification of Samples



Fig.17-1 Front Side of EUT



Fig.17-2 Back Side of EUT

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Annex A Photographs of Test Setup

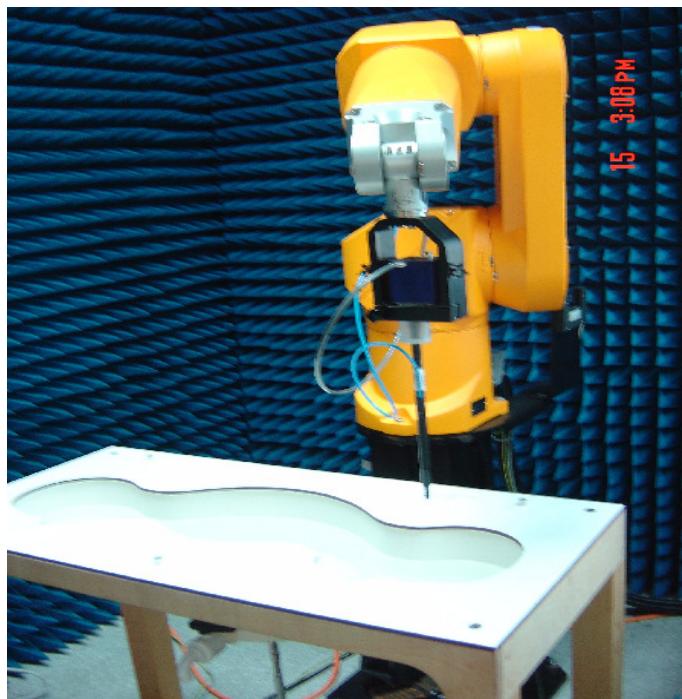


Fig.A-1 Photograph of the SAR measurement System

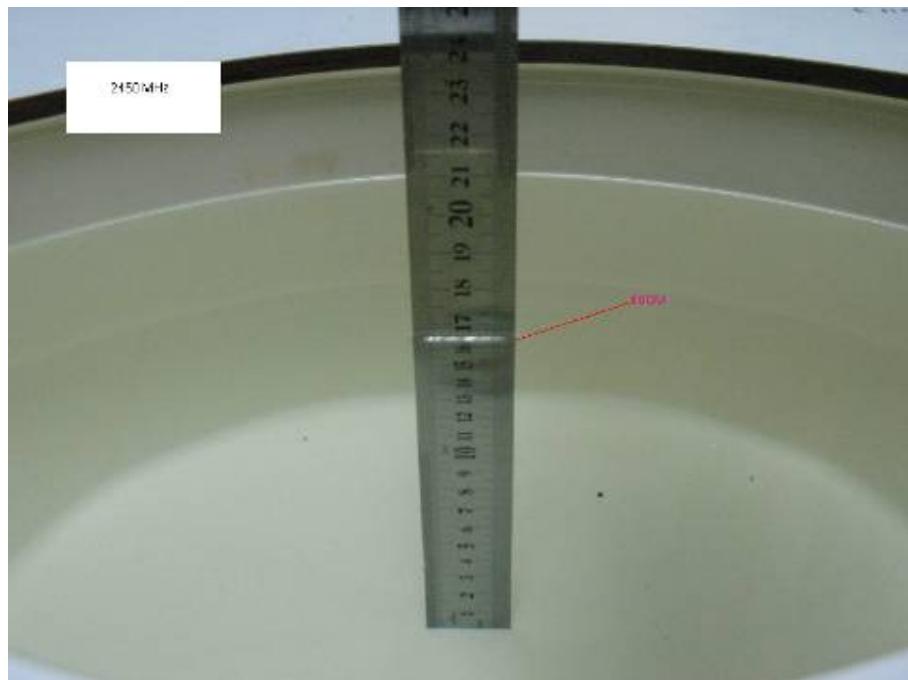


Fig.A-2 Photograph of the Tissue Simulant Liquid depth 15cm for Body Worn

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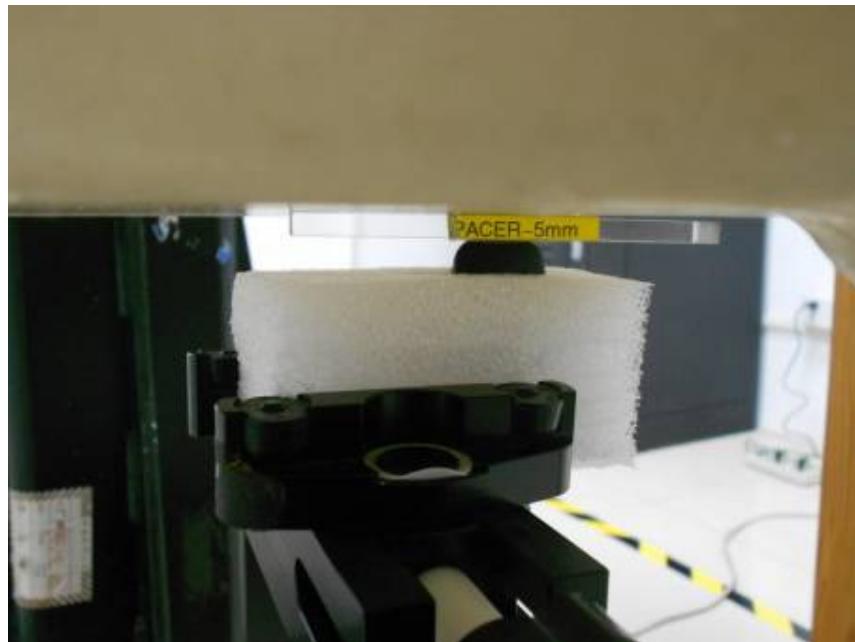


Fig.A-3a Photograph of the Top Side status



Fig.A-3b Photograph of the Front Side status

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Fig.A-3c Photograph of the Back Side status



Fig.A-3d Photograph of the Left Side status

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Fig.A-3e Photograph of the Right Side status

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Annex B Tissue Simulant Liquid

Annex B.1 Recipes for Tissue Simulant Liquid

The following 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 M + resistivity				HEC: Hydroxyethyl Cellulose				
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]								

Table B-1 Recipe of Tissue Simulant 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	$52.7\pm5\%$ (50.07~55.34)	$1.95\pm5\%$ (1.85~2.05)	22 ± 2
		Measured, 01-07,2013	51.3	2.01	

Table B-2 Measurement result of Tissue electric parameters

Frequency (MHz)	Measured Data	Measured Value		Target Value		Deviation	
		ϵ_r	σ [s/m]	ϵ_r	σ [s/m]	ϵ_r (%)	σ (%)
2412	01-07-2013	51.60	1.96	52.7	1.95	2.09	0.51
2438	01-07-2013	51.40	1.99	52.7	1.95	2.47	2.05
2464	01-07-2013	51.10	2.01	52.7	1.95	3.04	3.08

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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.

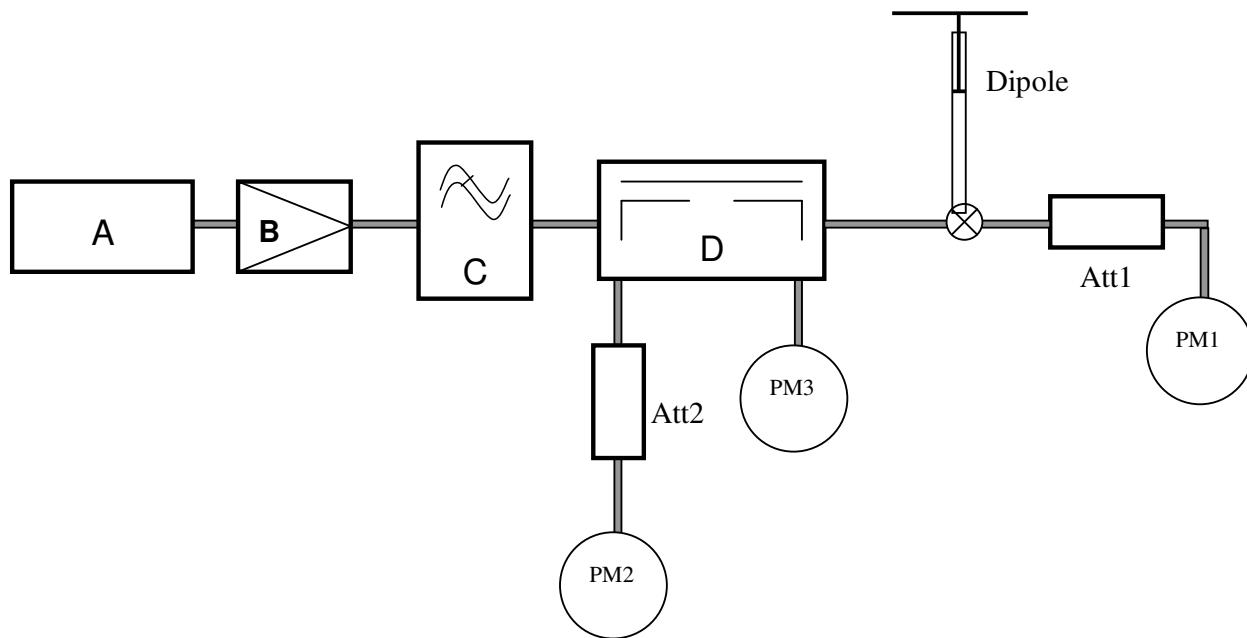


Fig. C-1 the microwave circuit arrangement used for SAR system verification

- 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

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Validation Kit	Frequency (MHz)	Tissue Type	Limit/Measurement		
			Condition	Recommended/Measured	1g
D2450V2	2450	Body	Calibration data		13.1
			Nomalized to 1W(for nominal Body TSL parameters)	Recommended Limit	52.4±10% (47.16-57.64)
			Nomalized to 1W(for nominal Body TSL parameters)	-	48.4
			250mW input power	Measured, 01-07, 2013	12.1

Table C-1 SAR System Validation Result

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System Performance Check at 2450MHzBody

Date/Time: 2013-1-7 9:04:40

Test Laboratory: SGS-EMC

System Performance Check at 2450MHzBody

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; $\sigma = 2.01$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3088; ConvF(4.20, 4.20, 4.20); Calibrated: 2012-11-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2012-11-27
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- 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) = 15.5 mW/g

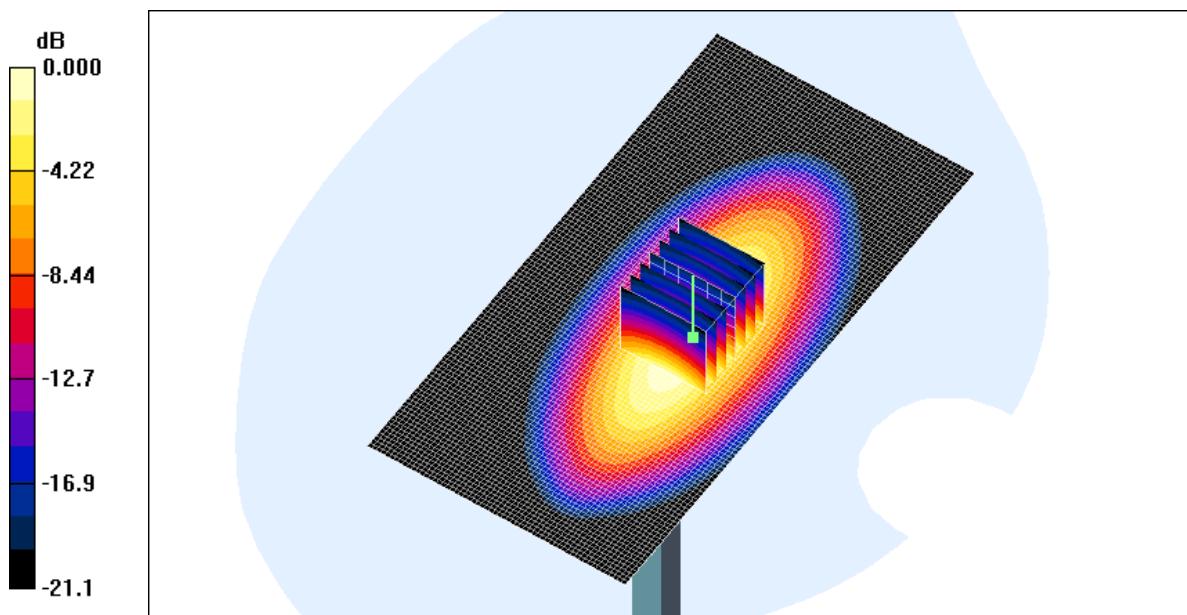
d=10mm, Pin=250mW /Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 83.8 V/m; Power Drift = -0.017 dB

Peak SAR (extrapolated) = 23.8W/kg

SAR(1 g) = 12.1 mW/g; SAR(10 g) = 5.71 mW/g

Maximum value of SAR (measured) = 14.3 mW/g



0 dB = 14.3mW/g

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Annex D Calibration certificate**Annex D.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 **SGS-SZ (Auden)**

Certificate No: **ES3-3088_Nov12/2**

CALIBRATION CERTIFICATE (Replacement of No:ES3-3088_Nov12)

Object **ES3DV3 - SN:3088**

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

Calibration date: **November 26, 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	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: December 18, 2012

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

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



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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3088

Manufactured: July 20, 2005
Calibrated: November 26, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3088**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.30	1.27	1.20	$\pm 10.1\%$
DCP (mV) ^B	97.5	95.4	94.8	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^C (k=2)
0	CW	0.00	X	0.0	0.0	1.0	112.5	$\pm 3.5\%$
			Y	0.0	0.0	1.0	108.8	
			Z	0.0	0.0	1.0	139.7	

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

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^C 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:3088**Calibration Parameter Determined in Head Tissue Simulating Media**

f (MHz) ^c	Relative Permittivity ^b	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	6.44	6.44	6.44	0.14	1.10	± 13.4 %
850	41.5	0.92	6.25	6.25	6.25	0.16	2.87	± 12.0 %
1810	40.0	1.40	5.12	5.12	5.12	0.61	1.30	± 12.0 %
1900	40.0	1.40	5.01	5.01	5.01	0.54	1.42	± 12.0 %
2000	40.0	1.40	4.93	4.93	4.93	0.52	1.45	± 12.0 %
2450	39.2	1.80	4.24	4.24	4.24	0.67	1.45	± 12.0 %
2600	39.0	1.96	4.03	4.03	4.03	0.64	1.57	± 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.

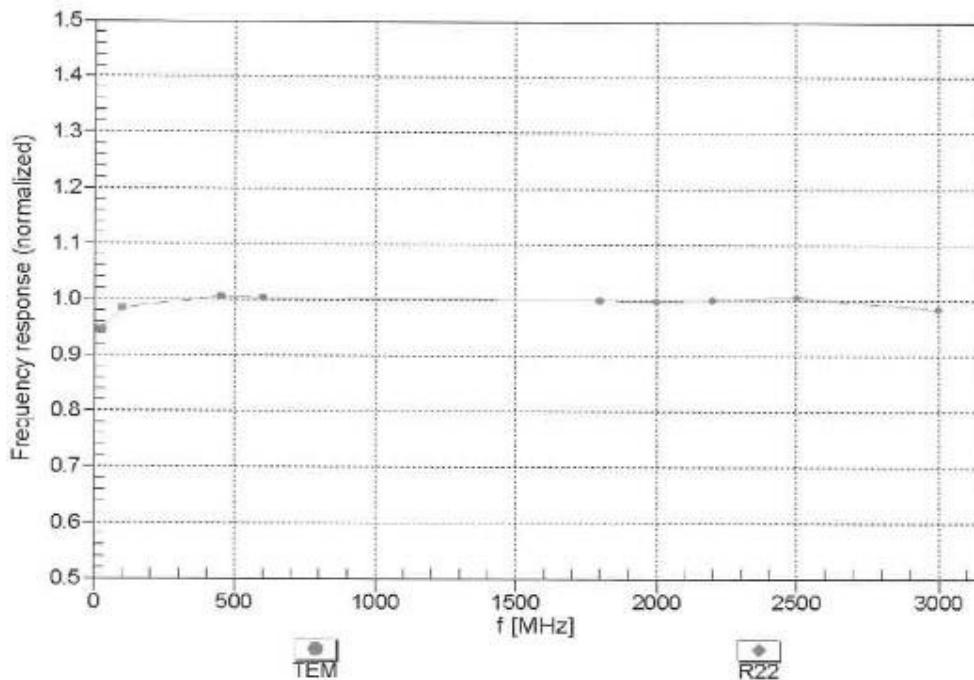
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3088**Calibration Parameter Determined in Body Tissue Simulating Media**

f (MHz) ^C	Relative Permittivity ^E	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	6.76	6.76	6.76	0.09	1.10	± 13.4 %
850	55.2	0.99	6.02	6.02	6.02	0.28	1.83	± 12.0 %
1900	53.3	1.52	4.91	4.91	4.91	0.40	1.81	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.63	1.45	± 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.

^E At frequencies below 3 GHz, the validity of tissue parameters (ϵ and α) 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 α) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

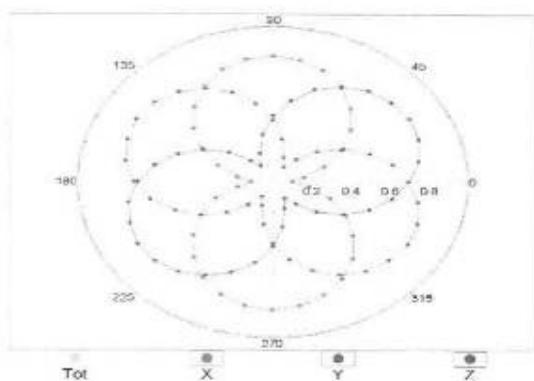
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



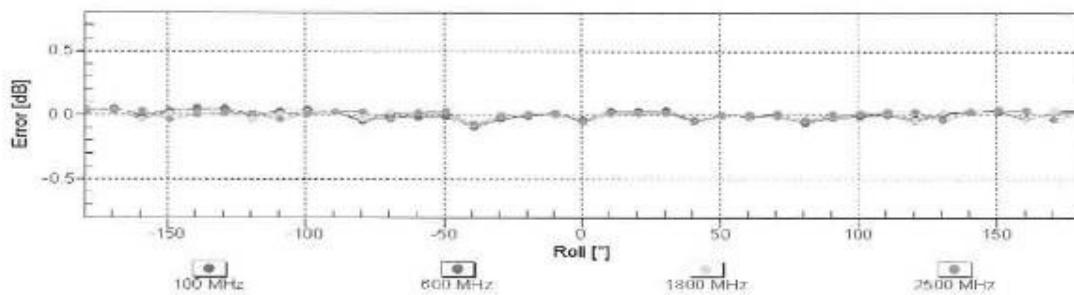
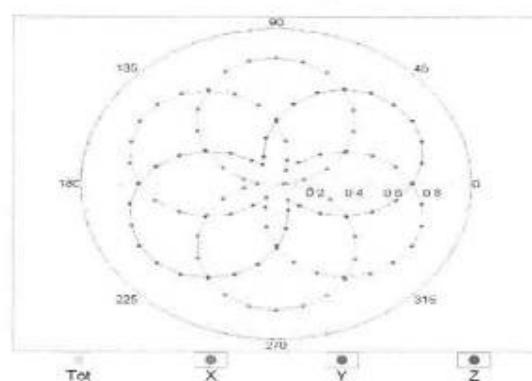
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

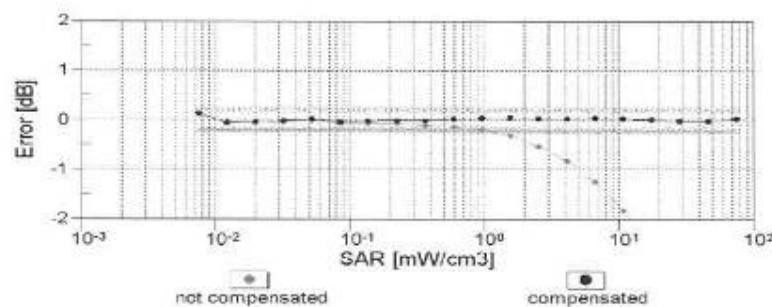
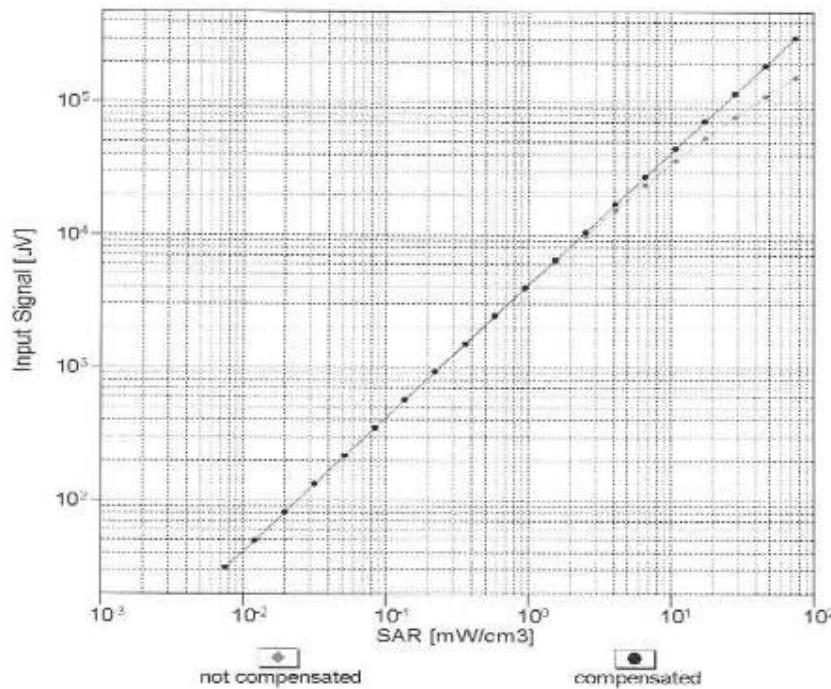
f=600 MHz, TEM



f=1800 MHz, R22

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

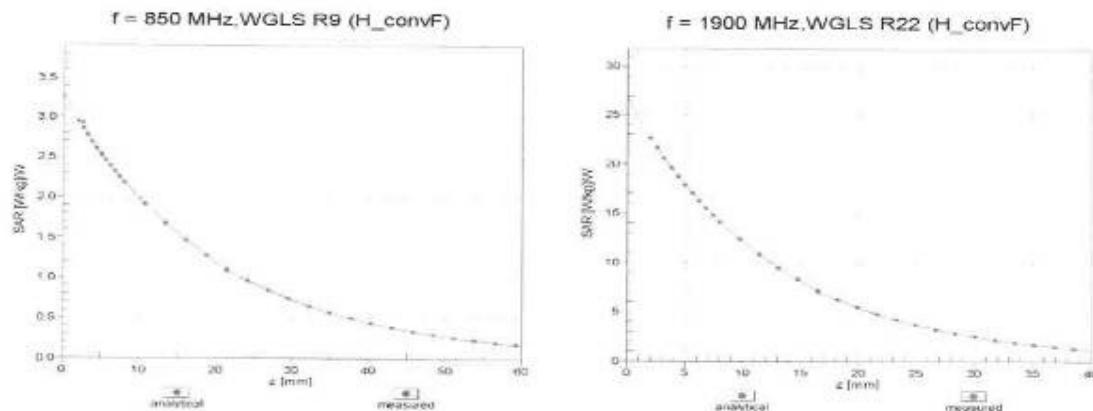
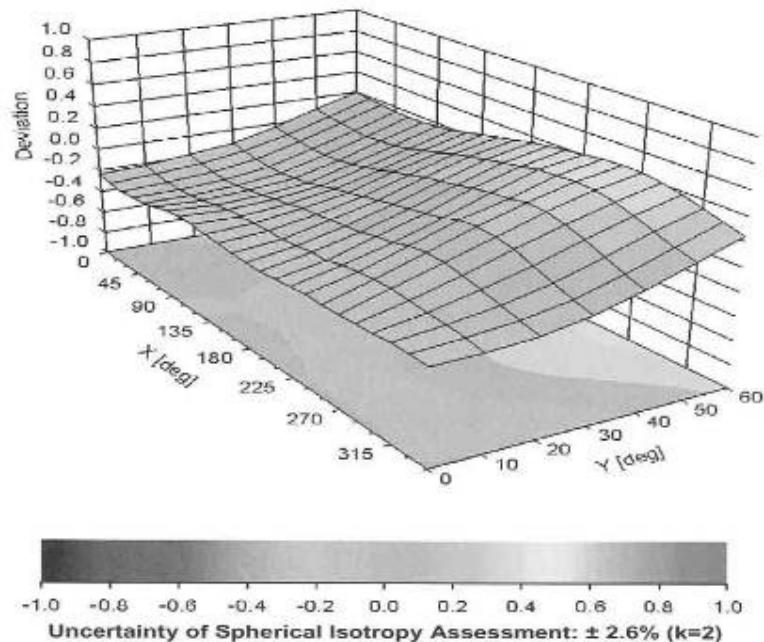
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)



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

ES3DV3- SN:3088

November 26, 2012

Conversion Factor Assessment**Deviation from Isotropy in Liquid**
Error (ϕ, θ), $f = 900$ MHz

Certificate No: ES3-3088_Nov12/2

Page 10 of 11

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

Sensor Arrangement	Triangular
Connector Angle (°)	-39.2
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

Annex D.2 DAE Calibration certification

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

IMPORTANT NOTICE

USAGE OF THE DAE 3

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 DAE3 unit is connected to a fragile 3-pin battery connector. Customer is responsible to apply outmost caution not to bend or damage the connector when changing batteries.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration the customer shall 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 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 Estop failure, 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 MΩ 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_BR03091211BD DAE3.doc

11.12.2009

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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 108

Client SGS-SZ (Auden)

Certificate No: DAE3-569_Nov12/2

CALIBRATION CERTIFICATE(Replacement of No: DAE3-569_Nov12)

Object DAE3 - SD 000 D03 AA - SN: 569

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

Calibration date: November 27, 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	02-Oct-12 (No:12728)	Oct-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V2.1	SE UWS 053 AA 1001	05-Jan-12 (in house check)	In house check: Jan-13

Calibrated by: Name: Dominique Steffen Function: Technician Signature:

Approved by: Fin Bomholt Function: R&D Director Signature:

Issued: December 18, 2012

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Certificate No: DAE3-569_Nov12/2

Page 1 of 5

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

No. 588, West Jindu Road, Shanghai, China 201612
中国•上海•松江区金都西路588号 邮编: 201612

t (86-21) 61915664 f (86-21) 61915678 www.cn.sgs.com
t (86-21) 61915664 f (86-21) 61915678 ee.shanghai@sgs.com

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



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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 = $6.1\mu\text{V}$, full range = $-100...+300\text{ mV}$
Low Range: 1LSB = 61nV , full range = $-1.....+3\text{mV}$

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

Calibration Factors	X	Y	Z
High Range	$402.968 \pm 0.1\% (\text{k}=2)$	$403.372 \pm 0.1\% (\text{k}=2)$	$403.548 \pm 0.1\% (\text{k}=2)$
Low Range	$3.94054 \pm 0.7\% (\text{k}=2)$	$3.95468 \pm 0.7\% (\text{k}=2)$	$3.94242 \pm 0.7\% (\text{k}=2)$

Connector Angle

Connector Angle to be used in DASY system	$263^\circ \pm 1^\circ$
---	-------------------------

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199993.76	-1.98	-0.00
Channel X	+ Input	19997.53	-2.30	-0.01
Channel X	- Input	-19999.17	2.28	-0.01
Channel Y	+ Input	199992.48	-3.57	-0.00
Channel Y	+ Input	20001.24	1.40	0.01
Channel Y	- Input	-19999.39	2.08	-0.01
Channel Z	+ Input	199990.99	-4.72	-0.00
Channel Z	+ Input	19999.07	-0.69	-0.00
Channel Z	- Input	-20000.76	0.87	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	1999.94	-0.18	-0.01
Channel X	+ Input	201.11	0.49	0.24
Channel X	- Input	-200.76	-1.41	0.71
Channel Y	+ Input	1999.36	-0.88	-0.04
Channel Y	+ Input	200.05	-0.59	-0.29
Channel Y	- Input	-199.85	-0.58	0.29
Channel Z	+ Input	2000.62	0.35	0.02
Channel Z	+ Input	198.90	-1.67	-0.83
Channel Z	- Input	-200.58	-1.29	0.65

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	-1.02	-2.35
	-200	3.10	1.32
Channel Y	200	4.92	4.59
	-200	-6.46	-6.42
Channel Z	200	-14.23	-14.62
	-200	12.06	11.62

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	-	2.47	-1.64
Channel Y	200	9.66	-	3.82
Channel Z	200	6.38	7.97	-

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	16193	16677
Channel Y	16547	16761
Channel Z	15792	16956

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	0.46	-1.51	2.07	0.68
Channel Y	-0.16	-1.86	1.29	0.63
Channel Z	-1.14	-2.59	0.30	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 D.3 Dipole Calibration certification
D2450V2

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Accreditation No.: SCS 108

Client **SGS-SZ (Auden)**

Certificate No: **D2450V2-733_Nov12/2**

CALIBRATION CERTIFICATE (Replacement of No:D2450V2-733_Nov12)

Object **D2450V2 - SN: 733**

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

Calibration date: **November 26, 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292763	01-Nov-12 (No. 217-01640)	Oct-13
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	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
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 54206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by:	Name Israe El-Naouq	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 18, 2012

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Certificate No: **D2450V2-733_Nov12/2**

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.3
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	38.7 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.4 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg ± 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	51.2 ± 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	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.3 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.1 W/kg ± 16.5 % (k=2)

Appendix**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	53.7 Ω + 1.7 $j\Omega$
Return Loss	- 28.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.1 Ω + 3.9 $j\Omega$
Return Loss	- 28.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 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: 26.11.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- ProbC: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

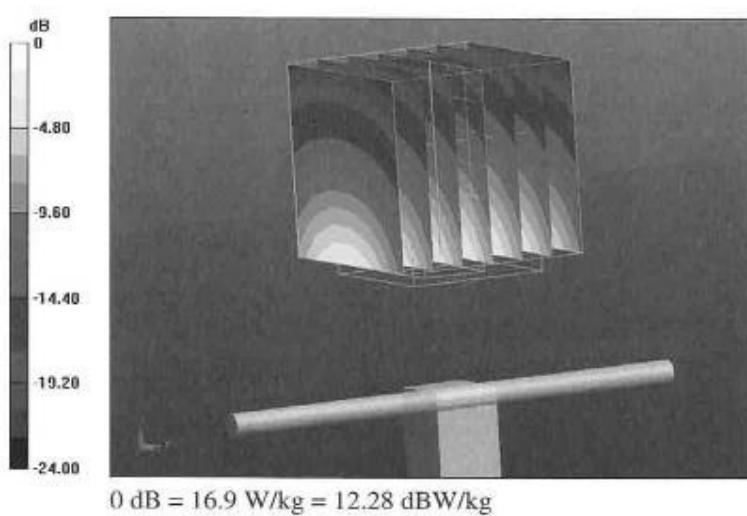
Measurement grid: dx=5mm, dy=5mm, dz=5mm

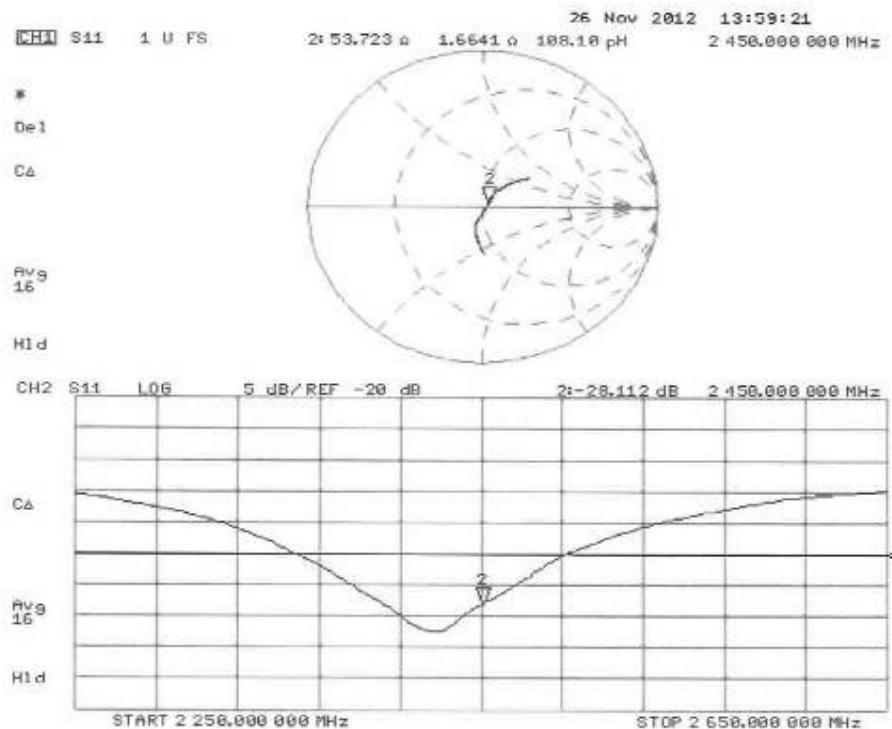
Reference Value = 98.958 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.16 W/kg

Maximum value of SAR (measured) = 16.9 W/kg



Impedance Measurement Plot for Head TSL

DASY5 Validation Report for Body TSL

Date: 26.11.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.01$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

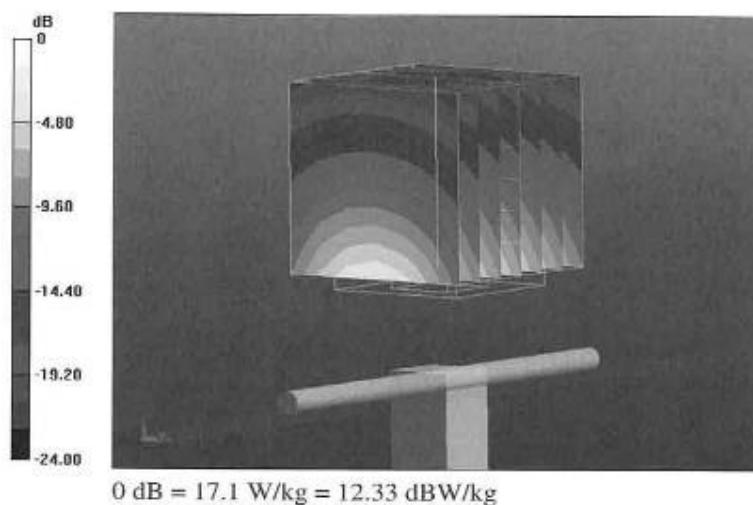
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.578 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.09 W/kg

Maximum value of SAR (measured) = 17.1 W/kg



Impedance Measurement Plot for Body TSL