

SAR Test Report

(Class II Permissive Change)

Product Name : HSPA Module

Model No. : EM770W

Applicant : HUAWEI TECHNOLOGIES CO. LTD.

Address : Bantian, Longgang District Shenzhen, China

Date of Receipt : 2009/12/24

Issued Date : 2010/08/11

Report No. : 107223R-HPUSP10V01

Report Version : V1.0

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Quie Tek Corporation.

Test Report Certification

Issued Date: 2010/08/11

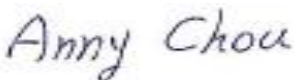
Report No.:107223R-HPUSP10V01

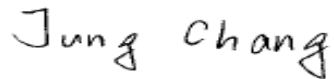


Product Name : HSPA Module
 Applicant : HUAWEI TECHNOLOGIES CO. LTD.
 Address : Bantian, Longgang District Shenzhen, China
 Manufacturer : HUAWEI TECHNOLOGIES CO. LTD.
 Trade Name : HUAWEI
 FCC ID : QISEM770W
 Model No. : EM770W
 Applicable Standard : FCC Oet65 Supplement C June 2001
 : IEEE Std. 1528-2003
 : 47CFR § 2.1093
 Test Result : Max. SAR Measurement (1g)
 : GSM 850MHz: **0.056** W/kg
 : PCS 1900MHz: **0.118** W/kg
 : WCDMA Band V: **0.036** W/kg
 : WCDMA Band II: **0.264** W/kg

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Quie Tek Corporation.

Documented By : 
 (Adm.Assistant / Anny Chou)

Tested By : 
 (Engineer / Jung Chang)

Approved By : 
 (Manager / Vincent Lin)

TABLE OF CONTENTS

Description	Page
1. General Information.....	5
1.1 EUT Description	5
1.2 Test Environment	7
2. SAR Measurement System	8
2.1 DASY5 System Description	8
2.1.1 Applications	9
2.1.2 Area Scans.....	9
2.1.3 Zoom Scan (Cube Scan Averaging).....	9
2.1.4 Uncertainty of Inter-/Extrapolation and Averaging.....	9
2.2 DASY5 E-Field Probe	10
2.2.1 Isotropic E-Field Probe Specification	10
2.3 Boundary Detection Unit and Probe Mounting Device	11
2.4 DATA Acquisition Electronics (DAE) and Measurement Server	11
2.5 Robot.....	12
2.6 Light Beam Unit.....	12
2.7 Device Holder	13
2.8 SAM Twin Phantom	13
3. Tissue Simulating Liquid	14
3.1 The composition of the tissue simulating liquid	14
3.2 Tissue Calibration Result	14
3.3 Tissue Dielectric Parameters for Head and Body Phantoms	16
4. SAR Measurement Procedure	17
4.1 SAR System Validation.....	17
4.1.1 Validation Dipoles.....	17
4.1.2 Validation Result	17
4.2 Arrangement Assessment Setup	18
5. SAR Exposure Limits	19
6. Test Equipment List.....	20
7. Measurement Uncertainty	21
8. Conducted Power Measurement	22
9. Test Results.....	29
9.1 SAR Test Results Summary	29
Appendix.....	33
Appendix A. SAR System Validation Data	

Appendix B. SAR measurement Data

Appendix C. Test Setup Photographs & EUT Photographs

Appendix D. Probe Calibration Data

Appendix E. Dipole Calibration Data

1. General Information

1.1 EUT Description

Product Name	HSPA Module
Model No.	EM770W
FCC ID	QISEM770W
TX Frequency	824MHz~849MHz(GSM 850/WCDMA Band V) 1850MHz ~1910MHz(PCS 1900/WCDMA Band II)
RX Frequency	824MHz~849MHz(GSM 850/WCDMA Band V) 1850MHz ~1910MHz(PCS 1900/WCDMA Band II)
Antenna Type	Coupling
Device Category	Portable
RF Exposure Environment	Uncontrolled
Max. Output Power (Conducted)	GSM 850: 32.39dBm PCS 1900: 29.21dBm WCDMA V: 23.87dBm WCDMA II: 22.27dBm

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	Yageo	CAN43139LWPE00402 CAN43139LWPE00403	PIFA	0.31 dBi for 850 Band 1.76 dBi for 1900 Band
2	WNC	81.EK815.G01 81.EK815.G02	PIFA	-0.95 dBi for 850 Band -0.12 dBi for 1900 Band

Note: 1. Only the higher gain antenna Ant 1 was tested and recorded in this report.

2. This is to request a Class II permissive change for **FCC ID: QISEM770W**, originally granted on **01/23/2009**.

The major change filed under this application is:

Change #1: Additional Chassis added

Model number: SMARTBOOK

Model name: EFIKA MX (or Notebook PC)

Change #2: Additional new antenna which are list in above.

The new antenna gain are below originally granted antenna gain.

(The device have co-located with WLAN card, but non-simultaneously transmit.)

3. Per 5 b) iii 3.KDB 178919 D01 Permissive Change Policy v04r04, the highest SAR measured for that antenna type in previous certification(s) is less than 0.8 W/kg,

SAR evaluation is not required to add an equivalent antenna.

4. The BT's power is less than 60/f; it's not required to do SAR evaluation testing.

1.2 Test Environment

Ambient conditions in the laboratory: GSM 850 & WCDMA Band V

Items	Required	Actual
Temperature (°C)	18-25	21.8
Humidity (%RH)	30-70	53

Ambient conditions in the laboratory: PCS 1900 & WCDMA Band II

Items	Required	Actual
Temperature (°C)	18-25	22.4
Humidity (%RH)	30-70	52

Site Description:

Accredited by TAF
Accredited Number: 0914
Effective through: December 12, 2011

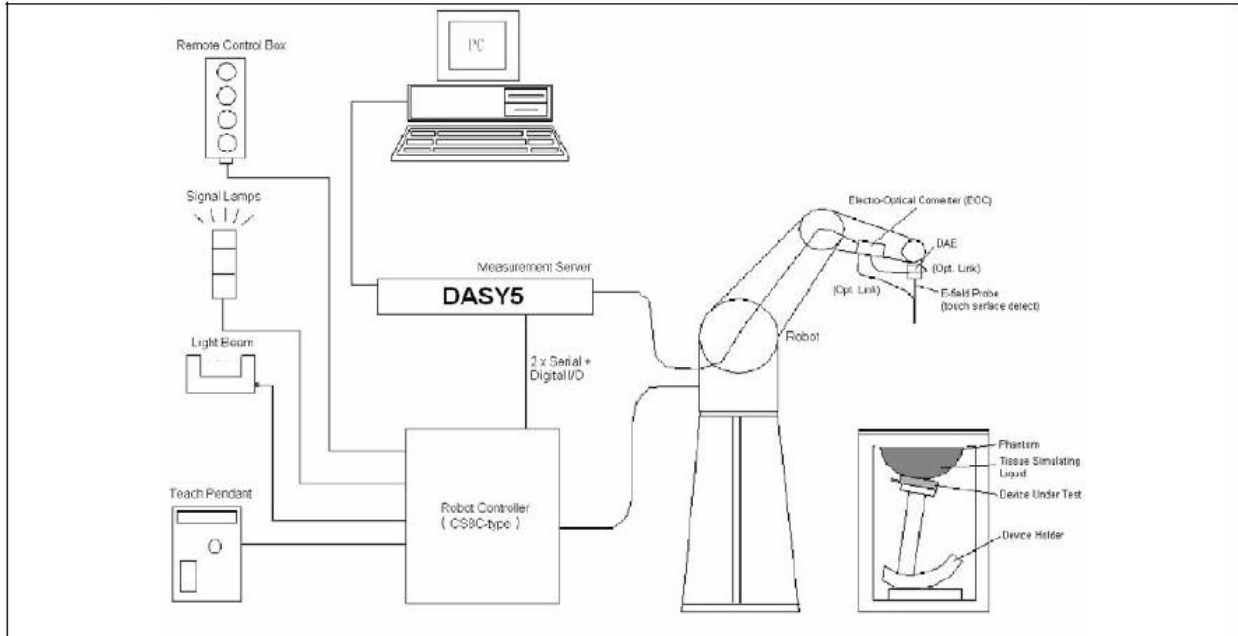


Site Name: Quietek Corporation

Site Address: No. 5-22, Ruei-Shu Valley, Ruei-Ping Tsuen,
Lin-Kou Shiang, Taipei,
Taiwan, R.O.C.
TEL: 886-2-8601-3788 / FAX: 886-2-8601-3789
E-Mail: service@quietek.com

2. SAR Measurement System

2.1 DASY5 System Description



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

- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

2.1.1 Applications

Predefined procedures and evaluations for automated compliance testing with all worldwide standards, e.g., IEEE 1528, OET 65, IEC 62209-1, IEC 62209-2, EN 50360, EN 50383 and others.

2.1.2 Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm^2 step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan).

2.1.3 Zoom Scan (Cube Scan Averaging)

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m^3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm, with the side length of the 10 g cube 21,5mm.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of $5\text{mm} \times 5\text{mm} \times 7\text{mm}$ ($8\text{mm} \times 8\text{mm} \times 5\text{mm}$) providing a volume of 32mm^3 in the X & Y axis, and 30mm^3 in the Z axis.

2.1.4 Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Postprocessor, DASY5 allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528. The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested handsets. The field gradients are covered by the spatially flat

distribution f_1 , the spatially steep distribution f_3 and f_2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x, y, z) = Ae^{-\frac{z}{2a}} \cos^2 \left(\frac{\pi}{2} \frac{\sqrt{x'^2 + y'^2}}{5a} \right)$$

$$f_2(x, y, z) = Ae^{-\frac{z}{a}} \frac{a^2}{a^2 + x'^2} \left(3 - e^{-\frac{2z}{a}} \right) \cos^2 \left(\frac{\pi}{2} \frac{y'}{3a} \right)$$

$$f_3(x, y, z) = A \frac{a^2}{\frac{a^2}{4} + x'^2 + y'^2} \left(e^{-\frac{2z}{a}} + \frac{a^2}{2(a + 2z)^2} \right)$$

2.2 DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG.

The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO 17025. The calibration data are in Appendix D.

2.2.1 Isotropic E-Field Probe Specification

Model	Ex3DV4	
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 μ W/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

2.3 Boundary Detection Unit and Probe Mounting Device

The DASY probes use a precise connector and an additional holder for the probe, consisting of a plastic tube and a flexible silicon ring to center the probe. The connector at the DAE is flexibly mounted and held in the default position with magnets and springs. Two switching systems in the connector mount detect frontal and lateral probe collisions and trigger the necessary software response.



2.4 DATA Acquisition Electronics (DAE) and Measurement Server

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit.

Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with the DAE electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.



2.5 Robot

The DASY5 system uses the high precision robots TX90 XL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used.

The XL robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller



2.6 Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.

The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.



2.7 Device Holder

The DASY5 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 center for both scales is the ear reference point (EPR).

Thus the device needs no repositioning when changing the angles.

The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon_r = 3$ and loss tangent $\delta = 0.02$. 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.



2.8 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 head
- Right head
- Flat phantom



The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

3. Tissue Simulating Liquid

3.1 The composition of the tissue simulating liquid

INGREDIENT (% Weight)	835MHz Head	835MHz Body	1900MHz Head	1900MHz Body
Water	40.45	52.4	54.90	40.5
Salt	1.45	1.40	0.18	0.50
Sugar	57.6	45.0	0.00	58.0
HEC	0.40	1.00	0.00	0.50
Preventol	0.10	0.20	0.00	0.50
DGBE	0.00	0.00	44.92	0.00

3.2 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using APREL Dielectric Probe Kit and Anritsu MS4623B Vector Network Analyzer.

Head Tissue Simulant Measurement

Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [S/m]	
835 MHz	Reference result $\pm 5\%$ window	42.54 40.413 to 44.667	0.91 0.8645 to 0.9555	N/A
	31-Dec-09	42.97	0.93	20.9

Body Tissue Simulant Measurement

Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [S/m]	
835 MHz	Reference result $\pm 5\%$ window	55.2 52.44 to 57.96	0.97 0.9215 to 1.0185	N/A
	31-Dec-09	54.12	0.98	20.9
824 MHz	Low channel	56.38	0.93	20.9
836 MHz	Mid channel	55.49	0.95	20.9
848 MHz	High channel	56.21	0.99	20.9

Head Tissue Simulant Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [S/m]	
1900 MHz	Reference result ± 5% window	39.9 37.905 to 41.895	1.42 1.349 to 1.491	N/A
	04-Jan-10	40.23	1.38	21.6

Body Tissue Simulant Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [S/m]	
1900 MHz	Reference result ± 5% window	53.3 50.635 to 55.965	1.52 1.444 to 1.596	N/A
	04-Jan-10	52.91	1.52	21.6
1850 MHz	Low channel	54.12	1.48	21.6
1880 MHz	Mid channel	53.88	1.51	21.6
1910 MHz	High channel	54.37	1.53	21.6

3.3 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

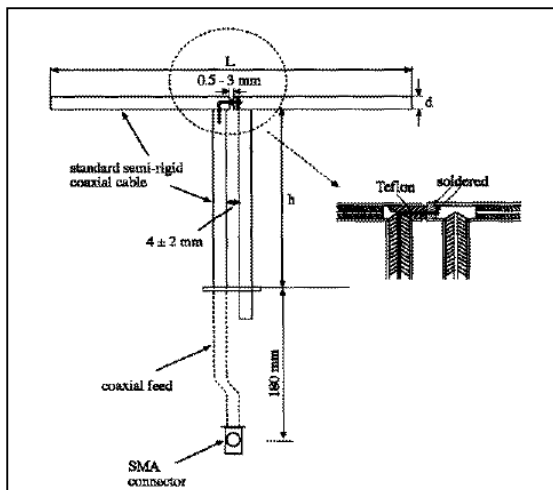
Target Frequency	Head		Body	
(MHz)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ϵ_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m³)

4. SAR Measurement Procedure

4.1 SAR System Validation

4.1.1 Validation Dipoles



The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE and FCC Supplement C. the table below provides details for the mechanical and electrical specifications for the dipoles.

Frequency	L (mm)	h (mm)	d (mm)
835MHz	165.0	900	3.6
1900MHz	68.0	39.5	3.6

4.1.2 Validation Result

System Performance Check at 835MHz &1900MHz

Validation Kit: ASL-D-835-S-2

Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
835 MHz	Reference result ± 10% window	9.33 8.397 to 10.263	6.42 5.778 to 7.062	N/A
	31-Dec-09	9.68	6.28	20.9

Validation Kit: ASL-D-1900-S-2

Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
1900 MHz	Reference result ± 10% window	36 32.4 to 39.6	20.78 18.702 to 22.858	N/A
	04-Jan-10	36.88	19.92	21.6

Note: All SAR values are normalized to 1W forward power.

4.2 Arrangement Assessment Setup

The ALSAS-10U calculates SAR using the following equation,

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

σ : represents the simulated tissue conductivity

ρ : represents the tissue density

The EUT is set to transmit at the required power in line with product specification, at each frequency relating to the LOW, MID, and HIGH channel settings.

Pre-scans are made on the device to establish the location for the transmitting antenna, using a large area scan in either air or tissue simulation fluid.

The EUT is placed against the Universal Phantom where the maximum area scan dimensions are larger than the physical size of the resonating antenna. When the scan size is not large enough to cover the peak SAR distribution, it is modified by either extending the area scan size in both the X and Y directions, or the device is shifted within the predefined area.

The area scan is then run to establish the peak SAR location (interpolated resolution set at 1mm²) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at 1mm³).

5. SAR Exposure Limits

SAR assessments have been made in line with the requirements of IEEE-1528, FCC Supplement C, and comply with ANSI/IEEE C95.1-1992 “Uncontrolled Environments” limits. These limits apply to a location which is deemed as “Uncontrolled Environment” which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

Limits for General Population/Uncontrolled Exposure (W/kg)

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60 W/kg
Spatial Average SAR (whole body)	0.08 W/kg
Spatial Peak SAR (10g for hands, feet, ankles and wrist)	4.00 W/kg

6. Test Equipment List

Instrument	Manufacturer	Model No.	Serial No.	Last Calibration	Next Calibration
Stäubli Robot TX60L	Stäubli	TX60L	F09/5BL1A1/A06	May. 2009	only once
Controller	Speag	CS8c	N/A	May. 2009	only once
Aprel Reference Dipole 835Mhz	Aprel	ALS-D-835-S-2	QTK-315	May. 2010	May. 2012
Aprel Reference Dipole 1900Mhz	Aprel	ALS-D-1900-S-2	QTK-318	May. 2010	May. 2012
SAM Twin Phantom	Speag	QD000 P40 CA	Tp 1515	N/A	N/A
Device Holder	Speag	N/A	N/A	N/A	N/A
Data Acquisition Electronic	Speag	DAE4	1204	Apr. 2010	Apr. 2011
E-Field Probe	Speag	EX3DV4	3602	May. 2009	May. 2010
SAR Software	Speag	DASY5	V5.0 Build 125	N/A	N/A
Aprel Dipole Spaccer	Aprel	ALS-DS-U	QTK-295	N/A	N/A
Power Amplifier	Mini-Circuit	ZHL-42	D051404-20	N/A	N/A
Directional Coupler	Agilent	778D-012	50550	N/A	N/A
Universal Radio Communication Tester	R&S	CMU 200	104846	May. 2010	May. 2011
Vector Network	Anritsu	MS4623B	992801	Aug. 2009	Aug. 2010
Signal Generator	Anritsu	MG3692A	042319	Jun. 2010	Jun. 2011
Power Meter	Anritsu	ML2487A	6K00001447	Apr. 2010	Apr. 2011
Wide Bandwidth Sensor	Anritsu	MA2491	030677	Apr. 2010	Apr. 2011

7. Measurement Uncertainty

Uncertainty								
Error Description	Uncertainty value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±5.9 %	N	1	1	1	±5.9 %	±5.9 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.4 %	R	$\sqrt{3}$	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Max. SAR Eval.	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Liquid Conductivity (target)	±5.0 %	R	$\sqrt{3}$	0.64	0.43	±1.8 %	±1.2 %	∞
Liquid Conductivity (meas.)	±2.5 %	N	1	0.64	0.43	±1.6 %	±1.1 %	∞
Liquid Permittivity (target)	±5.0 %	R	$\sqrt{3}$	0.6	0.49	±1.7 %	±1.4 %	∞
Liquid Permittivity (meas.)	±2.5 %	N	1	0.6	0.49	±1.5 %	±1.2 %	∞
Combined Std. Uncertainty						±10.9 %	±10.7 %	387
Expanded STD Uncertainty						±21.9 %	±21.4 %	

8. Conducted Power Measurement

Maximum Power-GPRS 850(↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	31.71	0.4	32.11	1.63
836.4	31.99	0.4	32.39	1.73
848.8	31.47	0.4	31.87	1.54

Maximum Power-GPRS 850(↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	29.47	0.4	29.87	0.97
836.4	29.36	0.4	29.76	0.95
848.8	29.17	0.4	29.57	0.91

Maximum Power-GPRS 850(↑ ↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	27.39	0.4	27.79	0.60
836.4	27.26	0.4	27.66	0.58
848.8	27.11	0.4	27.51	0.56

Maximum Power-GPRS 850(↑ ↑ ↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	25.32	0.4	25.72	0.37
836.4	25.22	0.4	25.62	0.36
848.8	25.08	0.4	25.48	0.35

Maximum Power-EGPRS 850(↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	25.52	0.4	25.92	0.39
836.4	24.63	0.4	25.03	0.32
848.8	24.77	0.4	25.17	0.33

Maximum Power-EGPRS 850(↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	23.49	0.4	23.89	0.24
836.4	23.39	0.4	23.79	0.24
848.8	23.24	0.4	23.64	0.23

Maximum Power-EGPRS 850(↑ ↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	21.59	0.4	21.99	0.16
836.4	21.49	0.4	21.89	0.15
848.8	21.31	0.4	21.71	0.15

Maximum Power-EGPRS 850(↑ ↑ ↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
824.2	19.48	0.4	19.88	0.10
836.4	19.40	0.4	19.80	0.10
848.8	19.23	0.4	19.63	0.09

Maximum Power-GPRS 1900(↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	28.41	0.6	29.21	0.83
1880	28.76	0.6	29.36	0.86
1909.8	28.44	0.6	29.04	0.80

Maximum Power-GPRS 1900(↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	25.52	0.6	26.12	0.41
1880	25.56	0.6	26.16	0.41
1909.8	25.46	0.6	26.06	0.40

Maximum Power-GPRS 1900(↑ ↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	23.54	0.6	24.14	0.26
1880	23.59	0.6	24.19	0.26
1909.8	23.48	0.6	24.08	0.26

Maximum Power-GPRS 1900(↑ ↑ ↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	21.47	0.6	22.07	0.16
1880	21.52	0.6	22.12	0.16
1909.8	21.45	0.6	22.05	0.16

Maximum Power-EGPRS 1900(↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	23.56	0.6	24.16	0.26
1880	23.62	0.6	24.22	0.26
1909.8	23.51	0.6	24.11	0.26

Maximum Power-EGPRS 1900(↑ ↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	21.56	0.6	22.16	0.16
1880	21.62	0.6	22.22	0.17
1909.8	21.54	0.6	22.14	0.16

Maximum Power-EGPRS 1900(↑↑↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	19.62	0.6	20.22	0.11
1880	19.66	0.6	20.26	0.11
1909.8	19.57	0.6	20.17	0.10

Maximum Power-EGPRS 1900(↑↑↑↑)

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	17.58	0.6	18.18	0.07
1880	17.64	0.6	18.24	0.07
1909.8	17.57	0.6	18.17	0.07

Maximum Power-WCDMA V

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
826.4	23.42	0.4	23.82	0.24
836.6	23.47	0.4	23.87	0.24
846.6	23.27	0.4	23.67	0.23

Maximum Power-WCDMA II

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1852.4	21.62	0.6	22.22	0.17
1880	21.57	0.6	22.17	0.16
1907.6	21.67	0.6	22.27	0.17

WCDMA V HSDPA								
Frequency (MHz)	Set 1		Set 2		Set 3		Set 4	
	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)
826.4	23.84	0.24	22.02	0.16	20.87	0.12	20.84	0.12
836.6	23.77	0.24	22.92	0.20	20.72	0.12	20.68	0.12
846.6	23.82	0.24	22.91	0.20	20.73	0.12	20.68	0.12
β_c	2		12		15		15	
β_d	15		15		8		4	
$\Delta_{ACK}, \Delta_{NACK} \Delta_{CQI}$	8		8		8		8	
Cable loss: 0.4dB for 850MHz ; 0.6dB for 1900MHz								

WCDMA II HSDPA								
Frequency (MHz)	Set 1		Set 2		Set 3		Set 4	
	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)
1852.4	22.24	0.17	21.23	0.13	20.41	0.11	21.30	0.13
1880	22.38	0.17	21.82	0.15	20.87	0.12	20.88	0.12
1907.6	22.38	0.17	21.29	0.13	21.43	0.14	20.33	0.11
β_c	2		12		15		15	
β_d	15		15		8		4	
$\Delta_{ACK}, \Delta_{NACK} \Delta_{CQI}$	8		8		8		8	
Cable loss: 0.4dB for 850MHz ; 0.6dB for 1900MHz								

WCDMA Band V HSUPA										
Frequency (MHz)	Set 1		Set 2		Set 3		Set 4		Set 5	
	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)
826.4	21.98	0.16	19.60	0.09	20.27	0.11	19.44	0.09	22.42	0.17
836.6	22.39	0.17	19.20	0.08	20.01	0.10	18.97	0.08	22.34	0.17
846.6	22.16	0.16	19.03	0.08	19.72	0.09	18.82	0.08	22.03	0.16
β_c	11		6		15		2		15	
β_d	15		15		9		15		15	
$\Delta_{ACK}, \Delta_{NACK} \Delta_{CQI}$	8		8		8		8		8	
AGV	20		12		15		17		21	
Cable loss: 0.4dB for 850MHz ; 0.6dB for 1900MHz										

WCDMA Band II HSUPA										
Frequency (MHz)	Set 1		Set 2		Set 3		Set 4		Set 5	
	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)	Power (dBm)	Power (Watts)
1852.4	21.72	0.15	19.34	0.09	19.61	0.09	19.23	0.08	21.85	0.15
1880	22.05	0.16	19.12	0.08	19.42	0.09	18.92	0.08	22.04	0.16
1907.6	21.37	0.14	18.63	0.07	19.33	0.09	18.56	0.07	21.88	0.15
β_c	11		6		15		2		15	
β_d	15		15		9		15		15	
$\Delta_{ACK}, \Delta_{NACK} \Delta_{CQI}$	8		8		8		8		8	
AGV	20		12		15		17		21	
Cable loss: 0.4dB for 850MHz ; 0.6dB for 1900MHz										

9. Test Results

9.1 SAR Test Results Summary

SAR MEASUREMENT						
Ambient Temperature (°C) : 21.8 ±2				Relative Humidity (%): 53		
Liquid Temperature (°C) : 20.9 ±2				Depth of Liquid (cm):>15		
Product: HSPA Module						
Test Mode: GSM 850 GPRS 2 Slot						
Test Position Body	Antenna Position	Frequency		Conducted Power (dBm)	SAR 1g (W/kg)	Limit (W/kg)
		Channel	MHz			
Bottom	Fixed	189	836.4	29.76	0.038	1.6
Test Mode: GSM 850 GPRS 3 Slot						
Bottom	Fixed	189	836.4	27.66	0.036	1.6
Test Mode: GSM 850 GPRS 4 Slot						
Bottom	Fixed	189	836.4	25.62	0.030	1.6
Test Mode: GSM 850 GPRS 2 Slot						
Bottom	Fixed	128	824.2	29.87	0.026	1.6
Bottom	Fixed	251	848.8	29.57	0.056	1.6
Test Mode: GSM 850 EGPRS 2 Slot						
Bottom	Fixed	251	848.8	23.64	0.053	1.6

SAR MEASUREMENT						
Ambient Temperature (°C): 22.4 ± 2				Relative Humidity (%): 52		
Liquid Temperature (°C): 21.6 ± 2				Depth of Liquid (cm):>15		
Product: HSPA Module						
Test Mode: PCS 1900 GPRS 2 Slot						
Test Position Body	Antenna Position	Frequency		Conducted Power (dBm)	SAR 1g (W/kg)	Limit (W/kg)
		Channel	MHz			
Bottom	Fixed	661	1880	26.16	0.109	1.6
Test Mode: PCS 1900 GPRS 3 Slot						
Bottom	Fixed	661	1880	24.19	0.103	1.6
Test Mode: PCS 1900 GPRS 4 Slot						
Bottom	Fixed	661	1880	22.12	0.089	1.6
Test Mode: PCS 1900 GPRS 2 Slot						
Bottom	Fixed	512	1850.2	26.12	0.118	1.6
Bottom	Fixed	810	1909.8	26.06	0.100	1.6
Test Mode: PCS 1900 EGPRS 2 Slot						
Bottom	Fixed	512	1850.2	22.16	0.112	1.6

SAR MEASUREMENT						
Ambient Temperature (°C) : 21.8 ±2				Relative Humidity (%): 53		
Liquid Temperature (°C) : 20.9 ±2				Depth of Liquid (cm):>15		
Product: HSPA Module						
Test Mode: WCDMA Band V						
Test Position Body	Antenna Position	Frequency		Conducted Power (dBm)	SAR 1g (W/kg)	Limit (W/kg)
		Channel	MHz			
Bottom	Fixed	4132	826.4	23.82	0.021	1.6
Bottom	Fixed	4183	836.6	23.87	0.036	1.6
Bottom	Fixed	4233	846.6	23.67	0.034	1.6

SAR MEASUREMENT						
Ambient Temperature (°C): 22.4 ± 2				Relative Humidity (%): 52		
Liquid Temperature (°C): 21.6 ± 2				Depth of Liquid (cm):>15		
Product: HSPA Module						
Test Mode: WCDMA Band II						
Test Position Body	Antenna Position	Frequency		Conducted Power (dBm)	SAR 1g (W/kg)	Limit (W/kg)
		Channel	MHz			
Bottom	Fixed	9262	1852.4	22.22	0.264	1.6
Bottom	Fixed	9400	1880	22.17	0.205	1.6
Bottom	Fixed	9538	1907.6	22.27	0.181	1.6

Appendix**Appendix A. SAR System Validation Data****Appendix B. SAR measurement Data****Appendix C. Test Setup Photographs & EUT Photographs****Appendix D. Probe Calibration Data****Appendix E. Dipole Calibration Data**

Appendix A. SAR System Validation Data

Date/Time: 12/31/2009

Test Laboratory: Quietek

SystemPerformanceCheck-835MHz_Head

DUT: Dipole 835 MHz; Type: ALS-D-835-S-2; Serial: QTK-315

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.93 \text{ mho/m}$; $\epsilon_r = 43$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

835MHz_Head/Area Scan (7x9x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (measured) = 2.72 mW/g

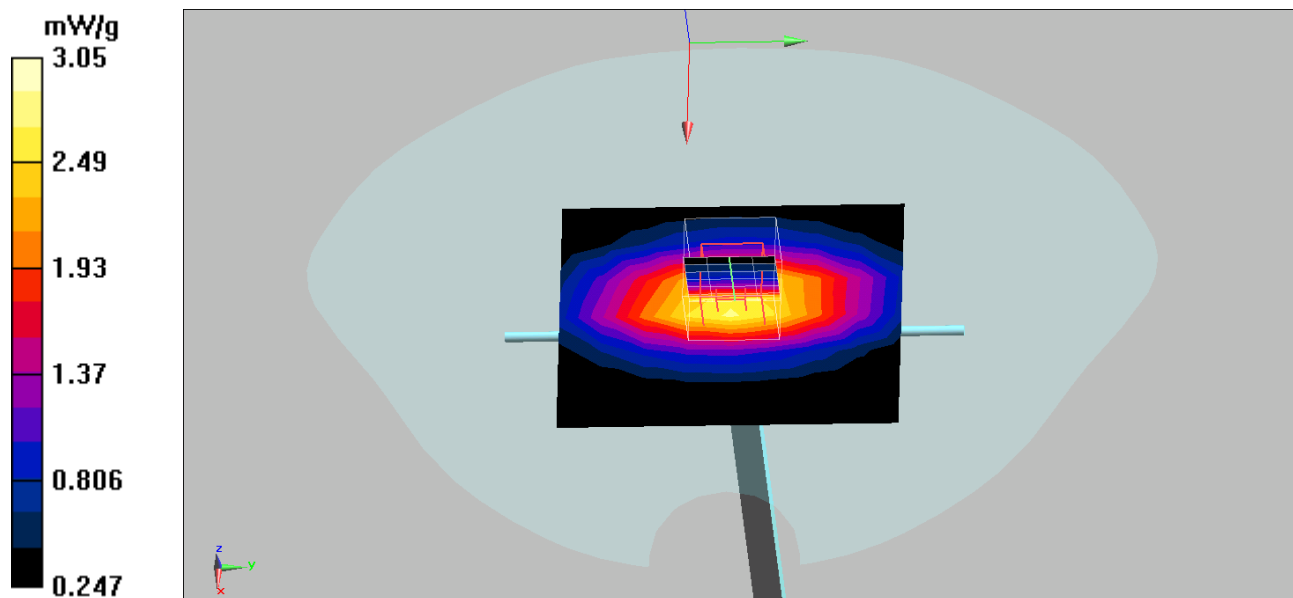
835MHz_Head/Zoom Scan (7x7x7) (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.8 V/m; Power Drift = -0.115 dB

Peak SAR (extrapolated) = 3.63 W/kg

SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.57 mW/g

Maximum value of SAR (measured) = 3.04 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek CORP

System Performance Check_1900MHz-Head

DUT: Dipole 1900 MHz; Type: ALS-D-1900-S-2; Serial: QTK-318

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.38$ mho/m; $\epsilon_r = 40.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.81, 7.81, 7.81); Calibrated: 5/20/2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

d=10mm, Pin=250mW, dist=4.0mm (EX-Probe)/Area Scan (7x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 9.45 mW/g

d=10mm, Pin=250mW, dist=4.0mm (EX-Probe)/Zoom Scan (7x7x7)

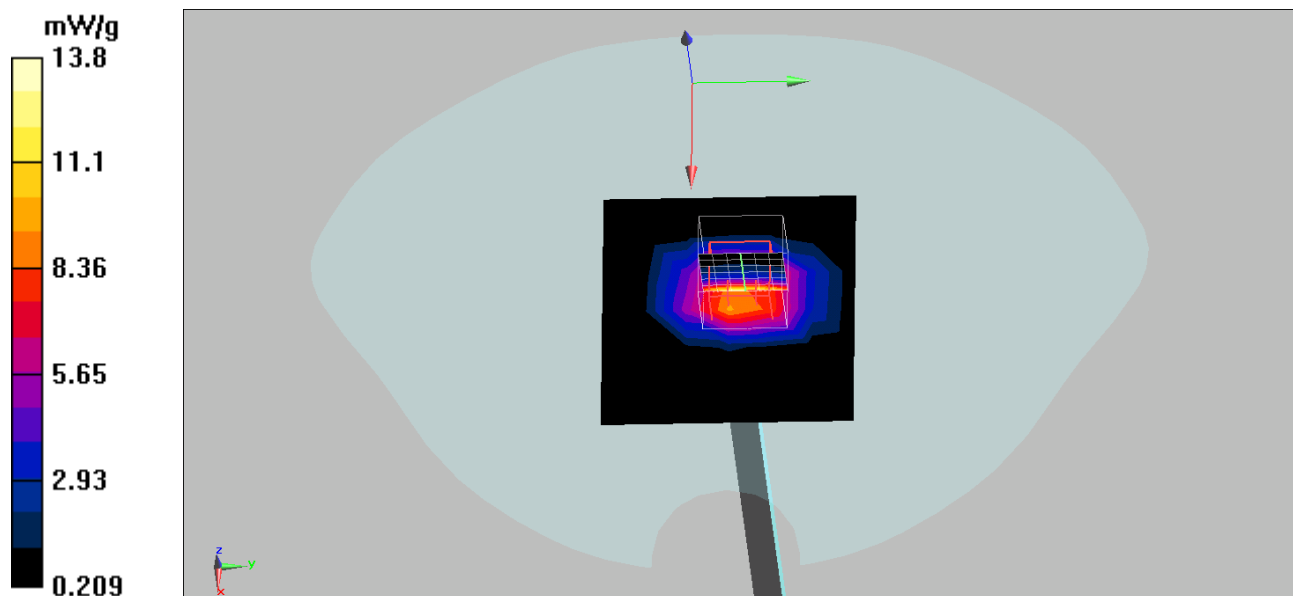
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.8 V/m; Power Drift = 0.059 dB

Peak SAR (extrapolated) = 18 W/kg

SAR(1 g) = 9.22 mW/g; SAR(10 g) = 4.98 mW/g

Maximum value of SAR (measured) = 13.9 mW/g



Appendix B. SAR measurement Data

Date/Time: 12/31/2009

Test Laboratory: Quietek

GSM850_189 GPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC GSM_850MHz_GPRS&EGPRS-2 Slot; Frequency: 836.4 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 21.8, Liquid Temperature (°C) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.039 mW/g

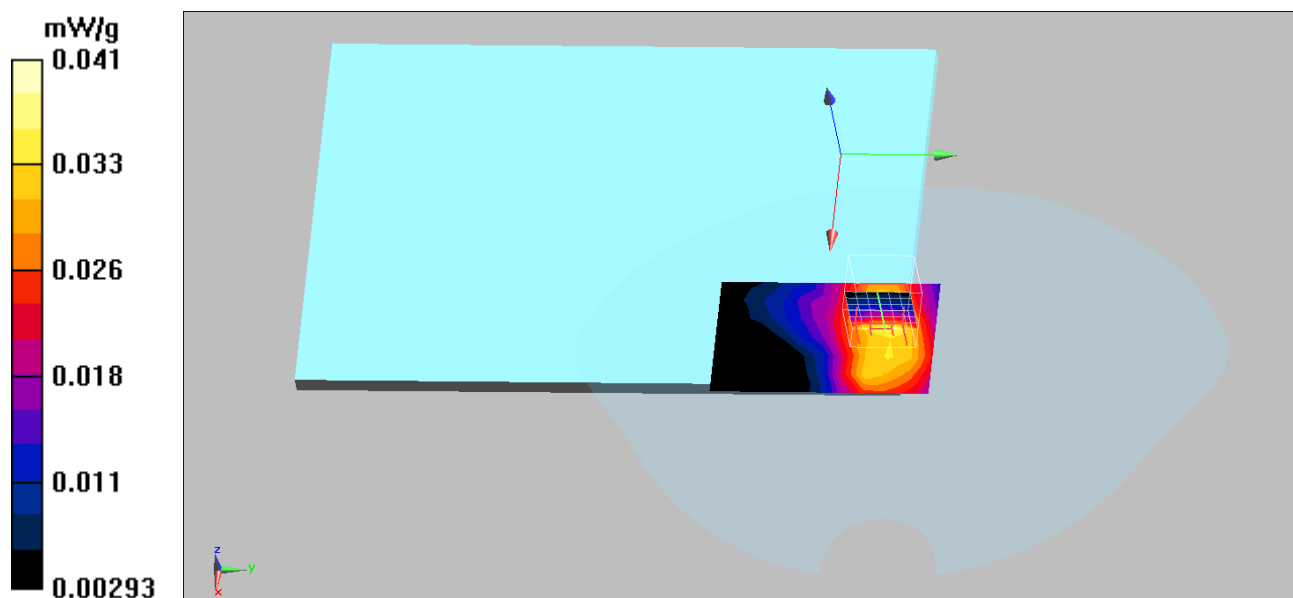
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.7 V/m; Power Drift = 0.057 dB

Peak SAR (extrapolated) = 0.053 W/kg

SAR(1 g) = 0.038 mW/g; SAR(10 g) = 0.026 mW/g

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



Date/Time: 12/31/2009

Test Laboratory: Quietek

GSM850_189 GPRS-3 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC GSM_850MHz_GPRS&EGPRS-3 Slot; Frequency: 836.4 MHz; Duty Cycle: 1:2.7

Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 21.8, Liquid Temperature (°C) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.038 mW/g

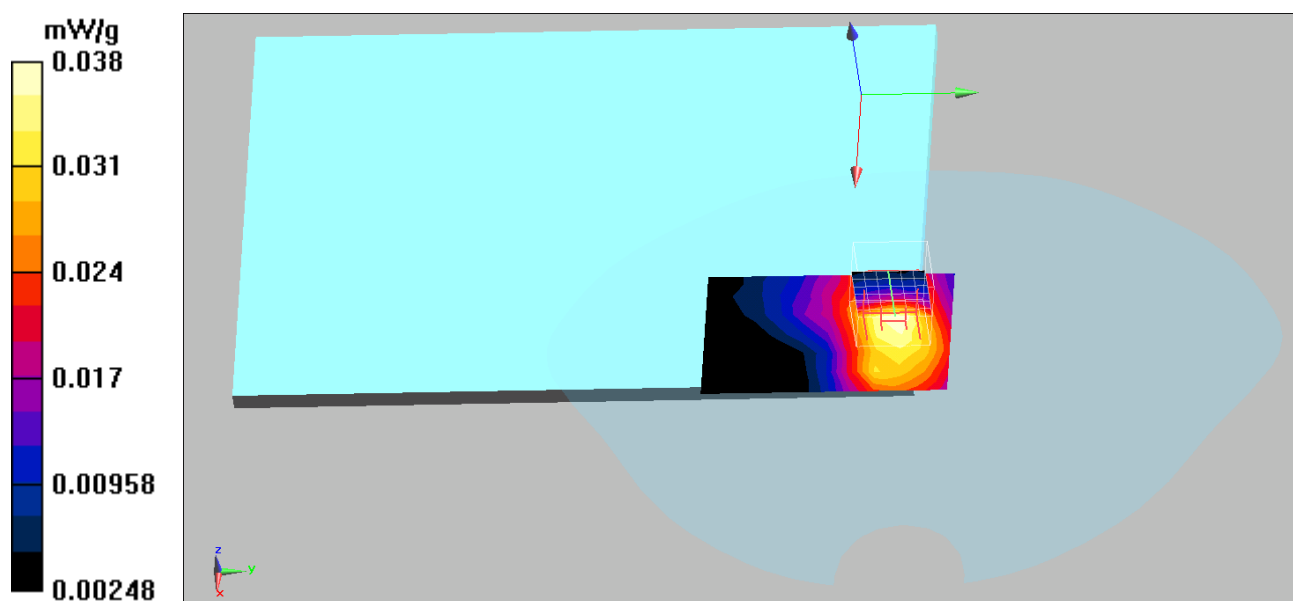
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.6 V/m; Power Drift = 0.056 dB

Peak SAR (extrapolated) = 0.050 W/kg

SAR(1 g) = 0.036 mW/g; SAR(10 g) = 0.024 mW/g

Maximum value of SAR (measured) = 0.039 mW/g



Date/Time: 12/31/2009

Test Laboratory: Quietek

GSM850_189 GPRS-4 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC GSM_850MHz_GPRS&EGPRS-4 Slot; Frequency: 836.4 MHz; Duty Cycle: 1:2

Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 21.8, Liquid Temperature (°C) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.032 mW/g

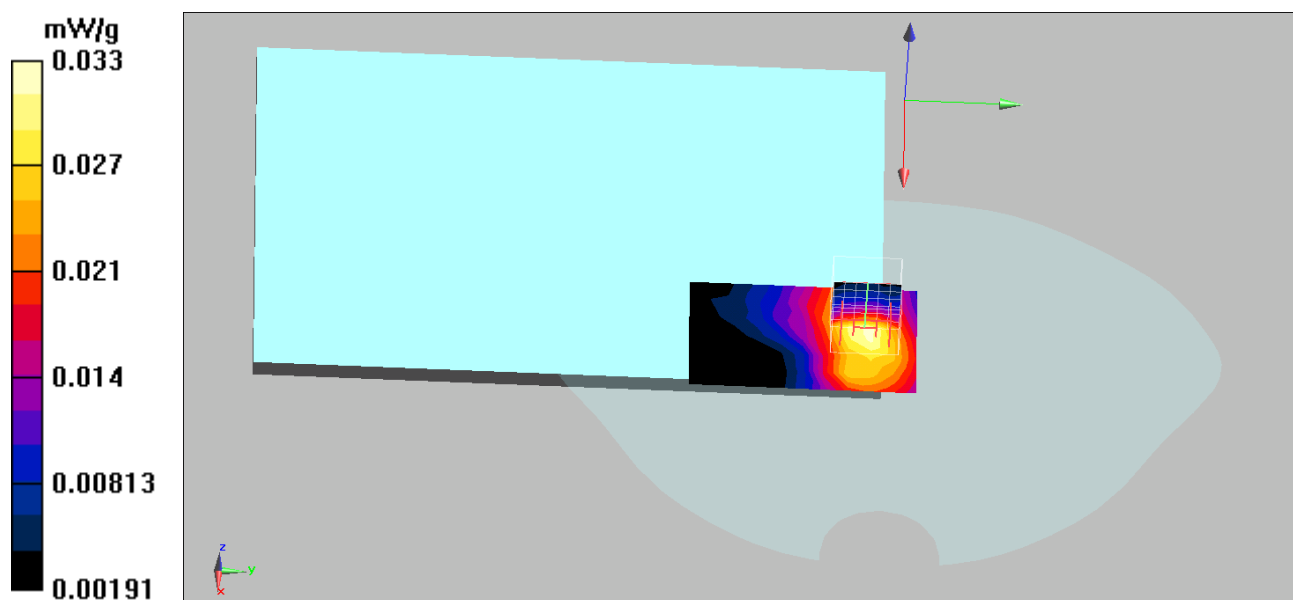
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.18 V/m; Power Drift = 0.00555 dB

Peak SAR (extrapolated) = 0.042 W/kg

SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.021 mW/g

Maximum value of SAR (measured) = 0.033 mW/g



Date/Time: 12/31/2009

Test Laboratory: Quietek

GSM850_128 GPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC GSM_850MHz_GPRS&EGPRS-2 Slot; Frequency: 824.2 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 824.2$ MHz; $\sigma = 0.93$ mho/m; $\epsilon_r = 56.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 21.8, Liquid Temperature (°C) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.027 mW/g

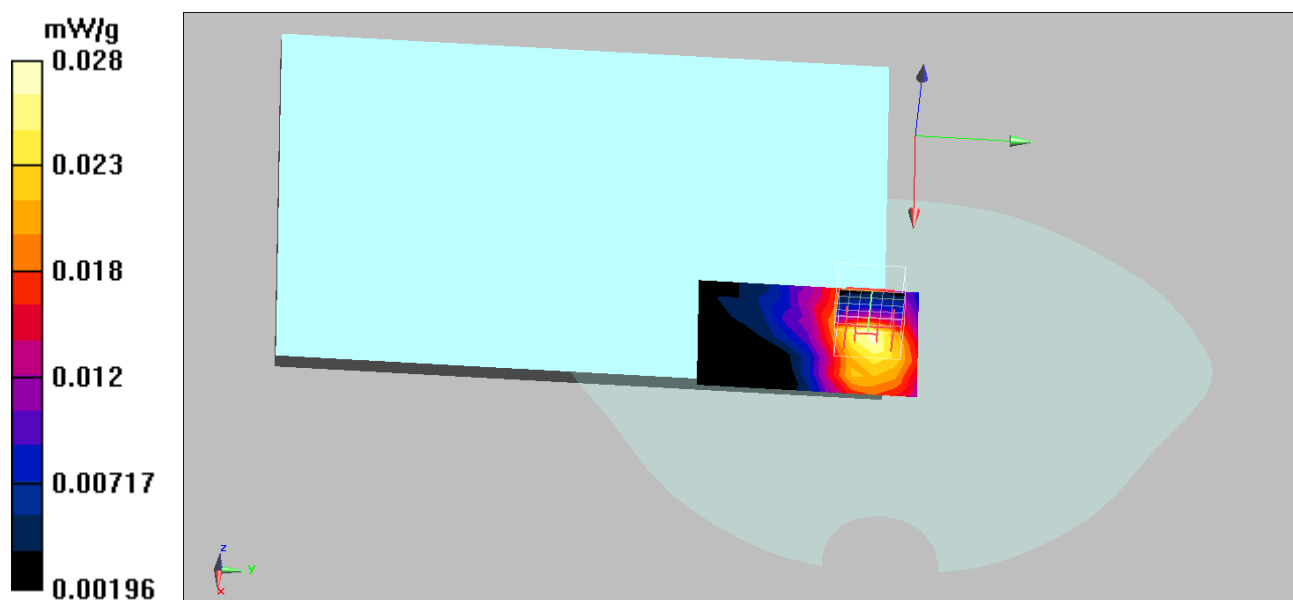
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.77 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 0.036 W/kg

SAR(1 g) = 0.026 mW/g; SAR(10 g) = 0.017 mW/g

Maximum value of SAR (measured) = 0.028 mW/g



Date/Time: 12/31/2009

Test Laboratory: Quietek

GSM850_251 GPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC GSM_850MHz_GPRS&EGPRS-2 Slot; Frequency: 848.8 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 848.8$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 56.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 21.8, Liquid Temperature (°C) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.061 mW/g

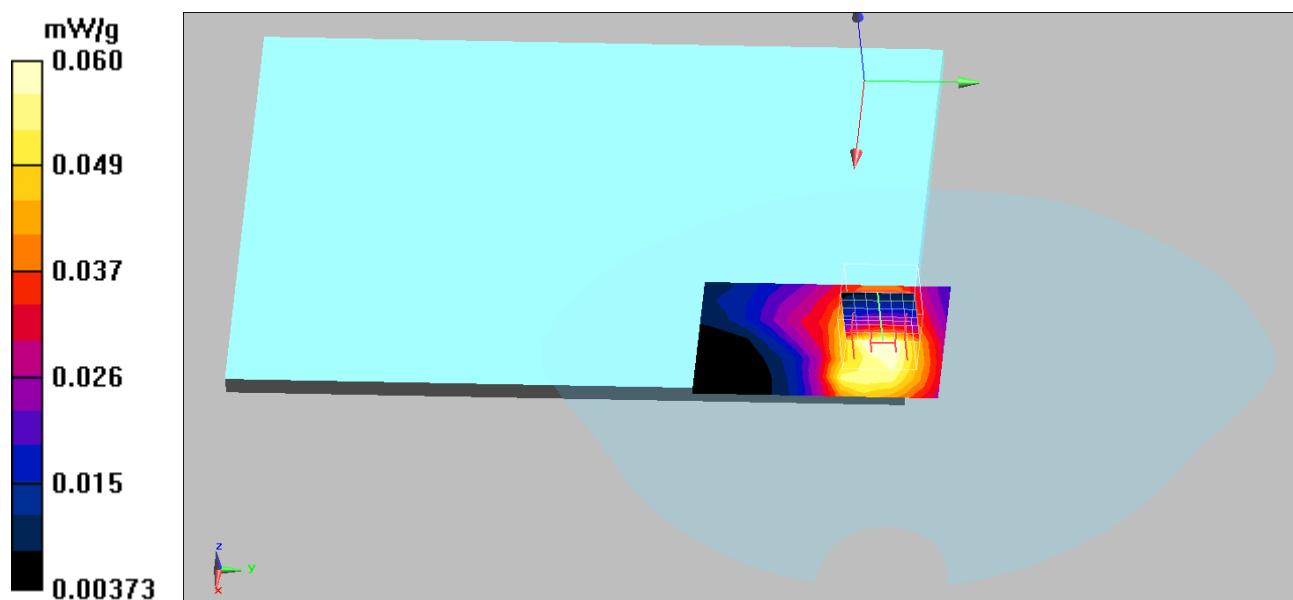
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.14 V/m; Power Drift = -0.129 dB

Peak SAR (extrapolated) = 0.107 W/kg

SAR(1 g) = 0.056 mW/g; SAR(10 g) = 0.039 mW/g

Maximum value of SAR (measured) = 0.060 mW/g



Date/Time: 12/31/2009

Test Laboratory: Quietek

GSM850_251 EGPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC GSM_850MHz_GPRS&EGPRS-2 Slot; Frequency: 848.8 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 848.8$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 56.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 21.8, Liquid Temperature (°C) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.058 mW/g

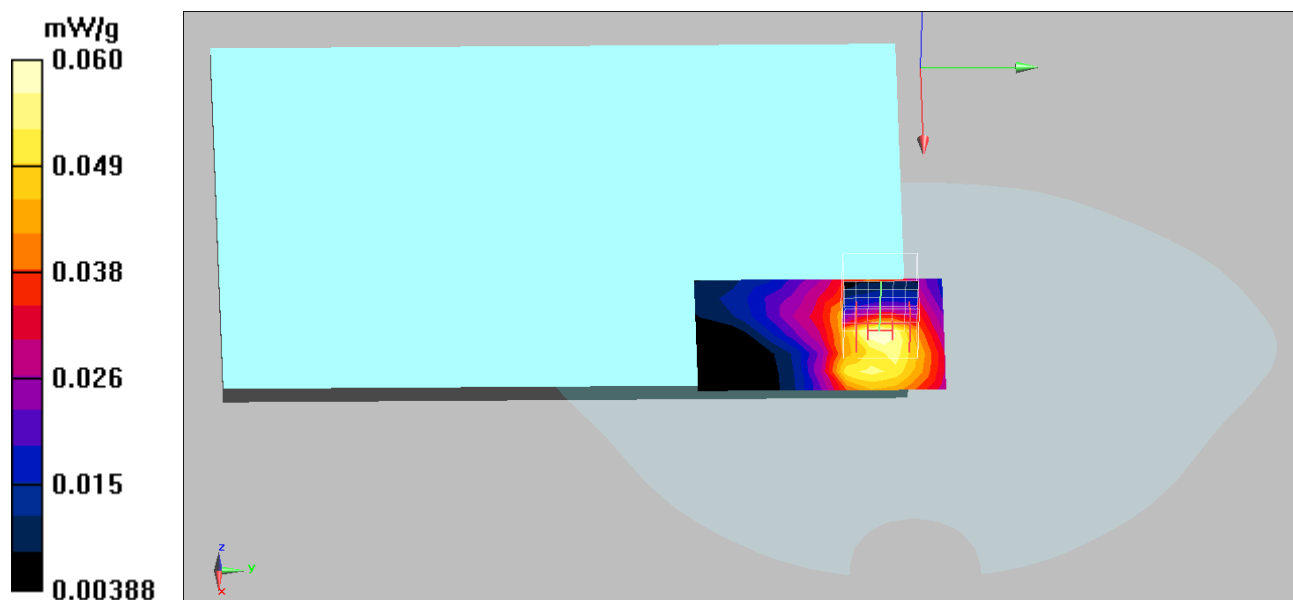
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.03 V/m; Power Drift = -0.046 dB

Peak SAR (extrapolated) = 0.091 W/kg

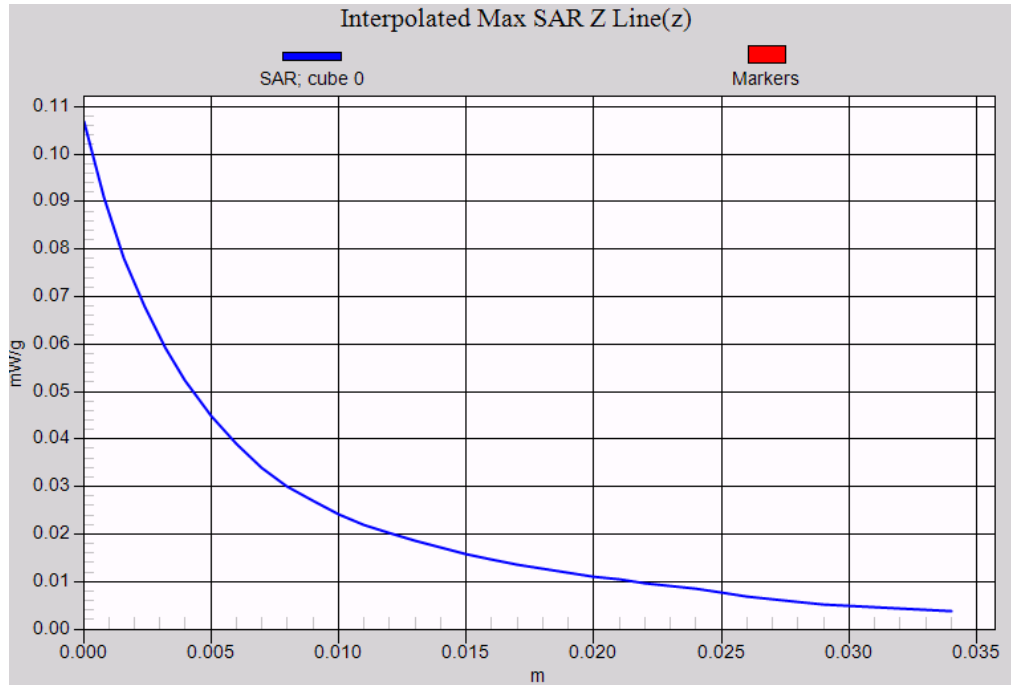
SAR(1 g) = 0.053 mW/g; SAR(10 g) = 0.038 mW/g

Maximum value of SAR (measured) = 0.060 mW/g



GSM 850 EUT Bottom Z-Axis plot

Channel: 251



Date/Time: 1/4/2010

Test Laboratory: Quietek

PCS1900_661 GPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC PCS_1900MHz_GPRS&EGPRS-2 Slot; Frequency: 1880 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.4, Liquid Temperature (°C) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.108 mW/g

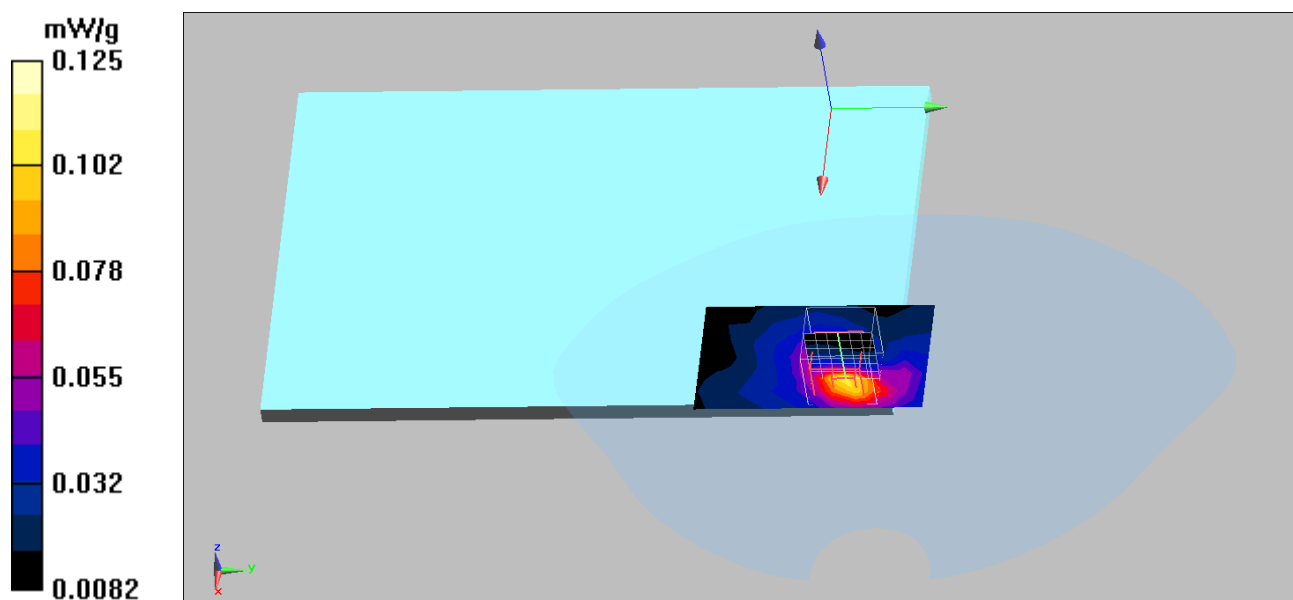
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.45 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 0.234 W/kg

SAR(1 g) = 0.109 mW/g; SAR(10 g) = 0.057 mW/g

Maximum value of SAR (measured) = 0.125 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek

PCS1900_661 GPRS-3 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC PCS_1900MHz_GPRS&EGPRS-3 Slot; Frequency: 1880 MHz; Duty Cycle: 1:2.7

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.4, Liquid Temperature (°C) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.103 mW/g

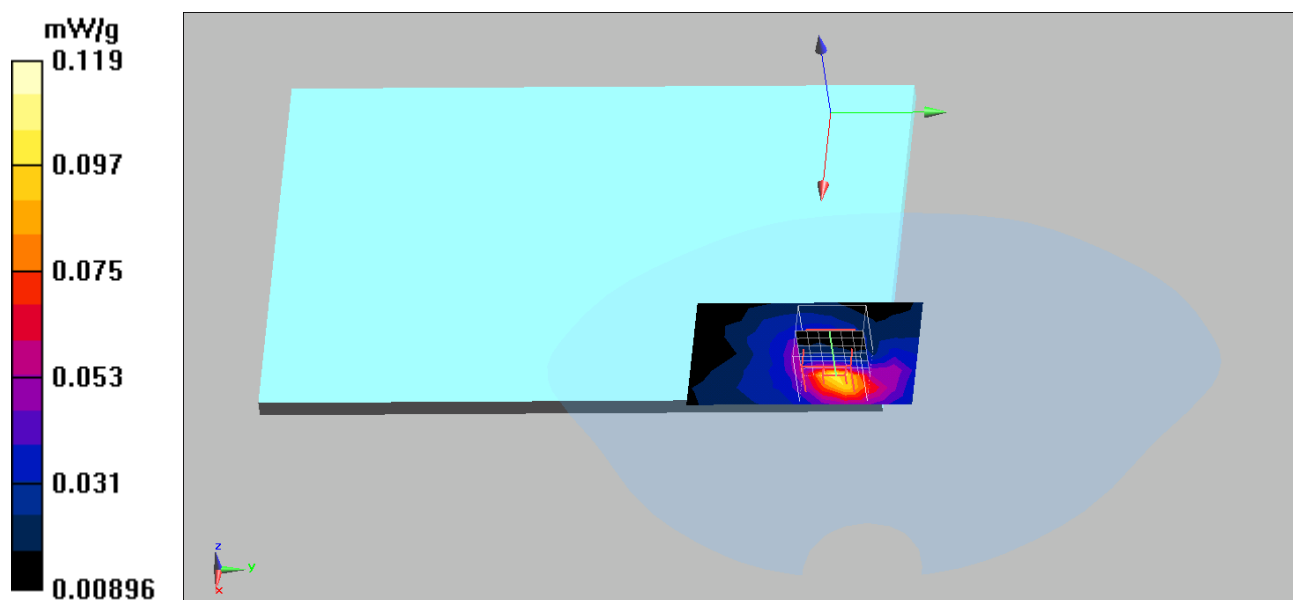
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.3 V/m; Power Drift = 0.032 dB

Peak SAR (extrapolated) = 0.223 W/kg

SAR(1 g) = 0.103 mW/g; SAR(10 g) = 0.054 mW/g

Maximum value of SAR (measured) = 0.119 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek

PCS1900_661 GPRS-4 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC PCS_1900MHz_GPRS&EGPRS-4 Slot; Frequency: 1880 MHz; Duty Cycle: 1:2

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.4, Liquid Temperature (°C) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.087 mW/g

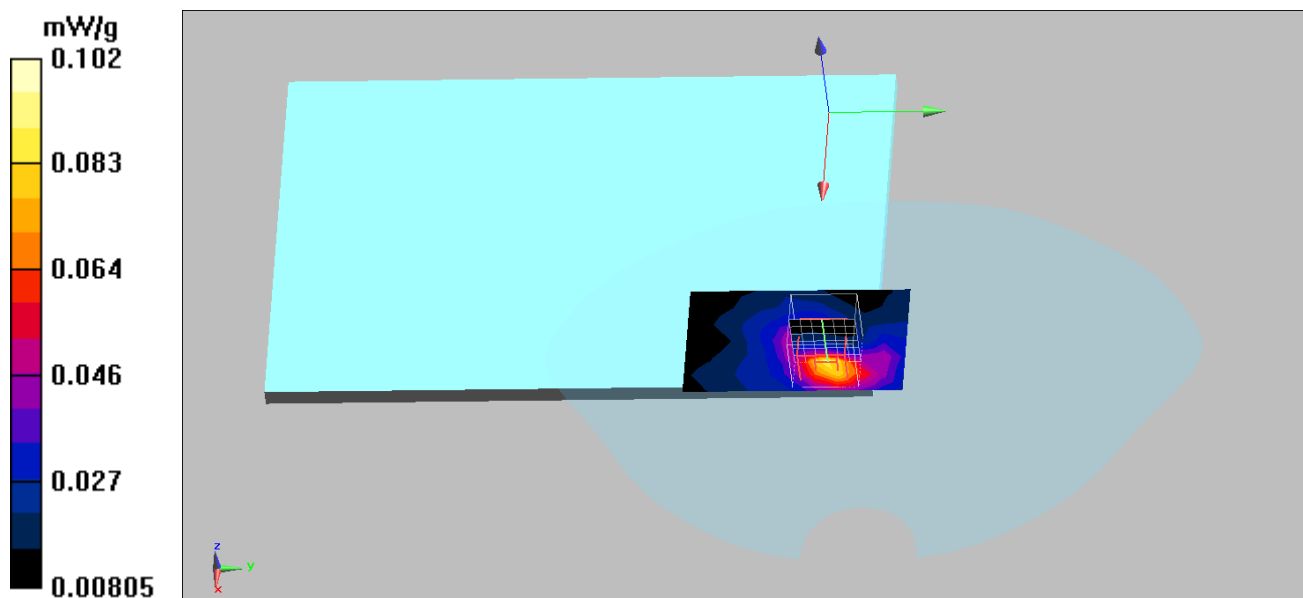
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.88 V/m; Power Drift = -0.105 dB

Peak SAR (extrapolated) = 0.193 W/kg

SAR(1 g) = 0.089 mW/g; SAR(10 g) = 0.046 mW/g

Maximum value of SAR (measured) = 0.102 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek

PCS1900_512 GPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC PCS_1900MHz_GPRS&EGPRS-2 Slot; Frequency: 1850.2 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.48$ mho/m; $\epsilon_r = 54.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.4, Liquid Temperature (°C) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.117 mW/g

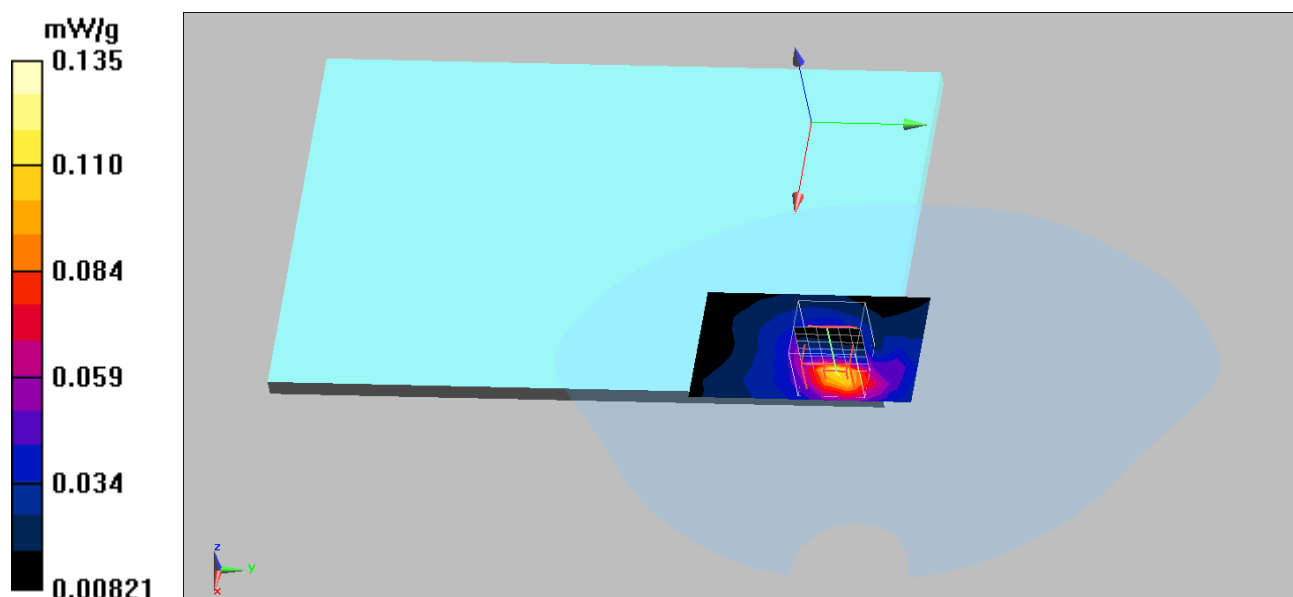
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.43 V/m; Power Drift = 0.049 dB

Peak SAR (extrapolated) = 0.252 W/kg

SAR(1 g) = 0.118 mW/g; SAR(10 g) = 0.061 mW/g

Maximum value of SAR (measured) = 0.135 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek

PCS1900_810 GPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC PCS_1900MHz_GPRS&EGPRS-2 Slot; Frequency: 1909.8 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 54.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.4, Liquid Temperature (°C) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.099 mW/g

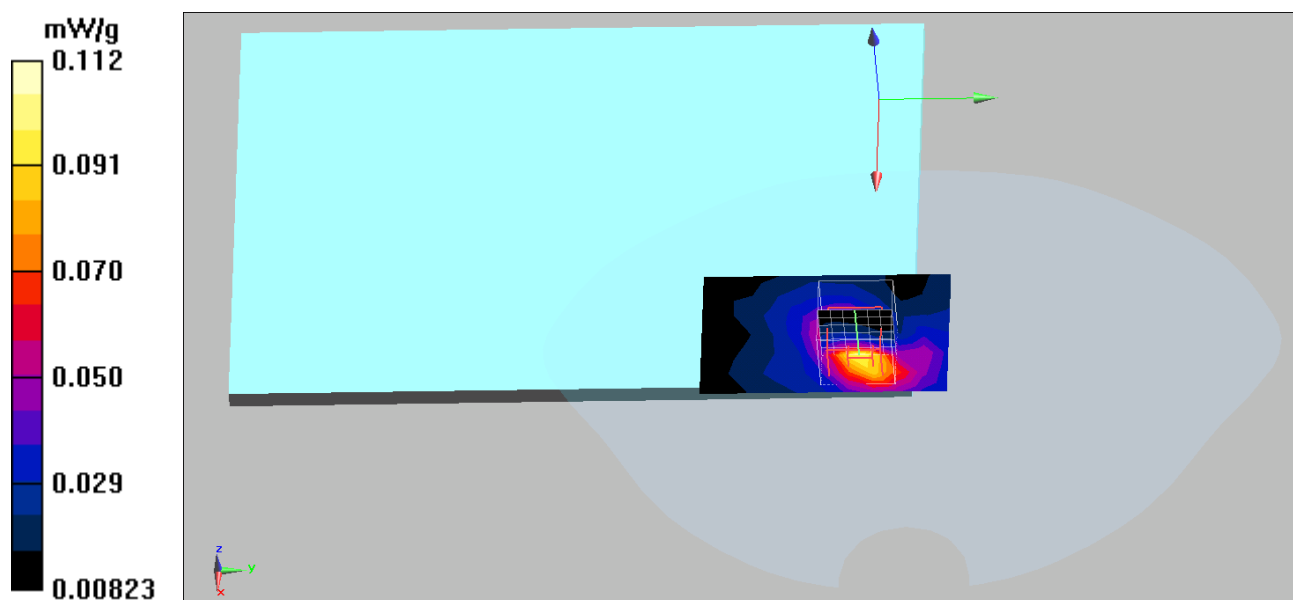
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.08 V/m; Power Drift = 0.076 dB

Peak SAR (extrapolated) = 0.224 W/kg

SAR(1 g) = 0.100 mW/g; SAR(10 g) = 0.052 mW/g

Maximum value of SAR (measured) = 0.112 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek

PCS1900_512 EGPRS-2 Slot

DUT: HSPA Module; Type: EM770W

Communication System: FCC PCS_1900MHz_GPRS&EGPRS-2 Slot; Frequency: 1850.2 MHz; Duty Cycle: 1:4.1

Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.48$ mho/m; $\epsilon_r = 54.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.4, Liquid Temperature (°C) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.094 mW/g

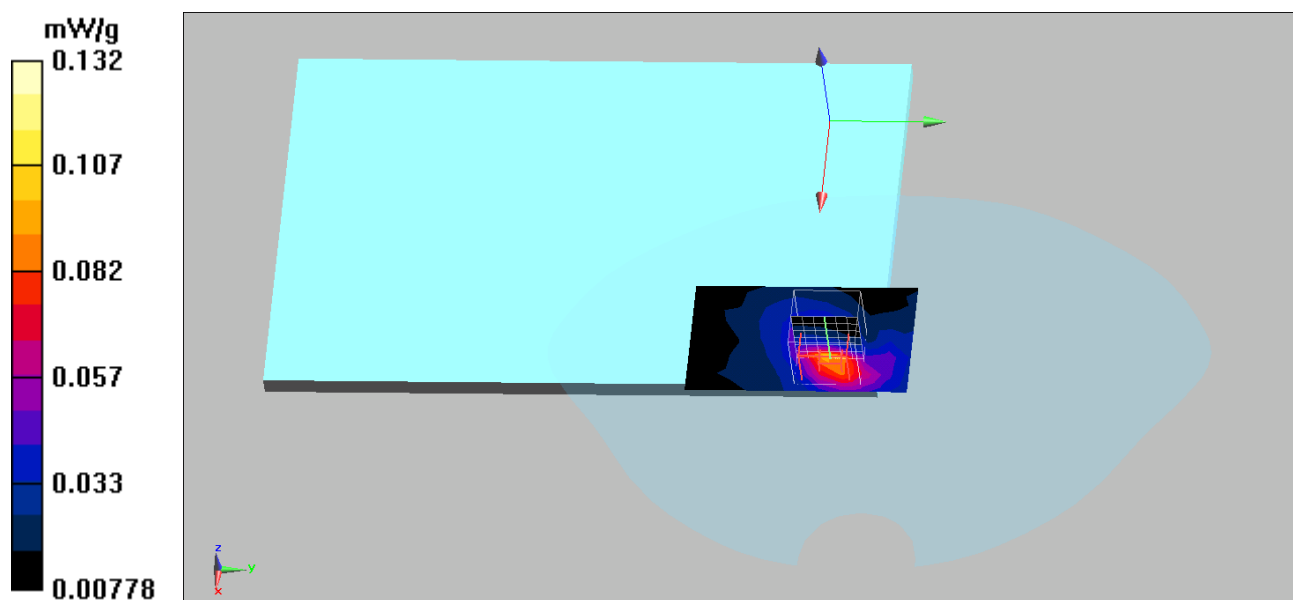
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.03 V/m; Power Drift = 0.098 dB

Peak SAR (extrapolated) = 0.248 W/kg

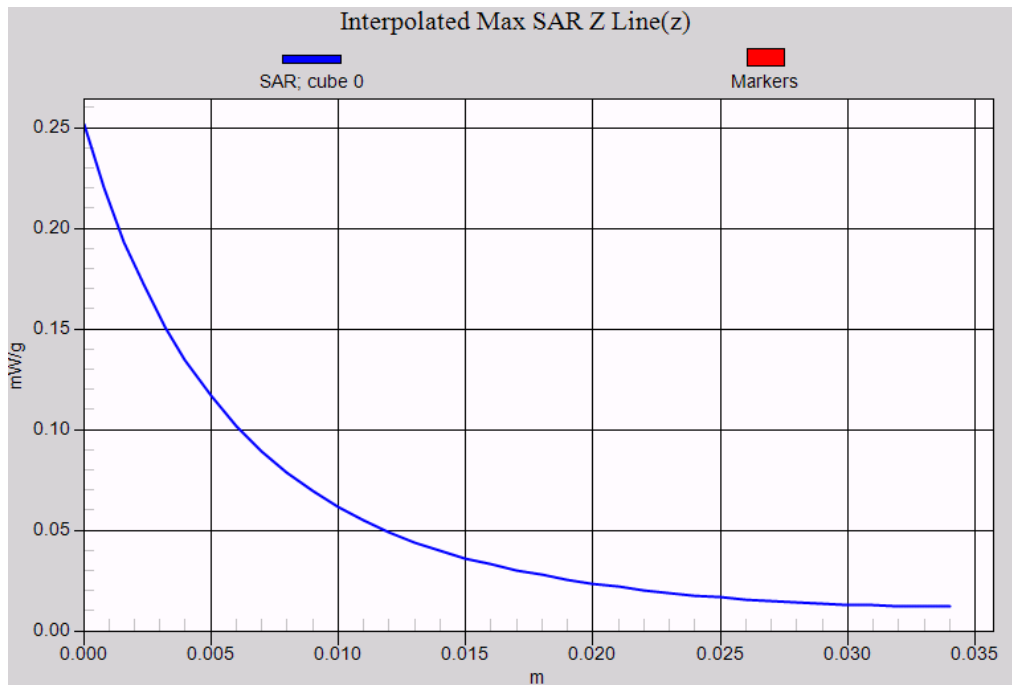
SAR(1 g) = 0.112 mW/g; SAR(10 g) = 0.061 mW/g

Maximum value of SAR (measured) = 0.132 mW/g



PCS 1900 EUT Bottom Z-Axis plot

Channel: 512



Date/Time: 12/31/2009

Test Laboratory: Quietek

WCDMA-Band V_ 4132 RMC

DUT: HSPA Module; Type: EM770W

Communication System: FCC WCDMA_Band-V; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 826.4 \text{ MHz}$; $\sigma = 0.93 \text{ mho/m}$; $\epsilon_r = 56.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature ($^{\circ}\text{C}$) : 21.8, Liquid Temperature ($^{\circ}\text{C}$) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (measured) = 0.021 mW/g

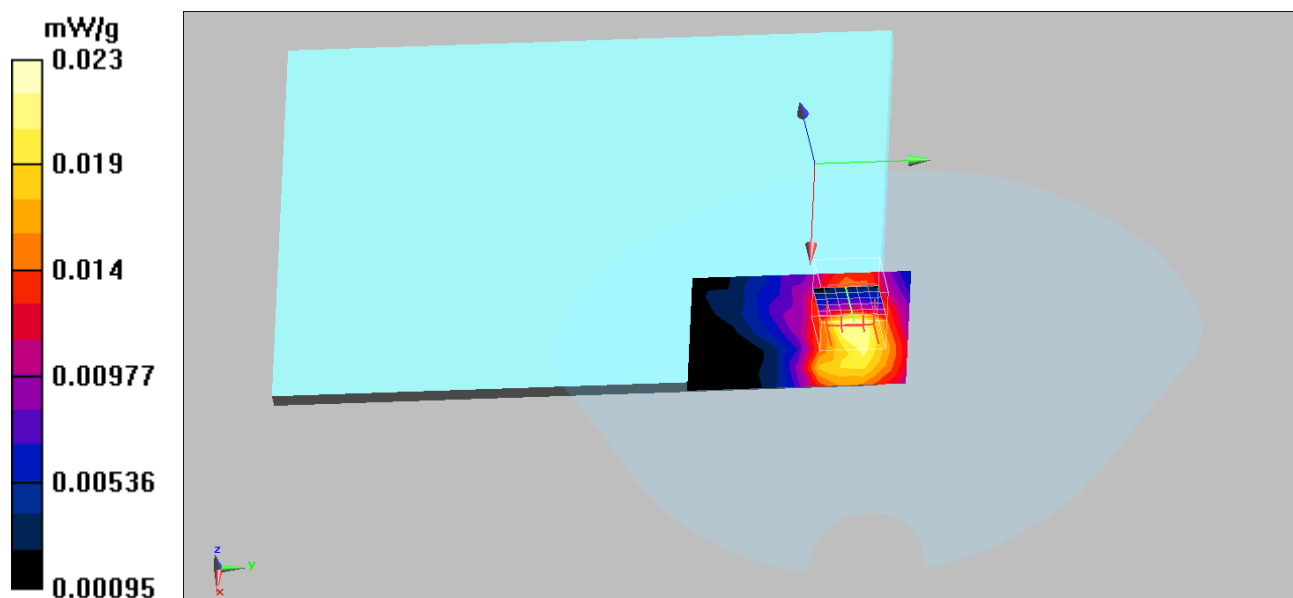
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.42 V/m; Power Drift = 0.044 dB

Peak SAR (extrapolated) = 0.028 W/kg

SAR(1 g) = 0.021 mW/g; SAR(10 g) = 0.014 mW/g

Maximum value of SAR (measured) = 0.023 mW/g



Date/Time: 12/31/2009

Test Laboratory: Quietek

WCDMA-Band V_ 4183 RMC

DUT: HSPA Module; Type: EM770W

Communication System: FCC WCDMA_Band-V; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 836.6 \text{ MHz}$; $\sigma = 0.95 \text{ mho/m}$; $\epsilon_r = 55.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature ($^{\circ}\text{C}$) : 21.8, Liquid Temperature ($^{\circ}\text{C}$) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

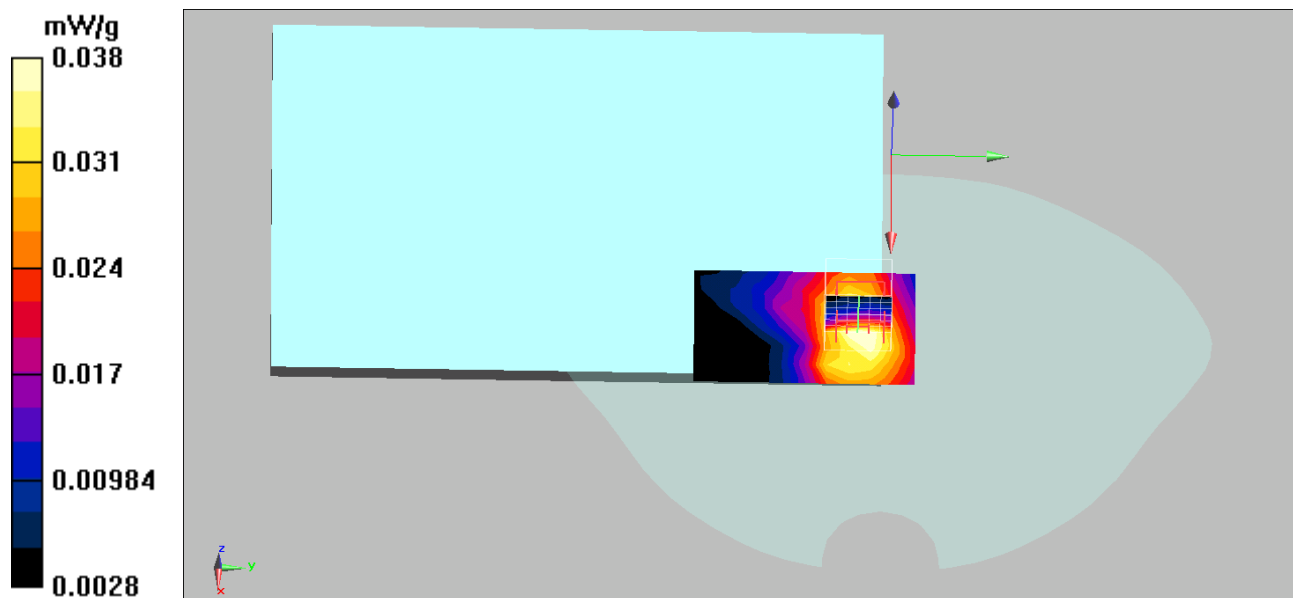
Maximum value of SAR (measured) = 0.038 mW/g

Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.69 V/m; Power Drift = 0.043 dB

Peak SAR (extrapolated) = 0.052 W/kg

SAR(1 g) = 0.036 mW/g; SAR(10 g) = 0.025 mW/g



Date/Time: 12/31/2009

Test Laboratory: Quietek

WCDMA-Band V_ 4233 RMC

DUT: HSPA Module; Type: EM770W

Communication System: FCC WCDMA_Band-V; Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0.99 \text{ mho/m}$, $\epsilon_r = 56.21$; $\rho = 1 \text{ kg/m}^3$ Medium parameters
used: $f = 846.6 \text{ MHz}$; $\sigma = 0.99 \text{ mho/m}$; $\epsilon_r = 56.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature ($^{\circ}\text{C}$) : 21.8, Liquid Temperature ($^{\circ}\text{C}$) : 20.9

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(9.32, 9.32, 9.32); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Left Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of U_x (measured) = 75.8 μV

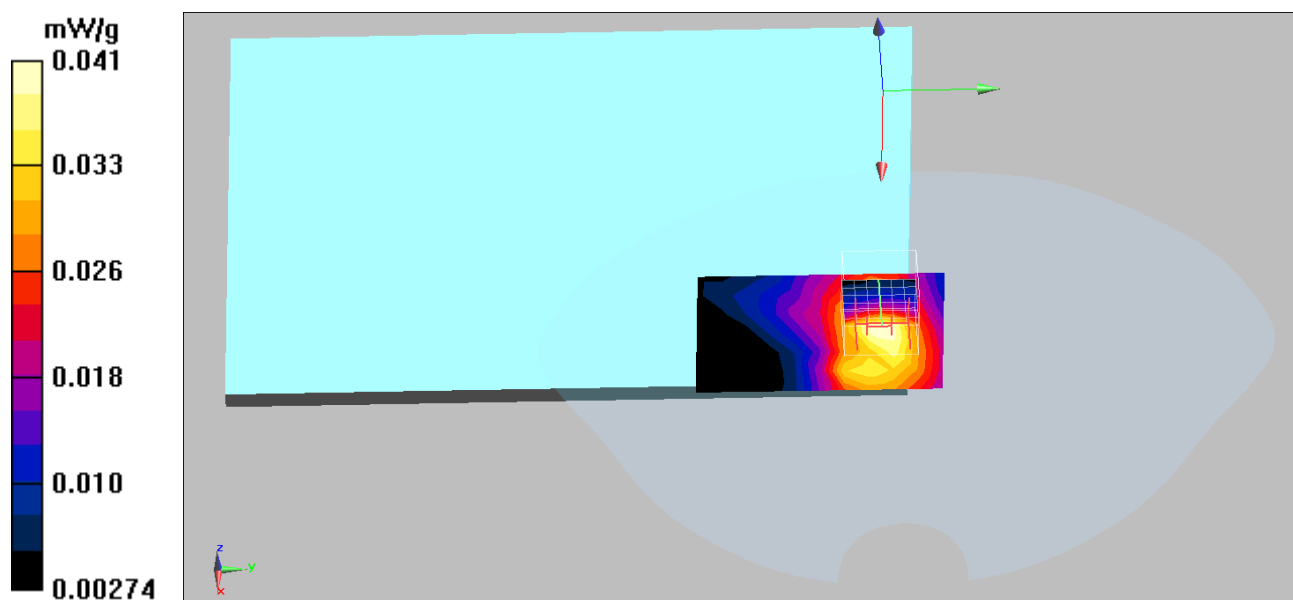
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.68 V/m; Power Drift = 0.186 dB

Peak SAR (extrapolated) = 0.060 W/kg

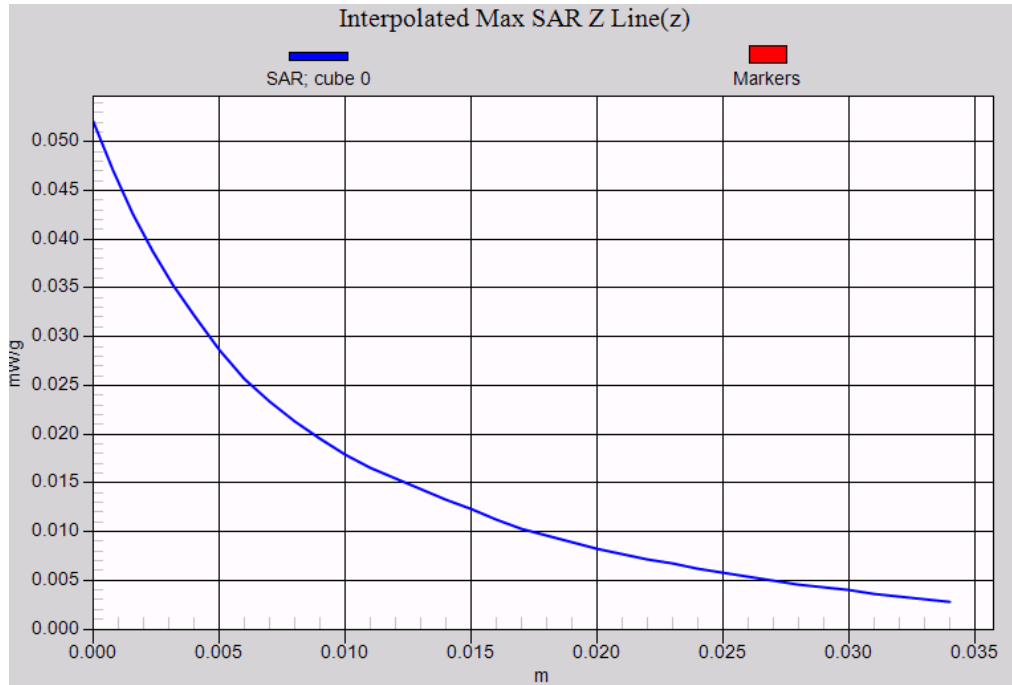
SAR(1 g) = 0.034 mW/g; SAR(10 g) = 0.026 mW/g

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



WCDMA Band V EUT Bottom Z-Axis plot

Channel: 4183



Date/Time: 1/4/2010

Test Laboratory: Quietek

WCDMA-Band II_ 9262 RMC

DUT: HSPA Module; Type: EM770W

Communication System: FCC WCDMA Band-II; Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1852.4 \text{ MHz}$; $\sigma = 1.49 \text{ mho/m}$; $\epsilon_r = 54.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature ($^{\circ}\text{C}$) : 22.4, Liquid Temperature ($^{\circ}\text{C}$) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (measured) = 0.288 mW/g

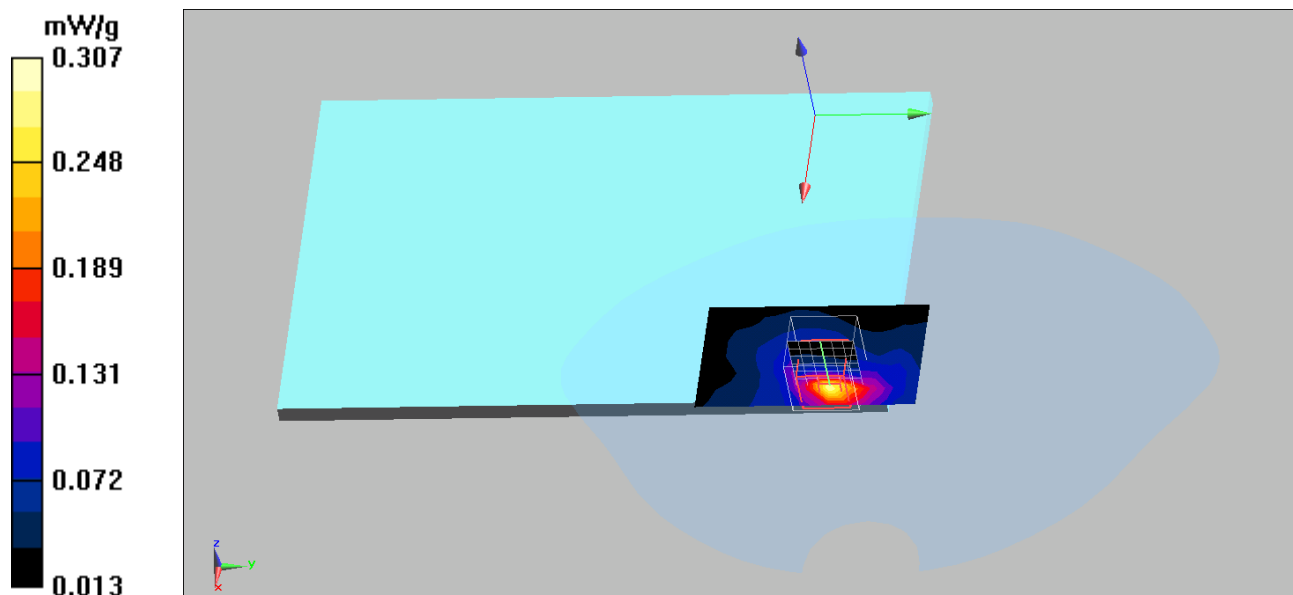
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 8.8 V/m; Power Drift = 0.183 dB

Peak SAR (extrapolated) = 0.577 W/kg

SAR(1 g) = 0.264 mW/g; SAR(10 g) = 0.131 mW/g

Maximum value of SAR (measured) = 0.307 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek

WCDMA-Band II_ 9400 RMC

DUT: HSPA Module; Type: EM770W

Communication System: FCC WCDMA_Band-II; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.4, Liquid Temperature (°C) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.226 mW/g

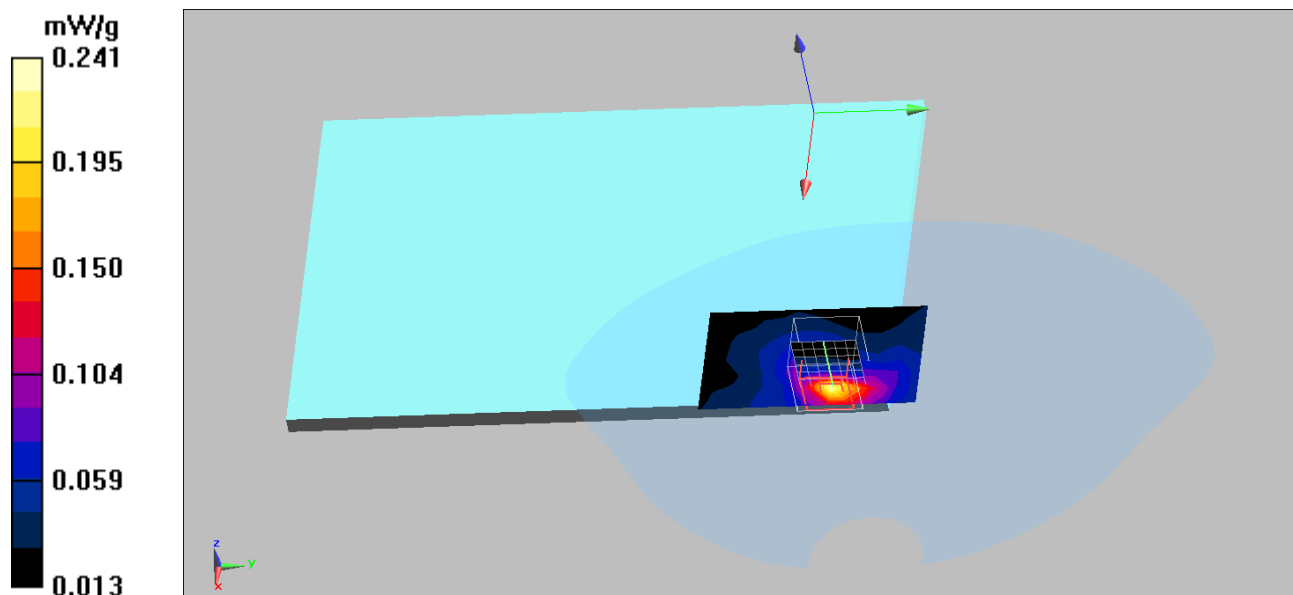
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.08 V/m; Power Drift = 0.027 dB

Peak SAR (extrapolated) = 0.454 W/kg

SAR(1 g) = 0.205 mW/g; SAR(10 g) = 0.102 mW/g

Maximum value of SAR (measured) = 0.241 mW/g



Date/Time: 1/4/2010

Test Laboratory: Quietek

WCDMA-Band II_ 9538 RMC

DUT: HSPA Module; Type: EM770W

Communication System: FCC WCDMA Band-II; Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1907.6 \text{ MHz}$; $\sigma = 1.54 \text{ mho/m}$; $\epsilon_r = 54.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature ($^{\circ}\text{C}$) : 22.4, Liquid Temperature ($^{\circ}\text{C}$) : 21.6

DASY4 Configuration:

- Probe: EX3DV4 - SN3602; ConvF(7.97, 7.97, 7.97); Calibrated: 5/20/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 4/7/2009
- Phantom: SAM Right Table; Type: SAM;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Body/Area Scan (7x11x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (measured) = 0.195 mW/g

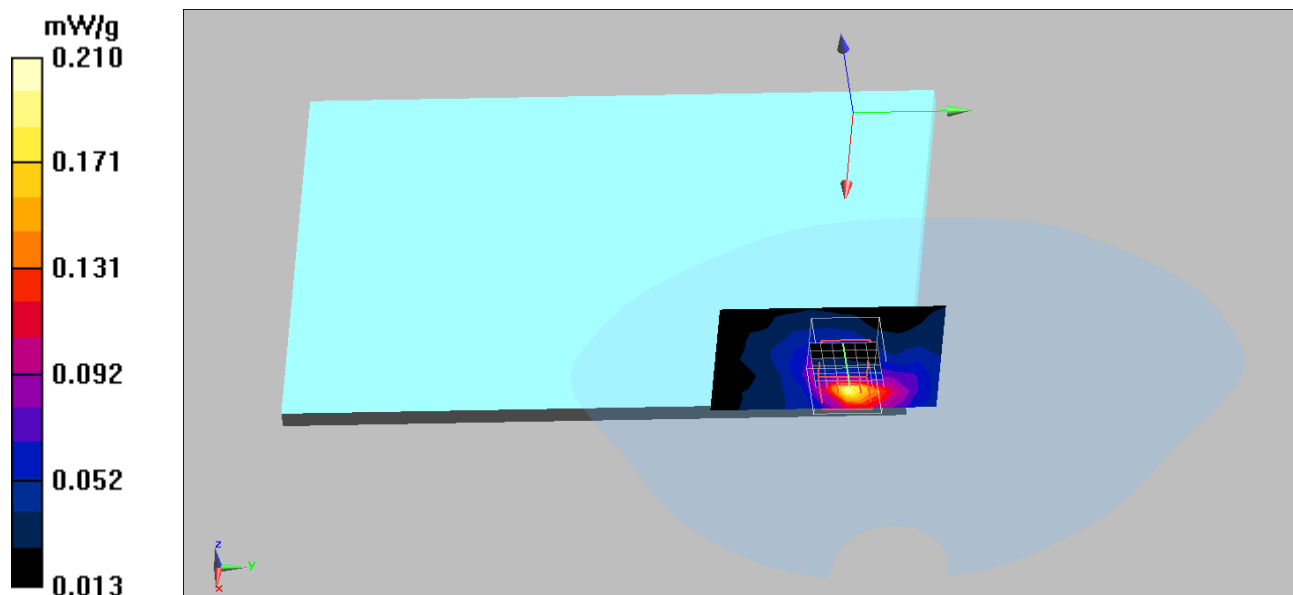
Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 7.66 V/m; Power Drift = 0.00707 dB

Peak SAR (extrapolated) = 0.406 W/kg

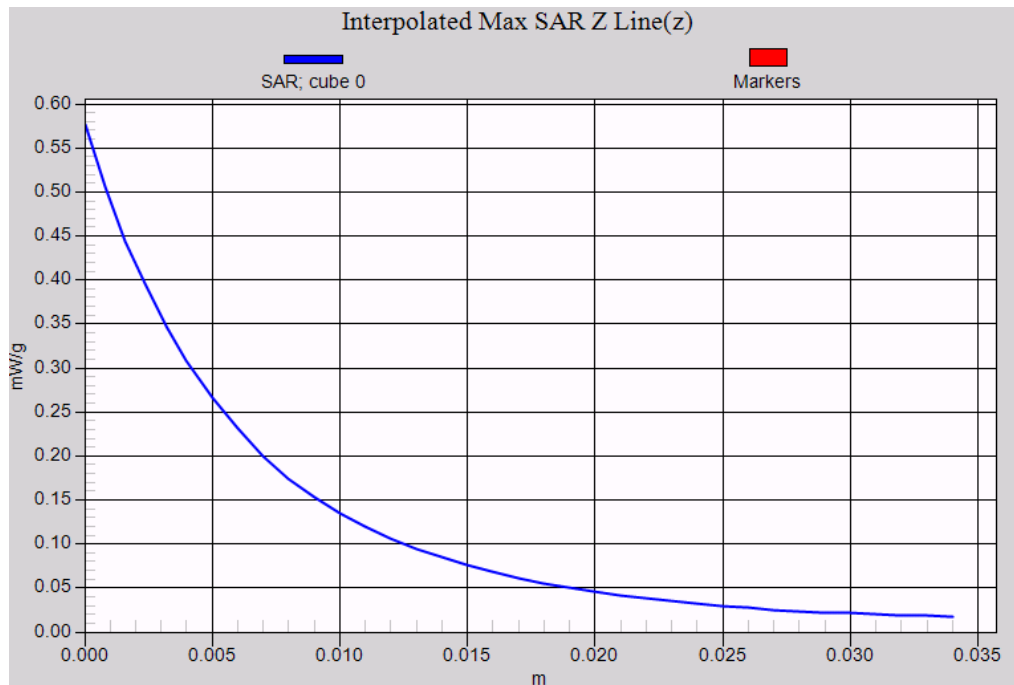
SAR(1 g) = 0.181 mW/g; SAR(10 g) = 0.090 mW/g

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



WCDMA Band II EUT Bottom Z-Axis plot

Channel: 9262





Appendix D. Probe Calibration Data

**Miniature Isotropic RF Probe
S/N: 3602**



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Client **Quietek (Auden)**

Certificate No: **EX3-3602_May09**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3602**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-14.v3 and QA CAL-23.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **May 20, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41283874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: May 20, 2009

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



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
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., $\vartheta = 0$ 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 $\vartheta = 0$ ($f \leq 900$ 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 effect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- 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 EX3DV4

SN:3602

Manufactured:	March 23, 2009
Calibrated:	May 20, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV4 SN:3602

Sensitivity in Free Space^A

Diode Compression^B

NormX	0.41 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	87 mV
NormY	0.40 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	89 mV
NormZ	0.52 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	89 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **900 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		2.0 mm	3.0 mm
SAR _{iso} [%]	Without Correction Algorithm	10.2	6.1
SAR _{iso} [%]	With Correction Algorithm	0.9	0.6

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		2.0 mm	3.0 mm
SAR _{iso} [%]	Without Correction Algorithm	6.7	2.9
SAR _{iso} [%]	With Correction Algorithm	0.5	0.3

Sensor Offset

Probe Tip to Sensor Center **1.0 mm**

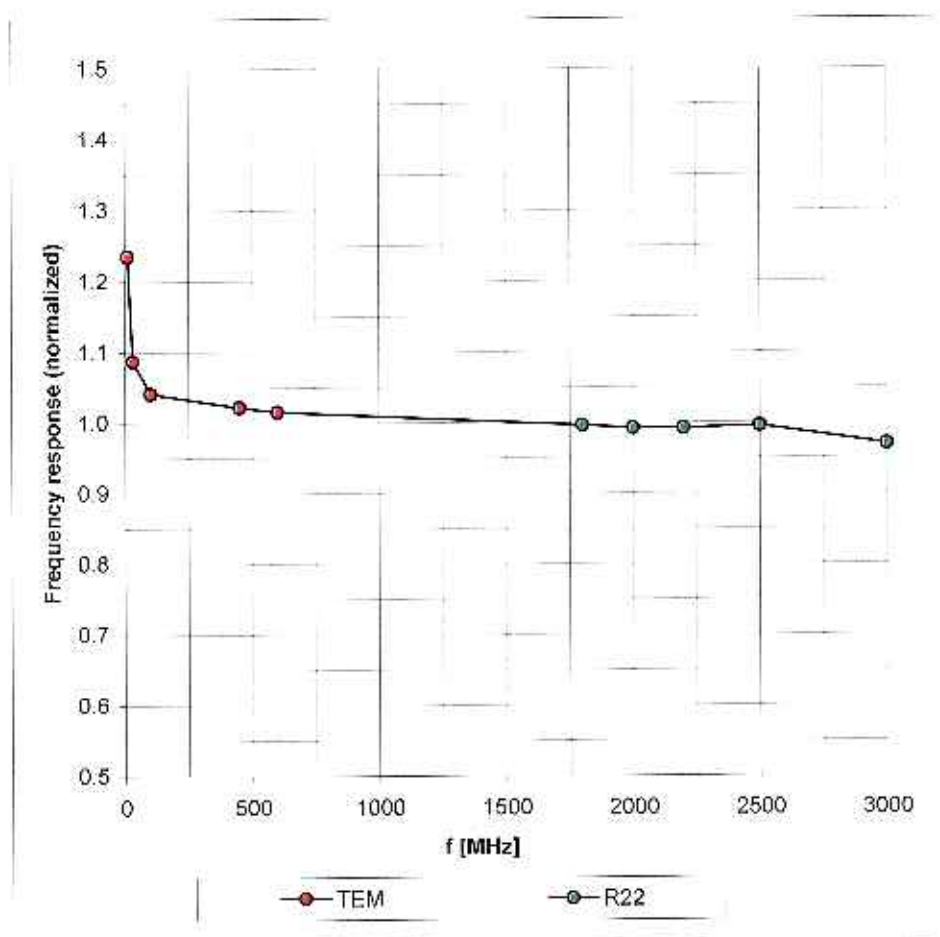
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL. (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

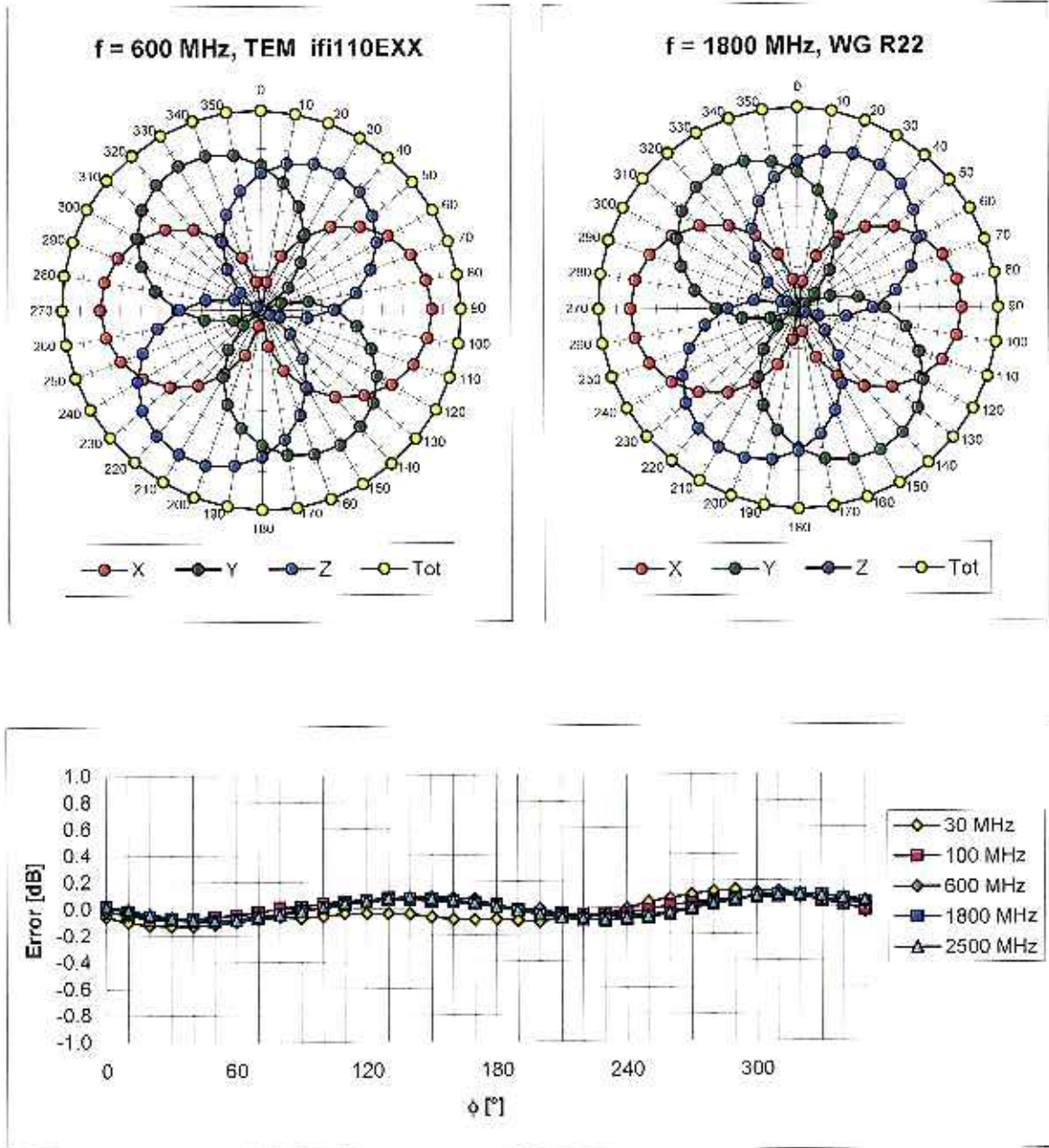
Frequency Response of E-Field

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



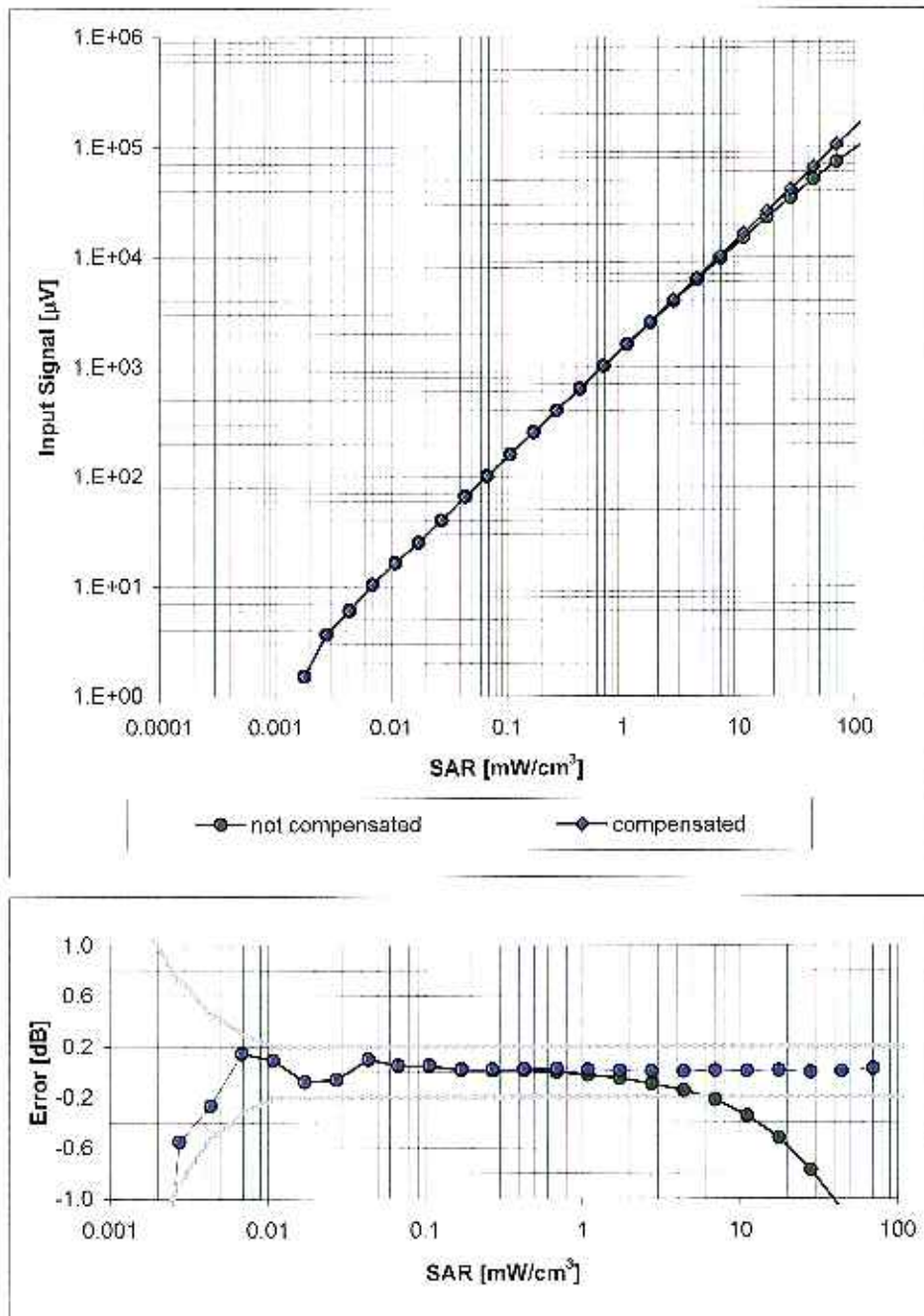
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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



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

Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$)



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

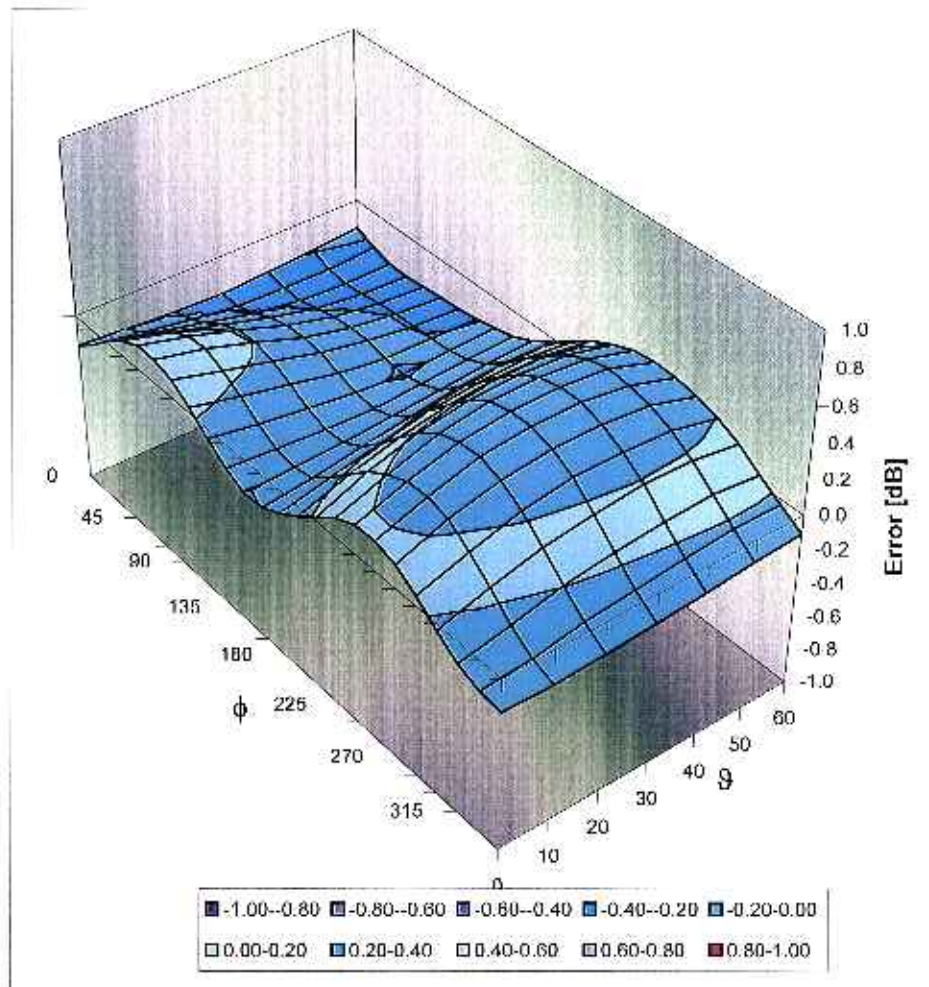
Conversion Factor Assessment

f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.56	0.71	9.14 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.65	0.65	8.86 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.84	0.55	7.81 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.84	0.56	7.55 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.46	0.70	7.10 ± 11.0% (k=2)
2600	± 50 / ± 100	Head	39.0 ± 5%	1.96 ± 5%	0.41	0.77	7.10 ± 11.0% (k=2)
3500	± 50 / ± 100	Head	37.9 ± 5%	2.91 ± 5%	0.42	1.00	6.26 ± 13.1% (k=2)
5200	± 50 / ± 100	Head	36.0 ± 5%	4.66 ± 5%	0.43	1.75	4.79 ± 13.1% (k=2)
5300	± 50 / ± 100	Head	35.9 ± 5%	4.76 ± 5%	0.43	1.75	4.43 ± 13.1% (k=2)
5500	± 50 / ± 100	Head	35.6 ± 5%	4.96 ± 5%	0.50	1.75	4.44 ± 13.1% (k=2)
5600	± 50 / ± 100	Head	35.5 ± 5%	5.07 ± 5%	0.50	1.75	4.42 ± 13.1% (k=2)
5800	± 50 / ± 100	Head	35.3 ± 5%	5.27 ± 5%	0.52	1.75	4.21 ± 13.1% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.72	0.65	9.32 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.55	0.74	8.97 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.70	0.65	7.97 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.48	0.78	7.68 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.42	0.79	6.90 ± 11.0% (k=2)
2600	± 50 / ± 100	Body	52.5 ± 5%	2.16 ± 5%	0.28	1.23	6.81 ± 11.0% (k=2)
3500	± 50 / ± 100	Body	51.3 ± 5%	3.31 ± 5%	0.35	1.22	5.75 ± 13.1% (k=2)
5200	± 50 / ± 100	Body	49.0 ± 5%	5.30 ± 5%	0.50	1.80	4.43 ± 13.1% (k=2)
5300	± 50 / ± 100	Body	48.5 ± 5%	5.42 ± 5%	0.52	1.80	4.23 ± 13.1% (k=2)
5500	± 50 / ± 100	Body	48.6 ± 5%	5.65 ± 5%	0.55	1.80	4.08 ± 13.1% (k=2)
5600	± 50 / ± 100	Body	48.5 ± 5%	5.77 ± 5%	0.55	1.80	3.95 ± 13.1% (k=2)
5800	± 50 / ± 100	Body	48.2 ± 5%	6.00 ± 5%	0.61	1.80	4.00 ± 13.1% (k=2)

^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.

Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)



Appendix E. Dipole Calibration

Validation Dipole 835 MHz

M/N: ALS-D-835

S/N: QTK-315

Validation Dipole 1900 MHz

M/N: ALS-D-1900

S/N: QTK-318



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 **Quietek (Auden)**

Certificate No: **ALS-835-QTK-315_May10**

CALIBRATION CERTIFICATE

Object **ALS-D-835 - SN: QTK-315**

Calibration procedure(s) **QA CAL-05.v7**
Calibration procedure for dipole validation kits

Calibration date: **May 21, 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-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
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	02-Mar-10 (No. DAE4-601_Mar10)	Mar-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-09)	In house check: Oct-10

Calibrated by: **Jeton Kastrati** **Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Signature

Issued: May 26, 2010

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



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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.7 $\pm$ 6 %	0.91 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.5 $\pm$ 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.32 mW / g
SAR normalized	normalized to 1W	9.28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.22 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.51 mW / g
SAR normalized	normalized to 1W	6.04 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.01 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.2 ± 6 %	0.98 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 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	2.46 mW / g
SAR normalized	normalized to 1W	9.84 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.72 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 mW / g
SAR normalized	normalized to 1W	6.44 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.39 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$49.2 \Omega + 0.5 j\Omega$
Return Loss	- 40.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$44.8 \Omega - 1.4 j\Omega$
Return Loss	- 24.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.583 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	APREL
Manufactured on	Not available

DASY5 Validation Report for Head TSL

Date/Time: 21.05.2010 11:41:57

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: ALS-D-835; Serial: ALS-D-835 - SN:QTK-315

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.91 \text{ mho/m}$; $\epsilon_r = 41.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.03.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 61

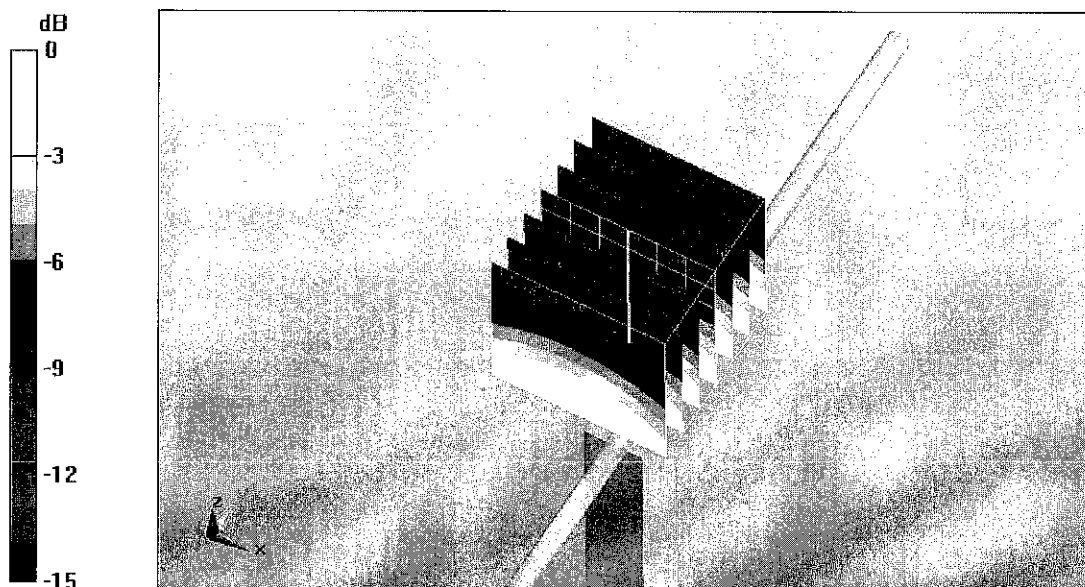
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.1 V/m ; Power Drift = -0.023 dB

Peak SAR (extrapolated) = 3.46 W/kg

SAR(1 g) = 2.32 mW/g ; SAR(10 g) = 1.51 mW/g

Maximum value of SAR (measured) = 2.71 mW/g

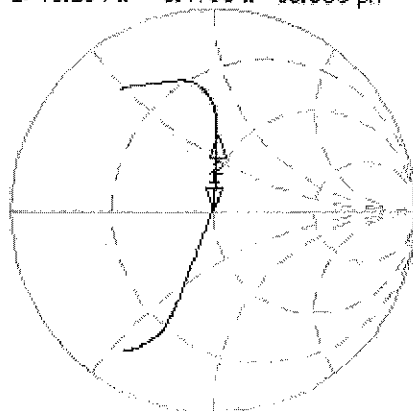


0 dB = 2.71 mW/g

Impedance Measurement Plot for Head TSL

21 May 2010 08:59:21
 CH1 S11 1 U FS 1: 49.164 Ω 0.4766 Ω 90.835 μ H 835.000 000 MHz

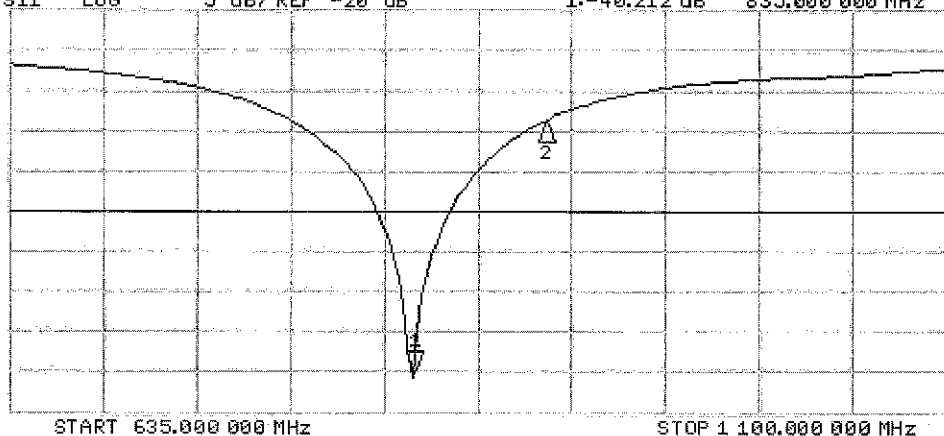
*
 Del
 Cor
 Avg
 16
 ↑



CH1 Markers
 2: 39.484 Ω
 33.041 Ω
 900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -40.212 dB 835.000 000 MHz

Cor
 Avg
 16
 ↑



CH2 Markers
 2: -8.7896 dB
 900.000 MHz

DASY5 Validation Report for Body

Date/Time: 21.05.2010 14:29:41

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: ALS-D-835; Serial: ALS-D-835 - SN:QTK-315

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.98 \text{ mho/m}$; $\epsilon_r = 54.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.03.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 61

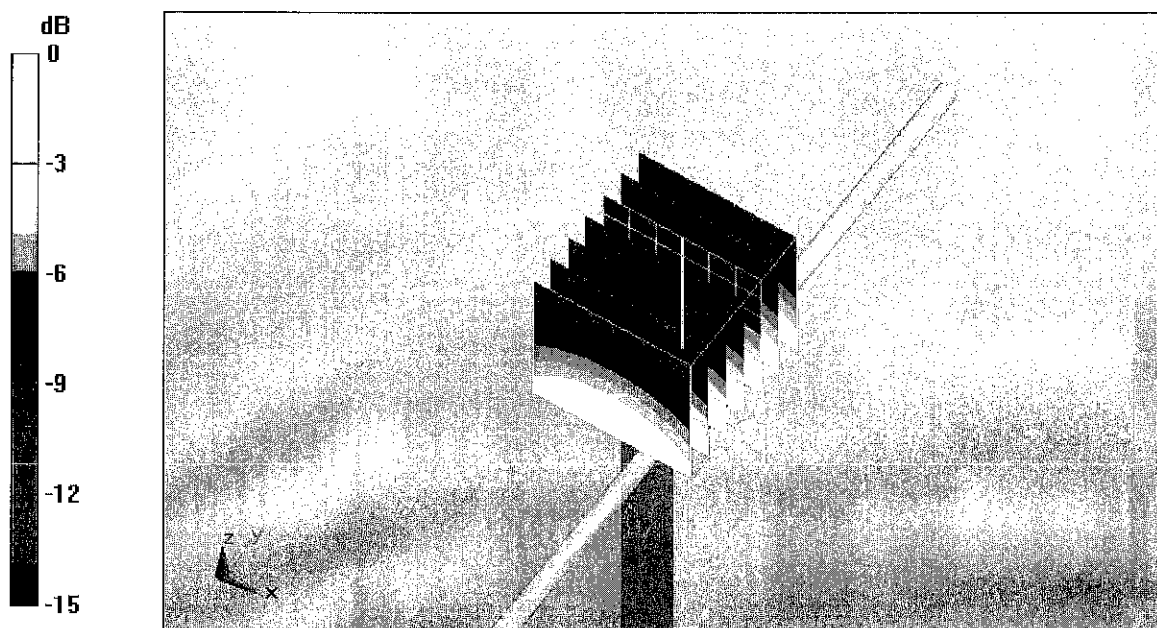
Pin250 mW/d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.7 V/m; Power Drift = 0.044 dB

Peak SAR (extrapolated) = 3.62 W/kg

SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.61 mW/g

Maximum value of SAR (measured) = 2.87 mW/g

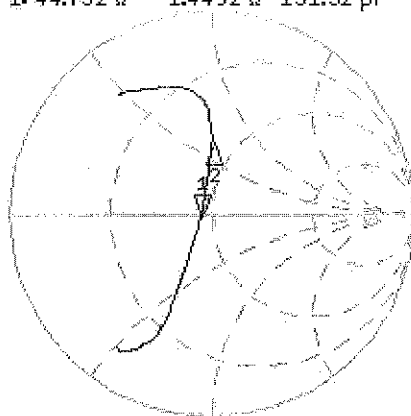


Impedance Measurement Plot for Body TSL

21 May 2010 15:03:52
 CH1 S11 1 U FS 1: 44.752 Ω -1.4492 Ω 131.52 pF 835.000 000 MHz

*
 Del
 Cor

Avg
 16

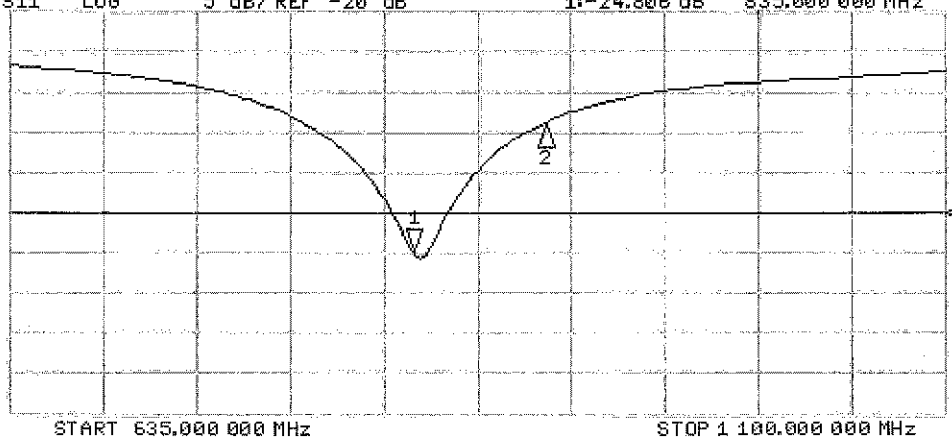


CH1 Markers
 2: 39.740 Ω
 30.904 Ω
 900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -24.806 dB 835.000 000 MHz

Cor

Avg
 16



CH2 Markers
 2: -9.2917 dB
 900.000 MHz



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Client **Quietek (Auden)**

Certificate No: **ALS-1900-QTK-318 May10**

CALIBRATION CERTIFICATE

Object **ALS-D-1900-SN: QTK-318**

Calibration procedure(s) **QA CAL-05.v7**
Calibration procedure for dipole validation kits

Calibration date: **May 26, 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-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
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	02-Mar-10 (No. DAE4-601_Mar10)	Mar-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-09)	In house check: Oct-10

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

Issued: May 28, 2010

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



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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.2
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	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.7 $\pm$ 6 %	1.41 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.5 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.65 mW / g
SAR normalized	normalized to 1W	38.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	38.4 mW /g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.00 mW / g
SAR normalized	normalized to 1W	20.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	19.9 mW /g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature during test	(21.6 ± 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	10.1 mW / g
SAR normalized	normalized to 1W	40.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.5 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.42 mW / g
SAR normalized	normalized to 1W	21.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.7 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$49.2\ \Omega + 6.3\ j\Omega$
Return Loss	- 23.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$45.2\ \Omega + 7.9\ j\Omega$
Return Loss	- 20.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.246 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	APREL
Manufactured on	Not available

DASY5 Validation Report for Head TSL

Date/Time: 25.05.2010 12:56:48

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:QTK-318

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.41$ mho/m; $\epsilon_r = 39.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.03.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 61

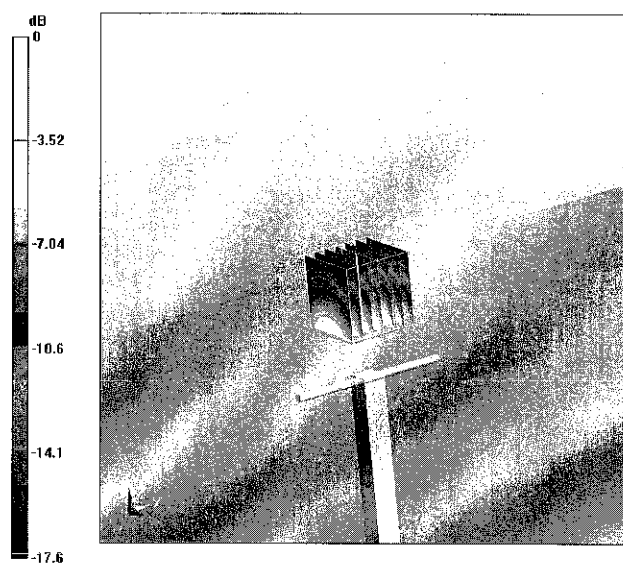
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.8 V/m; Power Drift = 0.052 dB

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 9.65 mW/g; SAR(10 g) = 5 mW/g

Maximum value of SAR (measured) = 12.1 mW/g



0 dB = 12.1mW/g

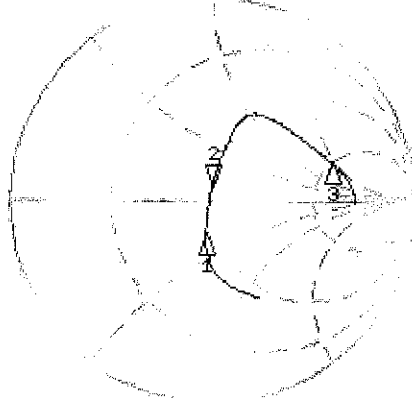
Impedance Measurement Plot for Head TSL

25 May 2010 10:07:02
 CH1 S11 1 U FS 2: 49.215 Ω 6.2676 Ω 525.01 pF 1 900.000 000 MHz

*
 Del
 Cor

Avg
 16

↑



CH1 Markers

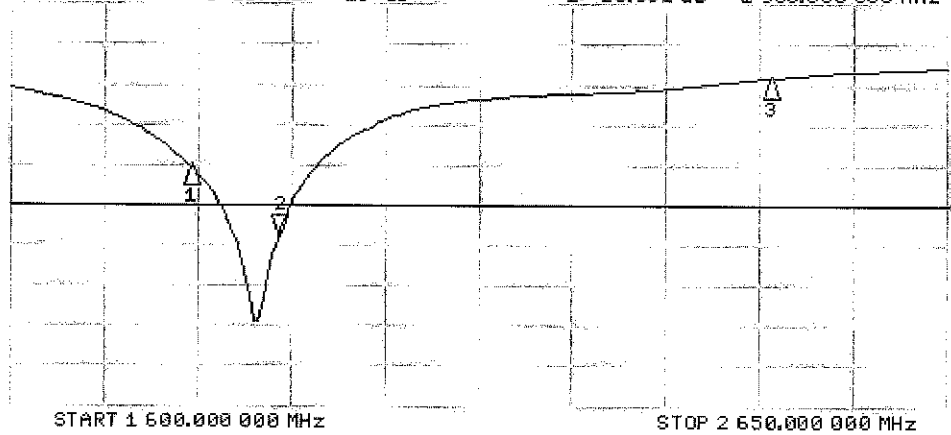
1: 44.340 Ω
 -15.813 Ω
 1.80000 GHz
 3: 152.32 Ω
 91.797 Ω
 2.45000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2: -23.961 dB 1 900.000 000 MHz

Cor

Avg
 16

↑



CH2 Markers

1: -15.113 dB
 1.80000 GHz
 3: -4.1702 dB
 2.45000 GHz

DASY5 Validation Report for Body

Date/Time: 26.05.2010 15:36:22

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:QTK-318

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.03.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 61

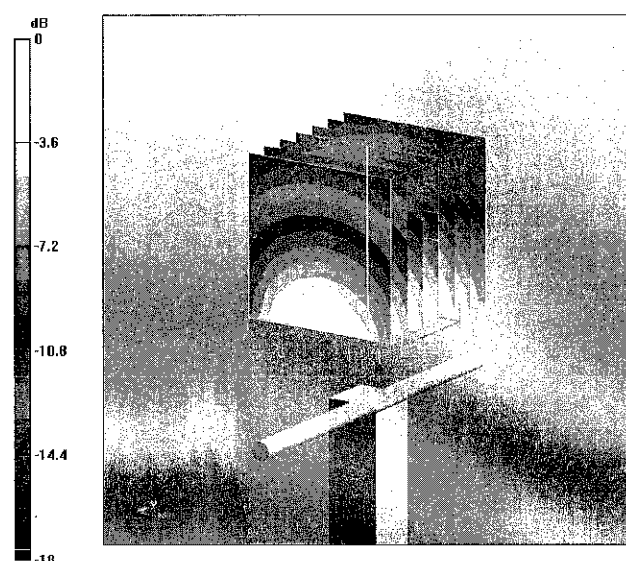
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.5 V/m; Power Drift = -0.018 dB

Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.42 mW/g

Maximum value of SAR (measured) = 12.7 mW/g



0 dB = 12.7mW/g

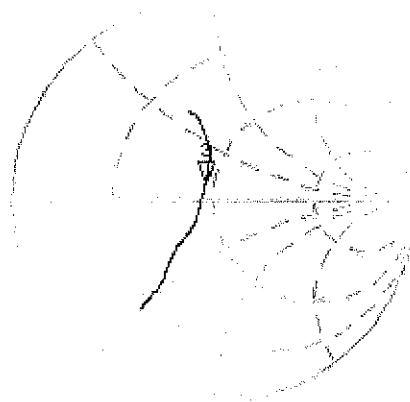
Impedance Measurement Plot for Body TSL

26 May 2010 09:14:44
 CH1 S11 1 U FS 3: 45.225 Ω 7.9160 Ω 663.09 μH 1 900.000 000 MHz

*
 Del
 Cor

Avg
 15

↑



CH2 S11 LOG 5 dB/REF -20 dB 3:-20.288 dB 1 900.000 000 MHz

Cor

Avg
 15

↑

