

A Test Lab Techno Corp.

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SAR EVALUATION REPORT

Test Report No.	: 1009FS14
Applicant	: Huawei Technologies Co., Ltd.
Product Type	: HSPA Module
Trade Name	: HUAWEI
Model Number	: EM770W
Dates of Test	: Aug. 28, 2010
Test Environment	: Ambient Temperature : $22 \pm 2^\circ \text{C}$ Relative Humidity : 40 - 70 %
Test Specification	: Standard C95.1-2005 IEEE Std. 1528-2003 2.1093;FCC/OET Bulletin 65 Supplement C [July 2001] RSS-102 Issue 3 (June 2009) FCC KDB 447498 D01 Mobile Portable RF Exposure V04, Published on Nov. 16, 2009 FCC KDB 616217 D01 SAR for Laptop with screen Ant V01, Published on Nov. 16, 2009 FCC KDB 941225 D01 SAR test for 3G devices V02
Max. SAR	: 1.460 W/kg Body SAR
Test Lab Location	: Chang-an Lab



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Sep. 24, 2010

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Sep. 24, 2010



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1. Description of Equipment under Test (EUT)

Applicant	: Huawei Technologies Co., Ltd.
Applicant Address	: Bantian, Longgang District, Shenzhen 518129, P. R. China
Manufacturer	: Huawei Technologies Co., Ltd.
Manufacturer Address	: Bantian, Longgang District, Shenzhen 518129, P. R. China
Product Type	: HSPA Module
Trade Name	: HUAWEI
Model Number	: EM770W
IMEI No.	: 357030020579369
FCC ID	: QISEM770W
IC ID	: 6369A-EM770W
Tx Frequency	: 1852.4 - 1907.6 MHz WCDMA(RMC 12.2K)/HSDPA/HSUPA Band II 826.4 - 846.6 MHz WCDMA(RMC 12.2K)/HSDPA/HSUPA Band V
RF Conducted Power	: 0.150 W / 21.76 dBm WCDMA(RMC 12.2K)/HSDPA/HSUPA Band II 0.205 W / 23.11 dBm WCDMA(RMC 12.2K)/HSDPA/HSUPA Band V
Max. SAR Measurement	: 1.460 W/kg Body SAR
Antenna Type	: PIFA Type
Device Category	: Mobile Device
RF Exposure Environment	: General Population / Uncontrolled
Battery Option	: Standard
Application Type	: Certification
Host Notebook PC	: Trade Name: PEGATRON Model Number: Lucid Manufacturer (1): Pegatron Corporation 5F, No. 76, Ligong St., Beitou District, Taipei City 112, Taiwan (R.O.C.) Manufacturer (2): Maintek Computer (Suzhou) Co., Ltd 233 Jin Feng Road, Suzhou City New District, Jiangsu Province, China Manufacturer (3): Protek (Shanghai) Limited No. 3768 Xiu Yan Rd., Nanhui District, Shanghai, China

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure limits specified in Standard C95.1-2005 / RSS-102 Issue 3 (June 2009) and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2003.



2. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user of **Huawei Technologies Co., Ltd. Trade Name : HUAWEI Model(s) : EM770W**. The test procedures, as described in American National Standards, Institute C95.1 - 2005 [1], FCC/OET Bulletin 65 Supplement C [July 2001] and RSS-102 Issue 3 (June 2009) were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 25cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

3. SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dw) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Figure 2).

SAR Mathematical Equation

$$\text{SAR} = \frac{d}{dt} \left(\frac{dw}{dm} \right) = \frac{d}{dt} \left(\frac{dw}{\rho dv} \right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

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

Where :

σ = conductivity of the tissue (S/m)

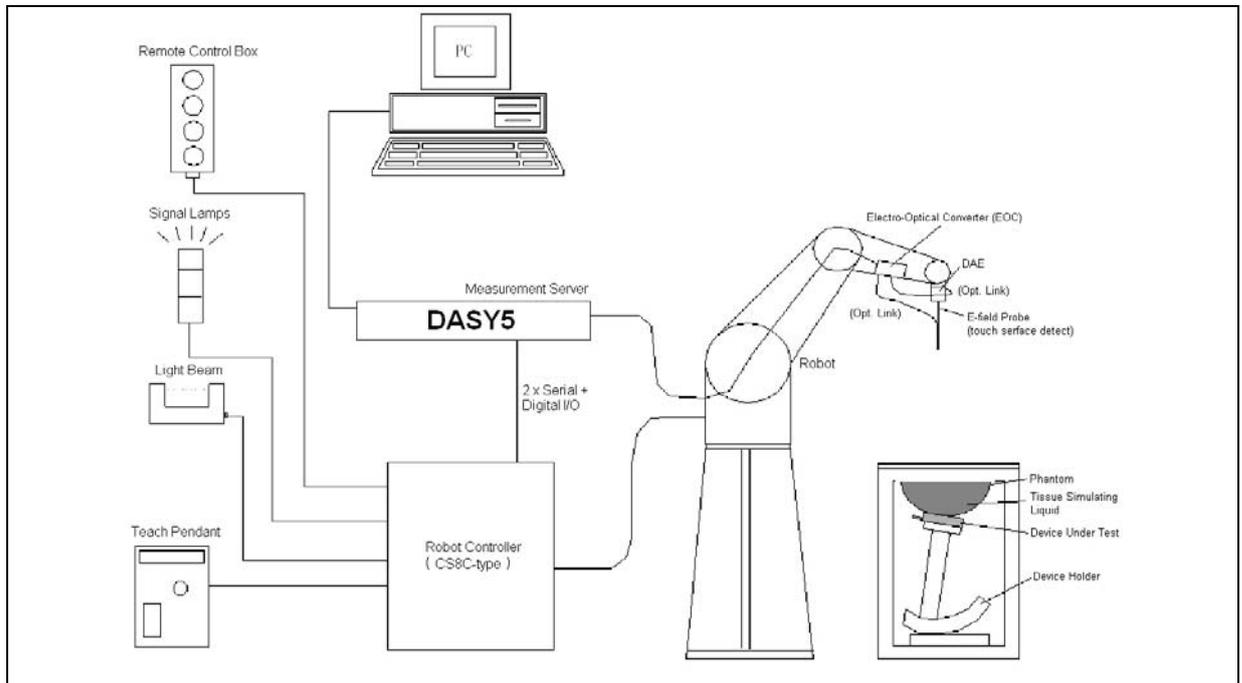
ρ = mass density of the tissue (kg/m³)

E = RMS electric field strength (V/m)

* Note :

The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane [2]

4. SAR Measurement Setup



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

1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. 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.
4. 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.
5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
6. A computer operating Windows 2003.
7. DASY5 software.
8. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The SAM twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. Validation dipole kits allowing validating the proper functioning of the system.



5. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Last Calibration	Remark
SPEAG	Dosimetric E-Field Probe	EX3DV4	3632	01/26/2010	(1)
SPEAG	835MHz System Validation Kit	D835V2	4d082	07/20/2010	(1)
SPEAG	1900MHz System Validation Kit	D1900V2	5d111	07/16/2010	(1)
SPEAG	Data Acquisition Electronics	DAE4	779	01/21/2010	(1)
SPEAG	Device Holder	N/A	N/A	NCR	-----
SPEAG	Phantom	SAM V4.0	TP-1150	NCR	-----
SPEAG	Robot	Staubli TX90XL	F07/564ZA1/C/01	NCR	-----
SPEAG	Software	DASY5 V5.0 Build 125	N/A	NCR	-----
SPEAG	Software	SEMCAD X V13.4 Build 125	N/A	NCR	-----
SPEAG	Measurement Server	SE UMS 011 AA	1025	NCR	-----
R&S	Wireless Communication Test Set	CMU200	109369	08/10/2010	(1)
Agilent	Wireless Communication Test Set	E5515C	GB47020167	05/25/2010	(1)
Agilent	ENA Series Network Analyzer	E5071B	MY42402996	11/04/2009	(2)
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	-----
R&S	Power Sensor	NRP-Z22	100179	05/20/2010	(1)
Agilent	Signal Generator	E8257D	MY44320425	03/09/2009	(2)
Agilent	Dual Directional Coupler	778D	50334	NCR	-----
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	-----
Mini-Circuits	Power Amplifier	ZVE-8G-SMA	D042005 671800514	NCR	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

NOTE: N.C.R. = No Calibration Request.



6. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue. The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 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 human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

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 $\rho = 1000 \text{ kg/m}^3$)				
Table 1. Tissue dielectric parameters for head and body phantoms				



6.1 Ingredients

The following ingredients are used:

- Water: deionized water (pure H₂O), resistivity $\geq 16 \text{ M } \Omega$ -as basis for the liquid
- Sugar: refined white sugar (typically 99.7 % sucrose, available as crystal sugar in food shops) to reduce relative permittivity
- Salt: pure NaCl -to increase conductivity
- Cellulose: Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20° C), CAS # 54290 -to increase viscosity and to keep sugar in solution.
- Preservative: Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 -to prevent the spread of bacteria and molds
- DGBE: Diethylenglycol-monobuthyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

6.2 Recipes

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

Note: The goal dielectric parameters (at 22 °C) must be achieved within a tolerance of $\pm 5\%$ for ϵ and σ .

Liquid type	MSL 900-B	
Ingredient	Weight (g)	Weight (%)
Water	633.91	50.75
Sugar	602.12	50.75
Cellulose	-	0.00
Salt	11.76	0.94
Preventol	1.20	0.10
Total amount	1,249.00	100.00
Goal dielectric parameters		
Frequency [MHz]	835	900
Relative Permittivity	55.2	55.0
Conductivity [S/m]	0.97	1.05

Liquid type	MSL 1950-A	
Ingredient	Weight (g)	Weight (%)
Water	697.94	69.79
DGBE	300.03	30.00
Salt	2.03	0.20
Total amount	1,000.00	100.00
Goal dielectric parameters		
Frequency [MHz]	1950	2000
Relative Permittivity	53.3	53.3
Conductivity [S/m]	1.52	1.52

6.3 Liquid Confirmation

6.3.1 Parameters

Liquid Verify (Ambient Temperature : 22 ± 2 °C ; Relative Humidity : 40 -70%)								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
835MHz Body	820MHz	22.0	ϵ_r	55.2	54.71	-0.88	± 5	08/28/2010
			σ	0.97	0.96	-0.67	± 5	
	835MHz	22.0	ϵ_r	55.2	54.68	-0.95	± 5	
			σ	0.97	0.98	1.11	± 5	
	850MHz	22.0	ϵ_r	55.2	54.67	-0.95	± 5	
			σ	0.97	1.00	3.18	± 5	
1900MHz Body	1850MHz	22.0	ϵ_r	53.3	52.60	-1.31	± 5	08/28/2010
			σ	1.52	1.46	-3.98	± 5	
	1900MHz	22.0	ϵ_r	53.3	52.65	-1.22	± 5	
			σ	1.52	1.51	-0.74	± 5	
	1930MHz	22.0	ϵ_r	53.3	52.45	-1.59	± 5	
			σ	1.52	1.55	2.15	± 5	

Table 2. Measured Tissue dielectric parameters for head and body phantoms

6.3.2 Liquid Depth

The liquid level was during measurement $15\text{cm} \pm 0.5\text{cm}$.

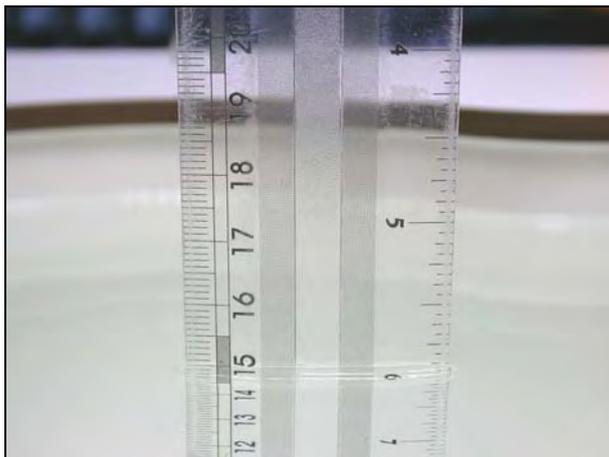


Figure 2. Head-Tissue-Simulating-Liquid

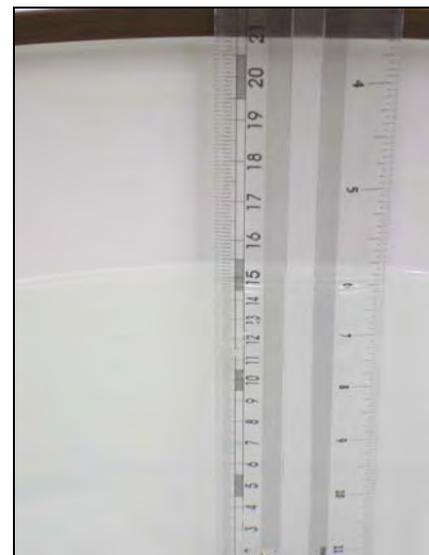


Figure 3. Body-Tissue-Simulating-Liquid



7. Measurement Process

7.1 Device and Test Conditions

The Test Device was provided by **Huawei Technologies Co., Ltd.** for this evaluation. The spatial peak SAR values were assessed for the lowest, middle and highest channels defined by **WCDMA(RMC 12.2K) / HSPDA / HSUPA Band II** (#9692=1852.4MHz, #9400=1880.0MHz, #9538=1907.6MHz) and **WCDMA(RMC 12.2K) / HSPDA / HSUPA Band V** (#4132=826.4MHz, #4183=836.6MHz, #4233=846.4MHz) systems..

HSDPA Date Devices setup for SAR Measurement.

HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors(β_c , β_d), and HS-DPCCH power offset parameters (Δ_{ACK} , Δ_{NACK} , Δ_{CQI}) should be set according to values indicated in the Table below.³² The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.³³

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1,2)}$	CM (dB) ⁽³⁾	MRP (dB) ⁽³⁾
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	12/15 ⁽⁴⁾	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note

- Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$
- For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude(EVM) with HS-DPCCH test in clause 5.13.1A and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and $\Delta_{NACK} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$ and $\Delta_{CQI} = 24/15$ with $\beta_{hs} = 24/15 * \beta_c$
- CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
- For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

Table 3. Setup for Release 5 HSDPA



HSPA Data Devices setup for SAR Measurement.

The following procedures are applicable to HSPA (HSUPA/HSDPA) data devices operating under 3GPP Release 6. Body exposure conditions generally apply to these devices, including handsets and data modems operating in various electronic devices. HSUPA operates in conjunction with WCDMA and HSDPA. SAR is initially measured in WCDMA test configurations without HSPA. The default test configuration is to establish a radio link between the DUT and a communication test set to configure a 12.2 kbps RMC (reference measurement channel) in Test Loop Mode 1. SAR for HSPA is selectively measured with HS-DPCCH, EDPCCH and E-DPDCH, all enabled, along with a 12.2 kbps RMC using the highest SAR configuration in WCDMA with 12.2 kbps RMC only. An FRC is configured according to HSDPCCH Sub-test 1 using H-set 1 and QPSK. HSPA is configured according to E-DCH Subtest 5 requirements. SAR for other HSPA sub-test configurations is also confirmed selectively according to output power, exposure conditions and E-DCH UE Category. Maximum output power is verified according to procedures in applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. The UE Categories for HSDPCCH and HSPA should be clearly identified in the SAR report. The following procedures are applicable only if Maximum Power Reduction (MPR) is implemented according to Cubic Metric (CM) requirements.

When voice transmission and head exposure conditions are applicable to a WCDMA/HSPA data device, head exposure is measured according to the 'Head SAR Measurements' procedures in the 'WCDMA Handsets' section of this document. SAR for body exposure configurations are measured according to the 'Body SAR Measurements' procedures in the 'WCDMA Handsets' section of this document. In addition, body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least $\frac{1}{4}$ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than $\frac{1}{4}$ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurements should be used to test for head exposure.

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA should be configured according to the β values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of this document.



The highest body SAR measured in Antenna Extended & Retracted configurations on a channel in 12.2 kbps RMC. The possible channels are the High, Middle & Low channel. Contact the FCC Laboratory for test and approval requirements if the maximum output power measured in E-DCH Sub-test 2 - 4 is higher than Sub-test 5.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	β_{ec}	β_{ed}	Bed (SF)	Bed (codes)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFCI
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Table 4. Setup for Release 6 HSPA / Release 7 HSPA+



7.2 RF Conducted Output Power

Band	Sub-test	CH	Frequency (MHz)	Burst – Average Conducted power (dBm)	Peak Conducted power (dBm)
WCDMA(RMC 12.2K) Band II	-----	Lowest	1852.4	21.16	22.62
		Middle	1880.0	21.76	22.61
		Highest	1907.6	21.40	22.69
HSDPA Band II	1	Lowest	1852.4	21.13	22.59
		Middle	1880.0	21.64	22.48
		Highest	1907.6	21.22	22.62
	2	Lowest	1852.4	21.05	22.52
		Middle	1880.0	21.60	22.43
		Highest	1907.6	21.17	22.56
	3	Lowest	1852.4	20.70	22.17
		Middle	1880.0	21.20	22.07
		Highest	1907.6	20.78	22.14
	4	Lowest	1852.4	20.71	22.10
		Middle	1880.0	21.19	22.07
		Highest	1907.6	20.74	22.13
HSUPA Band II	1	Lowest	1852.4	20.96	21.68
		Middle	1880.0	21.22	22.31
		Highest	1907.6	20.98	21.79
	2	Lowest	1852.4	18.98	19.72
		Middle	1880.0	19.26	20.32
		Highest	1907.6	19.00	19.85
	3	Lowest	1852.4	20.02	20.72
		Middle	1880.0	20.23	21.32
		Highest	1907.6	20.00	20.82
	4	Lowest	1852.4	18.97	19.71
		Middle	1880.0	19.27	20.33
		Highest	1907.6	19.04	19.81
	5	Lowest	1852.4	20.96	21.65
		Middle	1880.0	21.18	22.27
		Highest	1907.6	20.96	21.71



Band	Sub-test	CH	Frequency (MHz)	Burst – Average Conducted power (dBm)	Peak Conducted power (dBm)
WCDMA(RMC 12.2K) Band V	-----	Lowest	826.4	22.90	24.15
		Middle	836.6	23.11	24.22
		Highest	846.4	23.00	23.98
HSDPA Band V	1	Lowest	826.4	22.90	23.95
		Middle	836.6	23.10	24.16
		Highest	846.4	22.94	23.99
	2	Lowest	826.4	22.82	23.89
		Middle	836.6	23.04	24.13
		Highest	846.4	22.85	23.89
	3	Lowest	826.4	22.44	23.48
		Middle	836.6	22.61	23.69
		Highest	846.4	22.49	23.57
	4	Lowest	826.4	22.44	23.49
		Middle	836.6	22.61	23.69
		Highest	846.4	22.45	23.52
HSUPA Band V	1	Lowest	826.4	22.38	22.51
		Middle	836.6	22.20	22.33
		Highest	846.4	21.91	22.24
	2	Lowest	826.4	20.44	20.55
		Middle	836.6	20.20	20.36
		Highest	846.4	19.95	20.32
	3	Lowest	826.4	21.39	21.51
		Middle	836.6	21.22	21.36
		Highest	846.4	20.93	21.32
	4	Lowest	826.4	20.46	20.53
		Middle	836.6	20.24	20.38
		Highest	846.4	20.00	20.32
	5	Lowest	826.4	22.31	22.48
		Middle	836.6	22.17	22.33
		Highest	846.4	21.87	22.21



7.3 Test Mode Description

The device was tested in four different positions. They are bottom of tablet PC, Secondary Landscape, and Primary / Secondary Portrait. In these positions, the surface of DUT is touching with phantom 0cm gap.

The test position of Primary Landscape was not performed because the distance between WWAN and WLAN antennas were larger than 5cm. We expect that the SAR Value for this position will very low.

Body					
Band	CH	Phantom Position			Note
		Bottom	Secondary Landscape	Secondary Portrait	
WCDMA (RMC 12.2K) Band II	Low	■	■		
	Middle	■	■	■	
	High	■	■		
HSDPA Band II	Low	■			
	Middle	■			
	High	■			
HSUPA Band II	Low	■			
	Middle	■			
	High	■			
WCDMA (RMC 12.2K) Band V	Low	■			
	Middle	■	■	■	
	High	■			
HSDPA Band V	Low	■			
	Middle	■			
	High	■			
HSUPA Band V	Low	■			
	Middle	■			
	High	■			



7.4 Simultaneous Transmitting Evaluate

RF Conducted Power		
Band	dBm	W
WCDMA/HSDPA/HPUPA Band V	23.11	0.20
WCDMA/HSDPA/HPUPA Band II	21.76	0.15
Wi-Fi 802.11b	17.70	0.06
Wi-Fi 802.11g	17.00	0.05
Wi-Fi 802.11n_HT20	16.90	0.05
Wi-Fi 802.11n_HT40	15.27	0.03
BT	2.15	0.002

Antenna Distance	
Antenna Account	Distance (cm)
BT to WLAN	3.2
BT to WANM(License)	9.6
WLAN to WWAN(License)	14.4

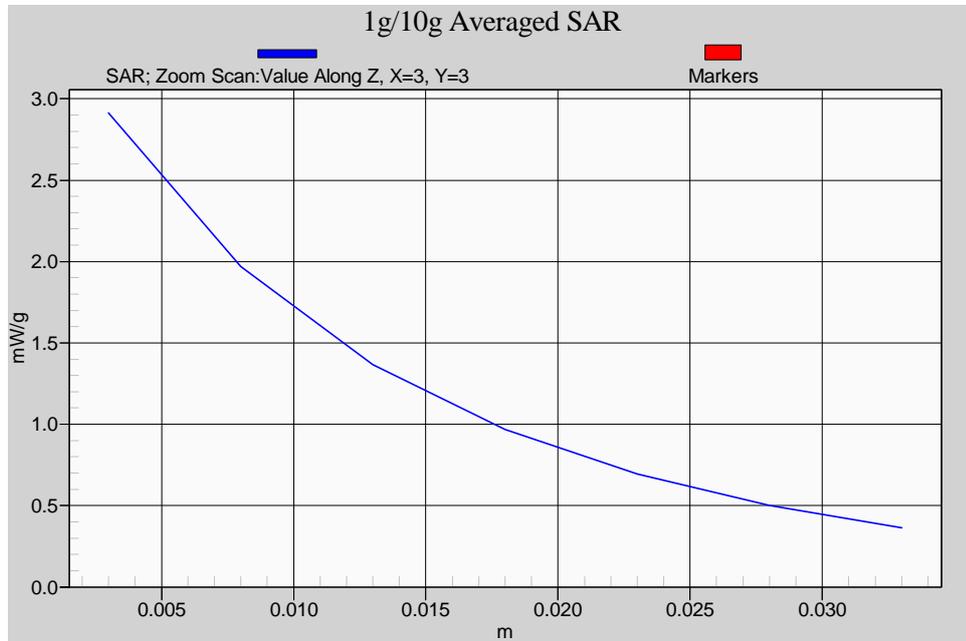
※ All system can't use at the same time.

7.5 System Performance Check

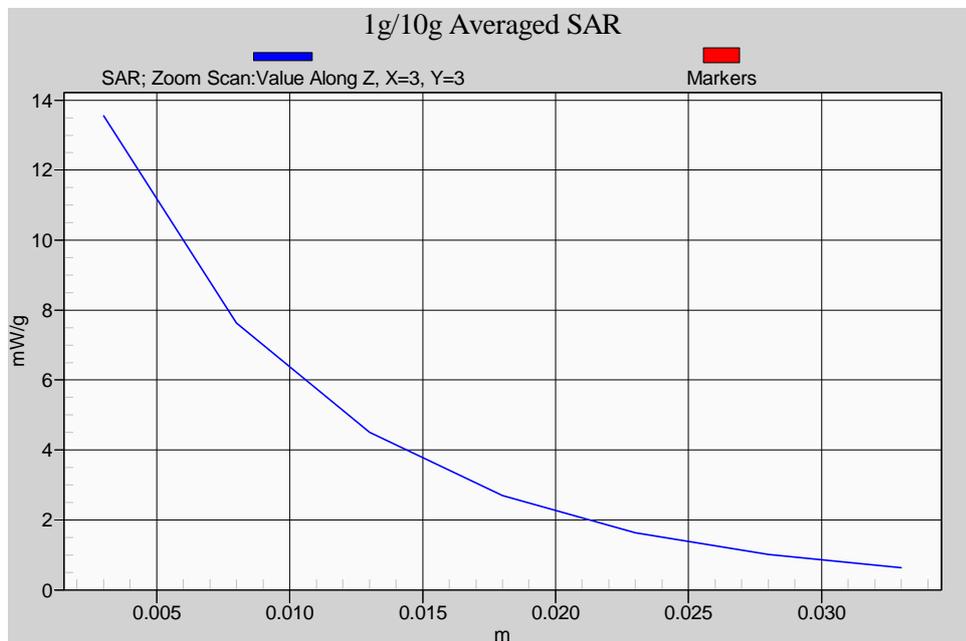
Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of $\pm 7\%$. The validation was performed at 835MHz and 1900MHz.

Validation kit		Mixture Type	SAR _{1g} [mW/g]		SAR _{10g} [mW/g]		Date of Calibration
D835V2-SN4d082		Body	10.32		6.76		07/20/2009
D1900V2-SN5d111		Body	42.4		22.64		07/16/2009
Frequency (MHz)	Power (dBm)	SAR _{1g} (mW/g)	SAR _{10g} (mW/g)	Drift (dB)	Difference Percentage		Date of Test
					1g	10g	
835 (Body)	250mW	2.49	1.63	0.054	-3.5 %	-3.6 %	08/28/2010
	Normalize to 1 Watt	9.96	6.52				
1900 (Body)	250mW	10.6	5.52	0.186	0.0 %	-2.5 %	08/28/2010
	Normalize to 1 Watt	42.4	22.08				

Z-axis Plot of System Performance Check



Body-Tissue-Simulating-Liquid 835MHz



Body-Tissue-Simulating-Liquid 1900MHz



7.6 Measurement Procedures

The evaluation was performed with the following procedures :

Surface Check : A surface checks job gathers data used with optical surface detection. It determines the distance from the phantom surface where the reflection from the optical detector has its peak. Any following measurement jobs using optical surface detection will then rely on this value. The surface check performs its search a specified number of times, so that the repeatability can be verified. The probe tip distance is 1.3mm to phantom inner surface during scans.

Reference : The reference job measures the field at a specified reference position, at 4 mm from the selected section's grid reference point.

Area Scan : The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines can find the maximum locations even in relatively coarse grids. 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. Any following zoom scan within the same procedure will then perform fine scans around these maxima. The area covered the entire dimension of the EUT and the horizontal grid spacing was 15 mm x 15 mm.

Zoom Scan : Zoom scans are used to assess the highest averaged SAR for cubic averaging volumes with 1 g and 10 g of simulated tissue. The zoom scan measures 7 x 7 x 9 points in a 30 x 30 x 24 mm cube whose base faces are centered around the maxima returned from a preceding area scan within the same procedure.

Drift : The drift job measures the field at the same location as the most recent reference job within the same procedure, with the same settings. The drift measurement gives the field difference in dB from the last reference measurement. Several drift measurements are possible for each reference measurement. This allows monitoring of the power drift of the device in the batch process. If the value changed by more than 5%, the evaluation was repeated.



7.7 Spatial Peak SAR Evaluation

The DASY5 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. Based on the Draft: SCC-34, SC-2, WG-2 - Computational Dosimetry, IEEE P1529/D0.0 (Draft Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) Associated with the Use of Wireless Handsets - Computational Techniques), a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

The base for the evaluation is a "cube" measurement in a volume of $(32 \times 32 \times 30) \text{mm}^3$ ($5 \times 5 \times 7$ points). The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Postprocessing engine (SEMCAD). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

The entire evaluation of the spatial peak values is performed within the Postprocessing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into three stages:

Interpolation and Extrapolation

The probe is calibrated at the center of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY5, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and SAR extrapolation routines. The interpolation, Maxima Search and extrapolation routines are all based on the modified Quadratic Shepard's method [7].



8. Measurement Uncertainty

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than $\pm 21.4\%$ [8] .

According to Std. C95.3 [9], the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ± 1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ± 2 dB can be expected.

According to CENELEC [10] , typical worst-case uncertainty of field measurements is ± 5 dB. For well-defined modulation characteristics the uncertainty can be reduced to ± 3 dB.



Error Description	Uncertainty value	Prob. Dist.	Div.	(c) 1g	(c) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v) v _{eff}
Measurement System								
Probe Calibration	± 5.5 %	N	1	1	1	± 5.5 %	± 5.5 %	
Axial Isotropy	± 4.7 %	R		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						± 10.7 %	± 10.5 %	387
Expanded STD Uncertainty						± 21.4 %	± 21.0 %	

Table 5. Uncertainty Budget of DASY



9. SAR Test Results Summary

Detail results see Appendix B.

9.1 WCDMA (RMC 12.2K) / HSDPA / HSUPA Band II - Body SAR

Ambient :

Temperature (°C) : 22 ± 2 Relative HUMIDITY (%) : 40-70

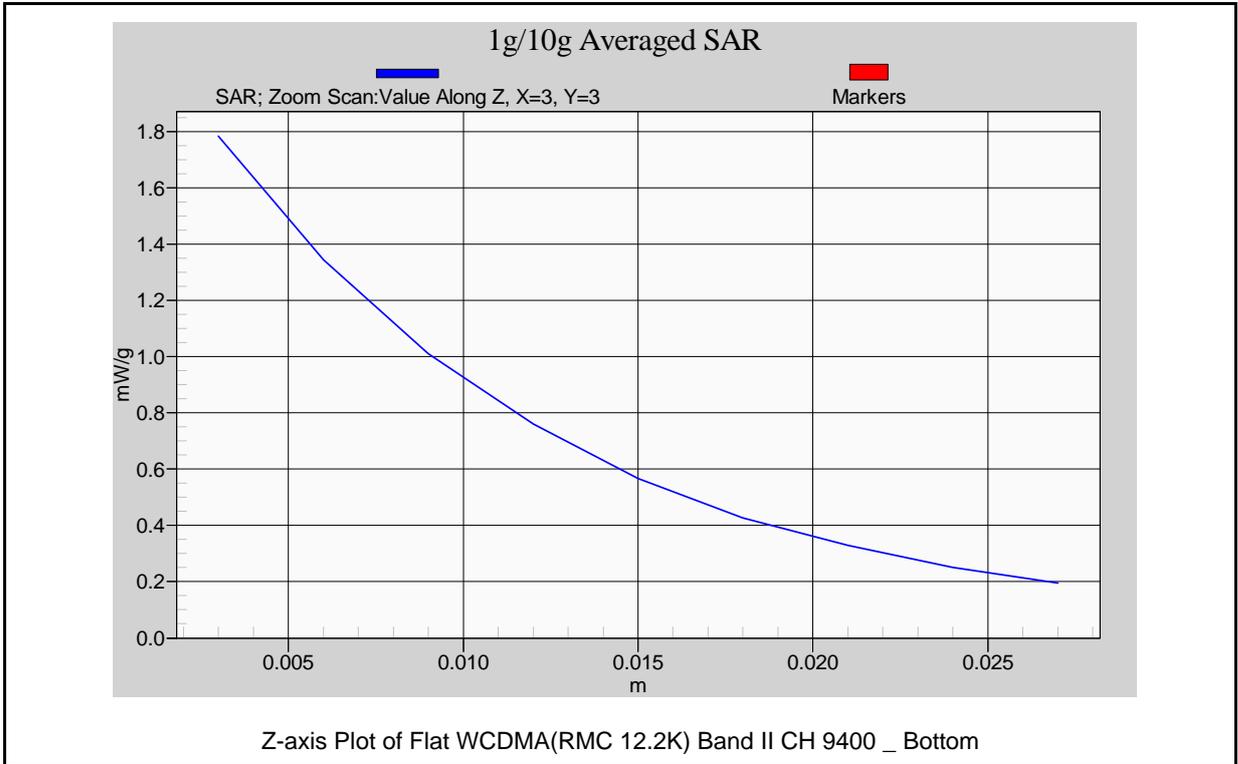
Liquid :

Mixture Type : MSL1900 Liquid Temperature (°C) : 22.0
 Depth of liquid (cm) : 15

Measurement :

Duty Cycle : 1:1 Probe S/N : 3632

Frequency		Band	Power (dBm)	Phantom Position	Antenna Position	Accessory	SAR _{1g} [mW/g]	Power Drift (dB)	Remark
MHz	CH								
1852.4	9262	WCDMA Band II	21.16	Flat	PIFA	N/A	1.010	-0.048	Bottom
1880.0	9400	WCDMA Band II	21.76	Flat	PIFA	N/A	1.460	-0.031	Bottom
1907.6	9538	WCDMA Band II	21.40	Flat	PIFA	N/A	1.400	0.146	Bottom
1852.4	9262	HSDPA Band II	21.13	Flat	PIFA	N/A	1.330	-0.121	Bottom
1880.0	9400	HSDPA Band II	21.64	Flat	PIFA	N/A	1.360	-0.056	Bottom
1907.6	9538	HSDPA Band II	21.22	Flat	PIFA	N/A	1.310	-0.141	Bottom
1852.4	9262	HSUPA Band II	20.96	Flat	PIFA	N/A	1.130	-0.183	Bottom
1880.0	9400	HSUPA Band II	21.22	Flat	PIFA	N/A	1.160	-0.123	Bottom
1907.6	9538	HSUPA Band II	20.98	Flat	PIFA	N/A	1.110	-0.088	Bottom
1852.4	9262	WCDMA Band II	21.16	Flat	PIFA	N/A	0.901	0.188	Secondary Landscape
1880.0	9400	WCDMA Band II	21.76	Flat	PIFA	N/A	1.130	0.126	Secondary Landscape
1907.6	9538	WCDMA Band II	21.40	Flat	PIFA	N/A	1.030	0.156	Secondary Landscape
1852.4	9400	WCDMA Band II	21.76	Flat	PIFA	N/A	0.228	0.055	Secondary Portrait
Std. C95.1-2005 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population						1.6 W/kg (mW/g) Averaged over 1 gram			





9.2 WCDMA (RMC 12.2K) / HSDPA / HSUPA Band V - Body SAR

Ambient :

Temperature (°C) : 22 ± 2

Relative HUMIDITY (%) : 40-70

Liquid :

Mixture Type : MSL835

Liquid Temperature (°C) : 22.0

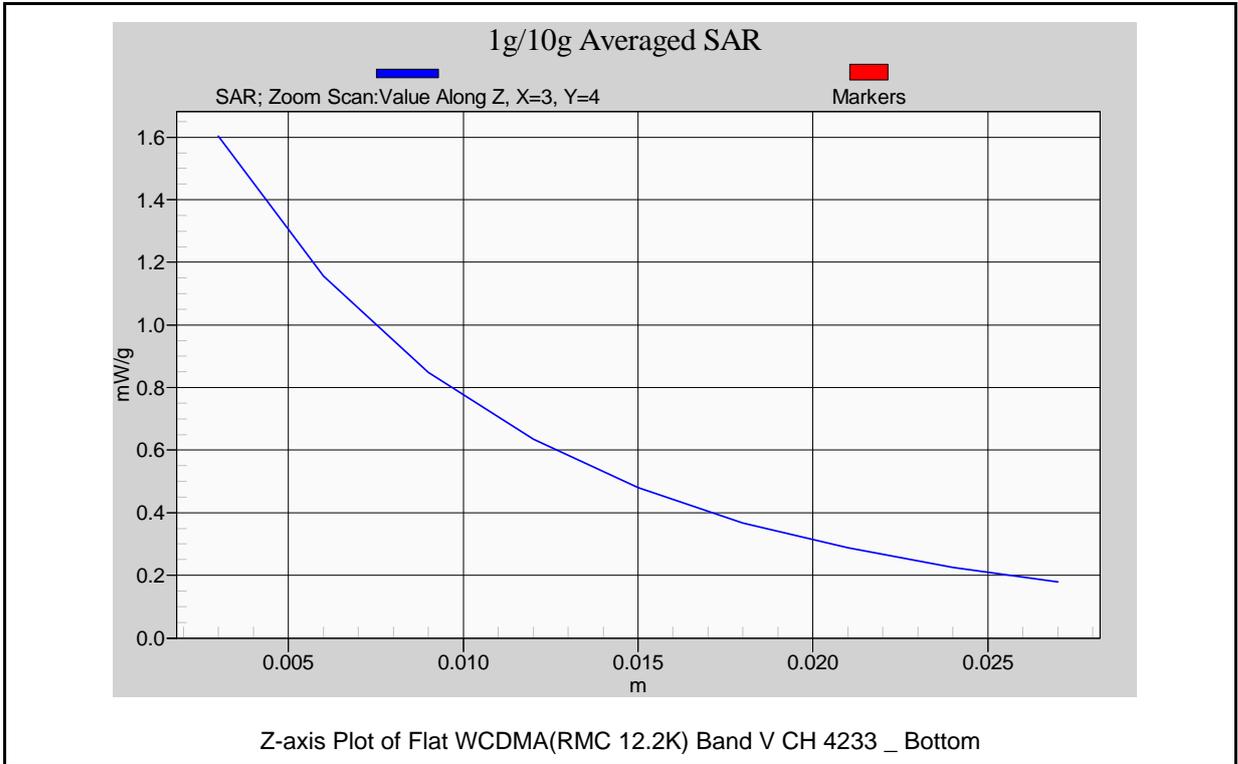
Depth of liquid (cm) : 15

Measurement :

Duty Cycle : 1:1

Probe S/N : 3632

Frequency		Band	Power (dBm)	Phantom Position	Antenna Position	Accessory	SAR _{1g} [mW/g]	Power Drift (dB)	Remark
MHz	CH								
826.4	4132	WCDMA Band V	22.90	Flat	PIFA	N/A	1.160	-0.031	Bottom
836.6	4183	WCDMA Band V	23.11	Flat	PIFA	N/A	1.190	-0.016	Bottom
846.4	4233	WCDMA Band V	23.00	Flat	PIFA	N/A	1.290	-0.034	Bottom
826.4	4132	HSDPA Band V	22.90	Flat	PIFA	N/A	1.060	-0.122	Bottom
836.6	4183	HSDPA Band V	23.10	Flat	PIFA	N/A	1.020	-0.111	Bottom
846.4	4233	HSDPA Band V	22.94	Flat	PIFA	N/A	1.010	-0.066	Bottom
826.4	4132	HSUPA Band V	22.38	Flat	PIFA	N/A	0.964	-0.160	Bottom
836.6	4183	HSUPA Band V	22.20	Flat	PIFA	N/A	0.985	-0.133	Bottom
846.4	4233	HSUPA Band V	21.91	Flat	PIFA	N/A	0.952	-0.034	Bottom
836.6	4183	WCDMA Band V	23.11	Flat	PIFA	N/A	0.772	0.091	Secondary Landscape
836.6	4183	WCDMA Band V	23.11	Flat	PIFA	N/A	0.190	0.087	Secondary Portrait
Std. C95.1-2005 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population						1.6 W/kg (mW/g) Averaged over 1 gram			





9.3 Std. C95.1-2005 RF Exposure Limit

Human Exposure	Population Uncontrolled	Occupational Controlled
	Exposure	Exposure
	(W/kg) or (mW/g)	(W/kg) or (mW/g)
Spatial Peak SAR*	1.60	8.00
(head)		
Spatial Peak SAR**	0.08	0.40
(Whole Body)		
Spatial Peak SAR***	1.60	8.00
(Partial-Body)		
Spatial Peak SAR****	4.00	20.00
(Hands / Feet / Ankle / Wrist)		
Table 6. Safety Limits for Partial Body Exposure		

Notes :

- * The Spatial Peak value of the SAR averaged over any 1 gram of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
- ** The Spatial Average value of the SAR averaged over the whole – body.
- *** The Spatial Average value of the SAR averaged over the partial – body.
- **** The Spatial Peak value of the SAR averaged over any 10 grams of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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

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



10. Conclusion

The SAR test values found for the portable mobile phone **Huawei Technologies Co., Ltd. Trade Name : HUAWEI Model(s) : EM770W** is below the maximum recommended level of 1.6 W/kg (mW/g).

11. References

- [1] Std. C95.1-2005, "American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz", New York.
- [2] NCRP, National Council on Radiation Protection and Measurements, "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields", NCRP report NO. 86, 1986.
- [3] T. Schmid, O. Egger, and N. Kuster, "Automatic E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.
- [4] K. Poković, T. Schmid, and N. Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.
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- [6] N. Kuster, and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [7] Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.
- [8] N. Kuster, R. Kastle, T. Schmid, "Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [9] Std. C95.3-1991, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, Aug. 1992.
- [10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz, Jan. 1995.



Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 9:27:32 AM

System Performance Check at 835MHz_20100828_Body

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d082

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

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.981 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 835MHz/Area Scan (61x121x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 2.86 mW/g

System Performance Check at 835MHz/Zoom Scan (7x7x7)/Cube 0:

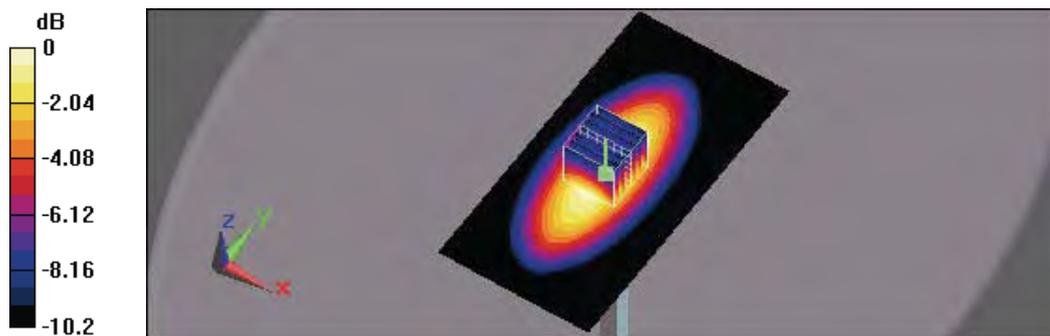
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.4 V/m; Power Drift = 0.054 dB

Peak SAR (extrapolated) = 3.73 W/kg

SAR(1 g) = 2.49 mW/g; SAR(10 g) = 1.63 mW/g

Maximum value of SAR (measured) = 2.91 mW/g



0 dB = 2.91mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 4:32:12 PM

System Performance Check at 1900MHz_20100828_Body

DUT: Dipole D1900V2_SN5d111; Type: D1900V2; Serial: D1900V2 - SN:5d111

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

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.51 \text{ mho/m}$; $\epsilon_r = 52.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

System Performance Check at 1900MHz/Area Scan (61x61x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 12.9 mW/g

System Performance Check at 1900MHz/Zoom Scan (7x7x7)/Cube 0:

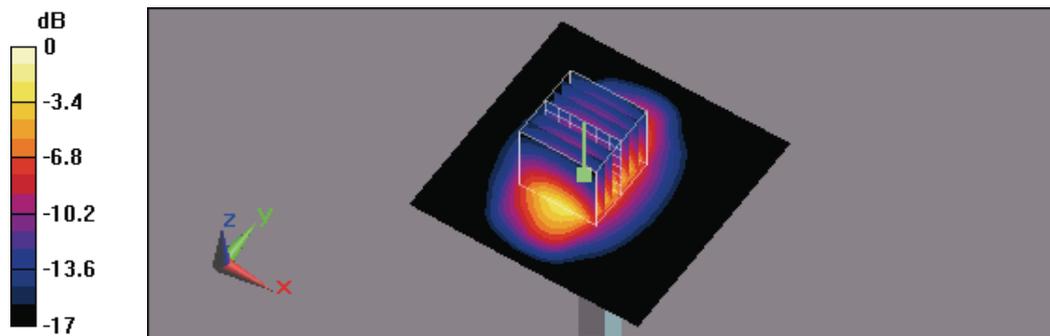
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 85.9 V/m; Power Drift = 0.186 dB

Peak SAR (extrapolated) = 19.5 W/kg

SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.52 mW/g

Maximum value of SAR (measured) = 13.6 mW/g



0 dB = 13.6mW/g



Appendix B - SAR Measurement Data

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 6:45:47 PM

Flat_WCDMA Band II CH9262_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

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

Medium parameters used (interpolated): $f = 1852.4$ MHz; $\sigma = 1.46$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

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

Maximum value of SAR (interpolated) = 1.36 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

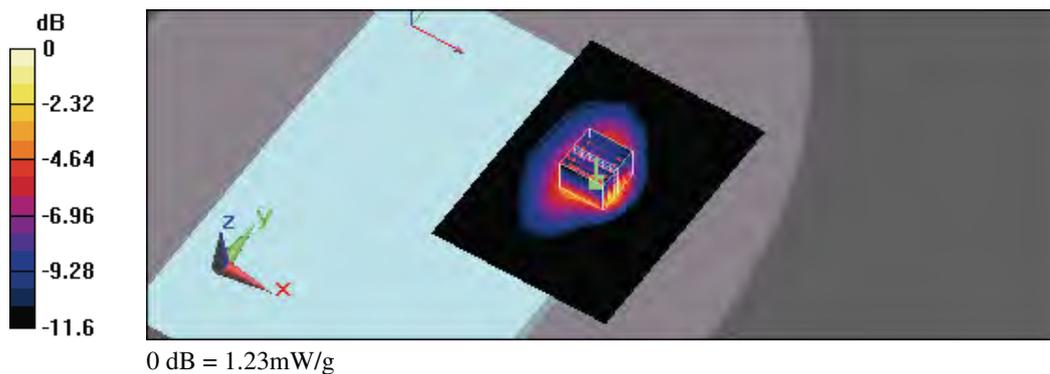
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 4.82 V/m; Power Drift = -0.048 dB

Peak SAR (extrapolated) = 1.68 W/kg

SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.575 mW/g

Maximum value of SAR (measured) = 1.23 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 7:19:44 PM

Flat_WCDMA Band II CH9400_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band II; Frequency: 1880 MHz;Duty Cycle: 1:1
 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.48$ mho/m; $\epsilon_r = 52.7$; $\rho = 1000$ kg/m³
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

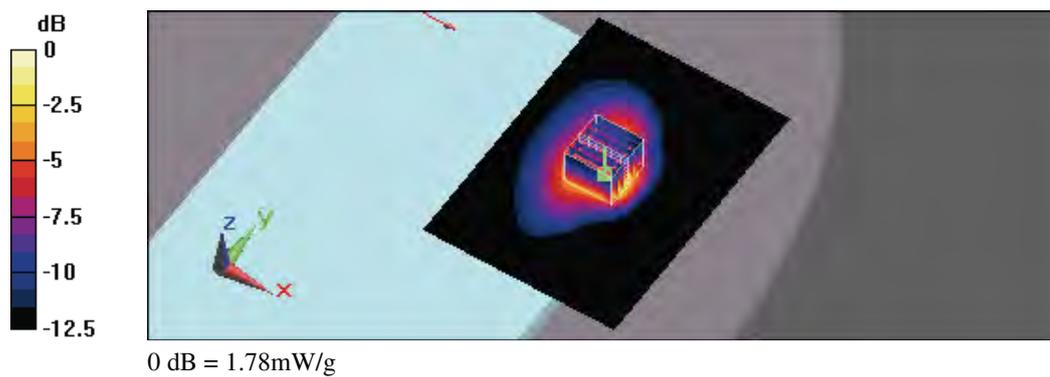
- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 1.91 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=3mm
 Reference Value = 4.99 V/m; Power Drift = -0.031 dB
 Peak SAR (extrapolated) = 2.44 W/kg
SAR(1 g) = 1.46 mW/g; SAR(10 g) = 0.822 mW/g
 Maximum value of SAR (measured) = 1.78 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 7:49:26 PM

Flat_WCDMA Band II CH9538_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band II; Frequency: 1907.6 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 1908 \text{ MHz}$; $\sigma = 1.52 \text{ mho/m}$; $\epsilon_r = 52.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.83 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

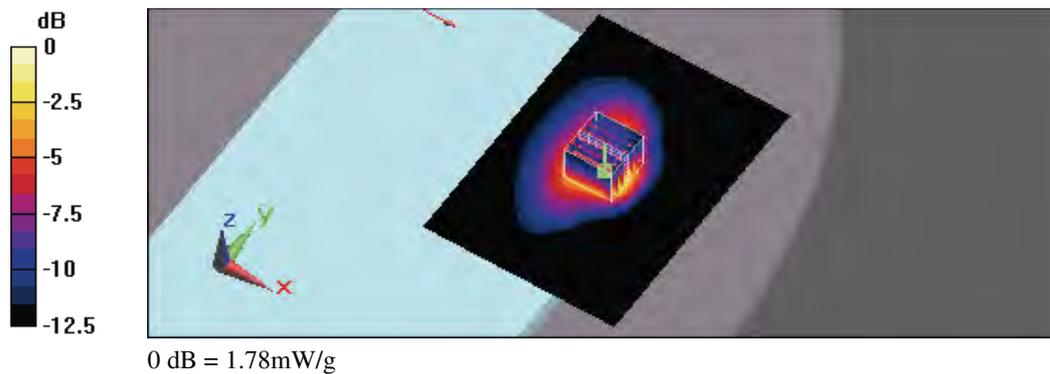
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.93 V/m; Power Drift = 0.146 dB

Peak SAR (extrapolated) = 2.32 W/kg

SAR(1 g) = 1.4 mW/g; SAR(10 g) = 0.786 mW/g

Maximum value of SAR (measured) = 1.71 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 1:31:44 AM

Flat_HSDPA Band II CH9262_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA HSDPA Band II; Frequency: 1852.4 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 1852.4 \text{ MHz}$; $\sigma = 1.46 \text{ mho/m}$; $\epsilon_r = 52.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

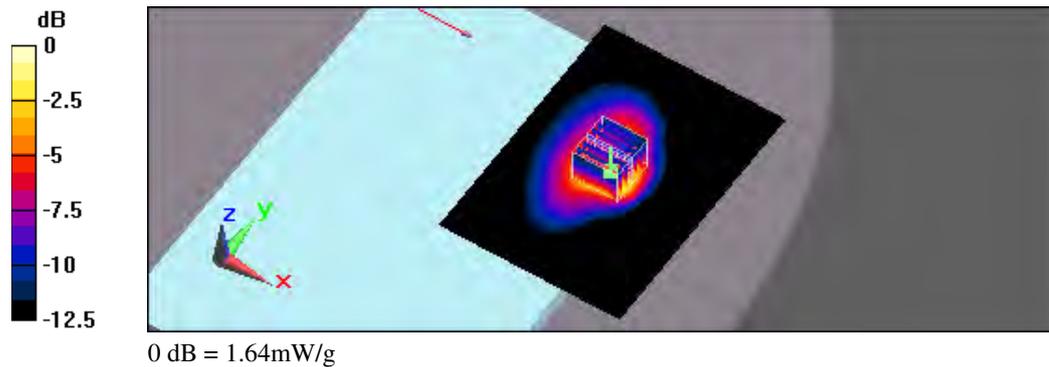
- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 1.81 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 4.77 V/m; Power Drift = -0.121 dB
 Peak SAR (extrapolated) = 2.38 W/kg
SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.803 mW/g
 Maximum value of SAR (measured) = 1.64 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 1:19:44 AM

Flat_HSDPA Band II CH9400_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA HSDPA Band II; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.48 \text{ mho/m}$; $\epsilon_r = 52.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS5 (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.91 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

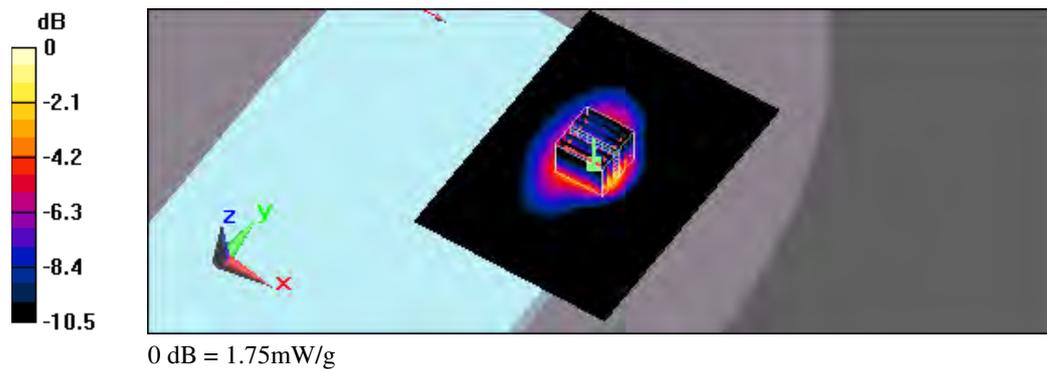
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.79 V/m; Power Drift = -0.056 dB

Peak SAR (extrapolated) = 2.44 W/kg

SAR(1 g) = 1.36 mW/g; SAR(10 g) = 0.811 mW/g

Maximum value of SAR (measured) = 1.75 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 2:06:22 AM

Flat_HSDPA Band II CH9538_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA HSDPA Band II; Frequency: 1907.6 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 1908 \text{ MHz}$; $\sigma = 1.52 \text{ mho/m}$; $\epsilon_r = 52.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.68 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

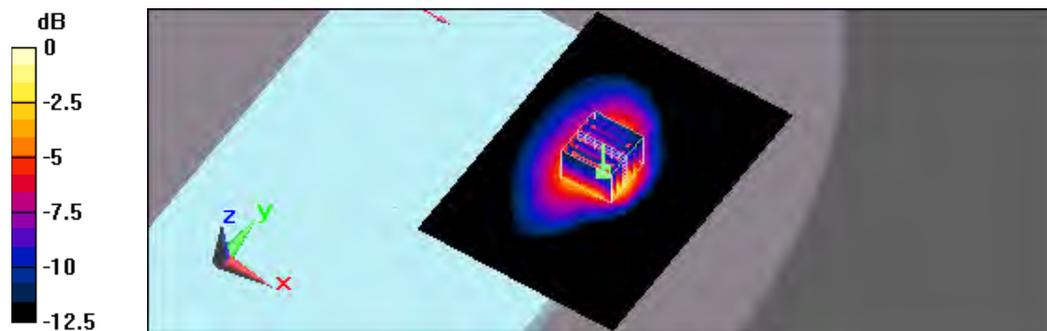
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 5.08 V/m; Power Drift = -0.141 dB

Peak SAR (extrapolated) = 2.53 W/kg

SAR(1 g) = 1.31 mW/g; SAR(10 g) = 0.782 mW/g

Maximum value of SAR (measured) = 1.61 mW/g



0 dB = 1.61mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 6:30:28 AM

Flat_HSUPA Band II CH9262_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: HSUPA WCDMA Band II; Frequency: 1852.4 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 1852.4$ MHz; $\sigma = 1.46$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

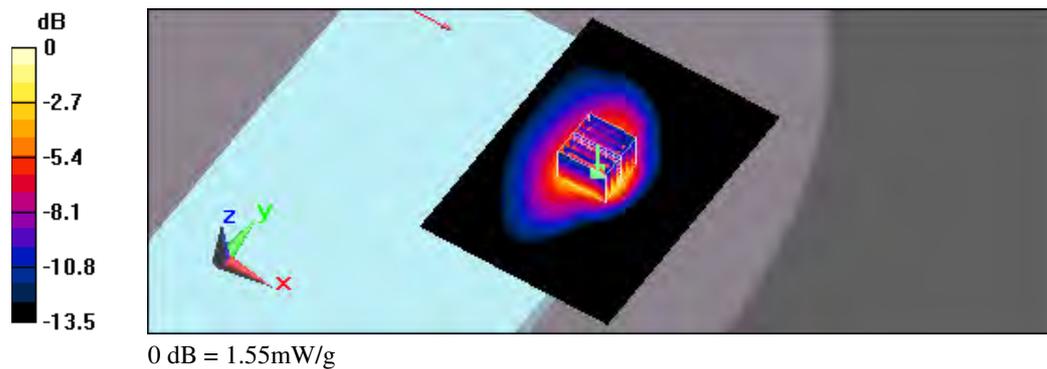
- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 1.69 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=3mm
 Reference Value = 4.61 V/m; Power Drift = -0.183 dB
 Peak SAR (extrapolated) = 1.93 W/kg
SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.766 mW/g
 Maximum value of SAR (measured) = 1.55 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 6:01:12 AM

Flat_HSUPA Band II CH9400_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: HSUPA WCDMA Band II; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.48 \text{ mho/m}$; $\epsilon_r = 52.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS5 (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.71 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

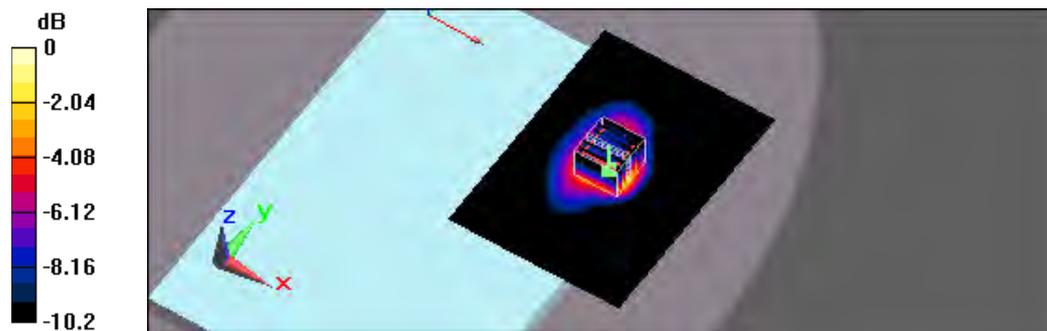
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.96 V/m; Power Drift = -0.123 dB

Peak SAR (extrapolated) = 2.02 W/kg

SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.788 mW/g

Maximum value of SAR (measured) = 1.58 mW/g



0 dB = 1.58mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 7:12:21 AM

Flat_HSUPA Band II CH9538_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: HSUPA WCDMA Band II; Frequency: 1907.6 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 1908 \text{ MHz}$; $\sigma = 1.52 \text{ mho/m}$; $\epsilon_r = 52.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.68 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

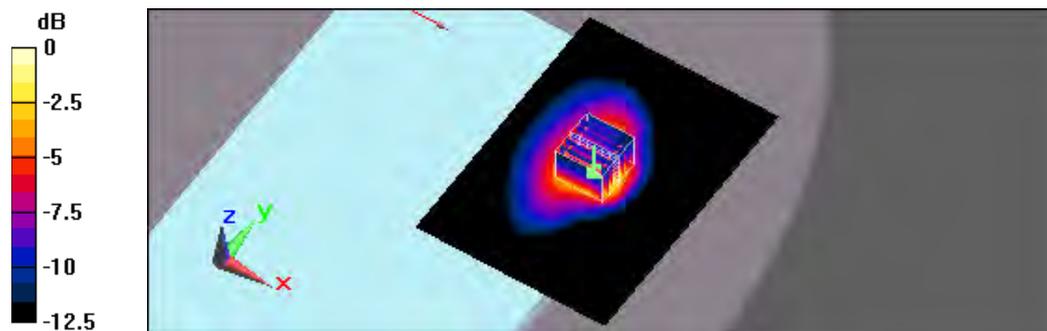
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.32 V/m; Power Drift = -0.088 dB

Peak SAR (extrapolated) = 1.91 W/kg

SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.758 mW/g

Maximum value of SAR (measured) = 1.53 mW/g



0 dB = 1.53mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 5:59:52 PM

Flat_WCDMA Band II CH9262_Tip Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band II; Frequency: 1852.4 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 1852.4 \text{ MHz}$; $\sigma = 1.46 \text{ mho/m}$; $\epsilon_r = 52.6$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (71x121x1):

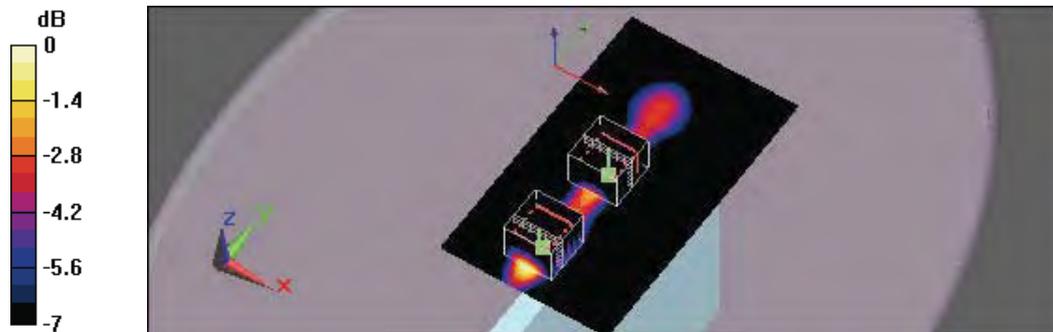
Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 1.16 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 19.2 V/m; Power Drift = 0.188 dB
 Peak SAR (extrapolated) = 1.72 W/kg
SAR(1 g) = 0.901 mW/g; SAR(10 g) = 0.466 mW/g
 Maximum value of SAR (measured) = 1.16 mW/g

Flat/Zoom Scan (7x7x9)/Cube 1:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 19.2 V/m; Power Drift = 0.188 dB
 Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.691 mW/g; SAR(10 g) = 0.311 mW/g
 Maximum value of SAR (measured) = 0.902 mW/g



0 dB = 0.902mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 8:24:48 PM

Flat_WCDMA Band II CH9400_Tip Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band II; Frequency: 1880 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.48 \text{ mho/m}$; $\epsilon_r = 52.7$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS5 (IEEE/IEC)

DASY5 Configuration:

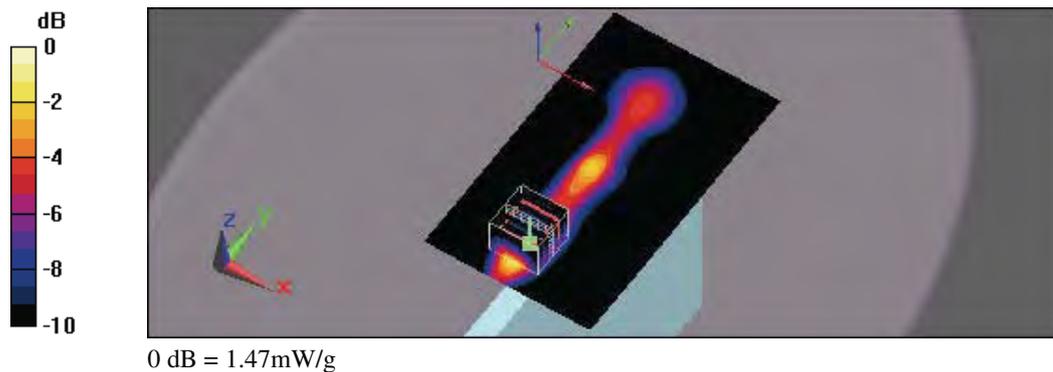
- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (71x121x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 1.47 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 22.1 V/m; Power Drift = 0.126 dB
 Peak SAR (extrapolated) = 2.19 W/kg
SAR(1 g) = 1.13 mW/g; SAR(10 g) = 0.576 mW/g
 Maximum value of SAR (measured) = 1.47 mW/g





Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 8:53:52 PM

Flat_WCDMA Band II CH9538_Tip Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band II; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1908$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (71x121x1):

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

Maximum value of SAR (interpolated) = 1.33 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 21.6 V/m; Power Drift = 0.156 dB

Peak SAR (extrapolated) = 2.02 W/kg

SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.525 mW/g

Maximum value of SAR (measured) = 1.35 mW/g

Flat/Zoom Scan (7x7x9)/Cube 1:

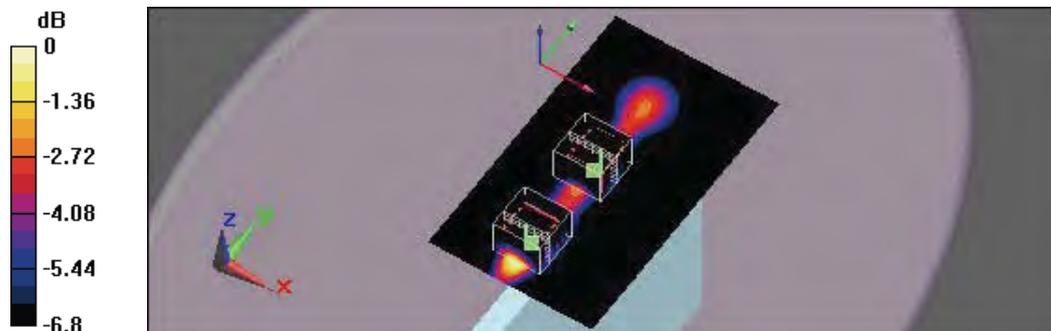
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 21.6 V/m; Power Drift = 0.156 dB

Peak SAR (extrapolated) = 1.61 W/kg

SAR(1 g) = 0.791 mW/g; SAR(10 g) = 0.359 mW/g

Maximum value of SAR (measured) = 0.979 mW/g



0 dB = 0.979mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 9:40:29 PM

Flat_WCDMA Band II CH9400_Right Side edge Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band II; Frequency: 1880 MHz;Duty Cycle: 1:1
 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.48 \text{ mho/m}$; $\epsilon_r = 52.7$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

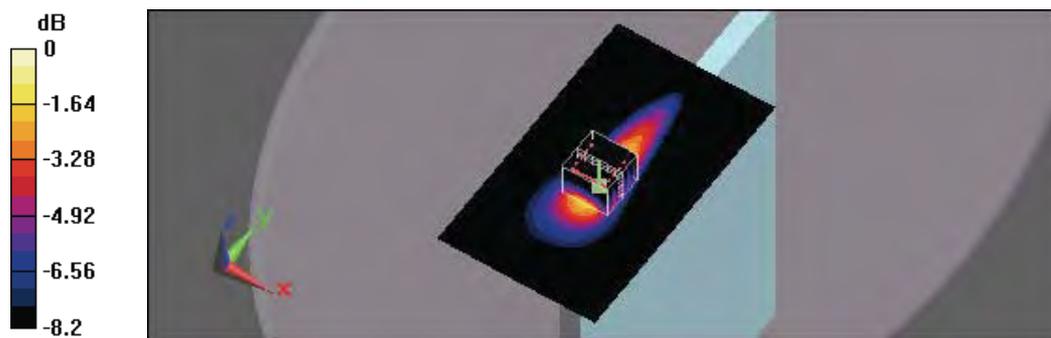
- Probe: EX3DV4 - SN3632; ConvF(7.57, 7.57, 7.57); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125;SEMCAD X Version 13.4 Build 125

Flat/Area Scan (71x121x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 0.276 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 7.09 V/m; Power Drift = 0.055 dB
 Peak SAR (extrapolated) = 0.467 W/kg
SAR(1 g) = 0.228 mW/g; SAR(10 g) = 0.124 mW/g
 Maximum value of SAR (measured) = 0.295 mW/g



0 dB = 0.295mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 2:32:38 PM

Flat_WCDMA Band V CH4132_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band V; Frequency: 826.4 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 826.4 \text{ MHz}$; $\sigma = 0.97 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS5 (IEEE/IEC)

DASY5 Configuration:

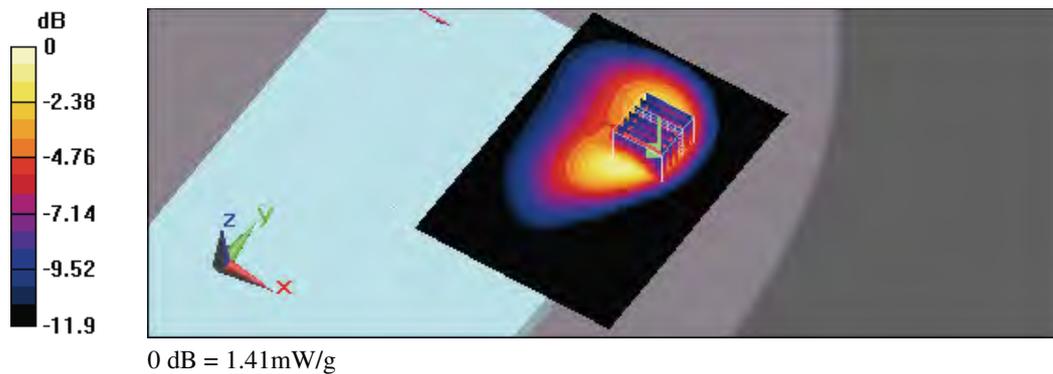
- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 1.39 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 4.58 V/m; Power Drift = -0.031 dB
 Peak SAR (extrapolated) = 2.11 W/kg
SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.662 mW/g
 Maximum value of SAR (measured) = 1.41 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 2:02:08 PM

Flat_WCDMA Band V CH4183_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 837 \text{ MHz}$; $\sigma = 0.983 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.4 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

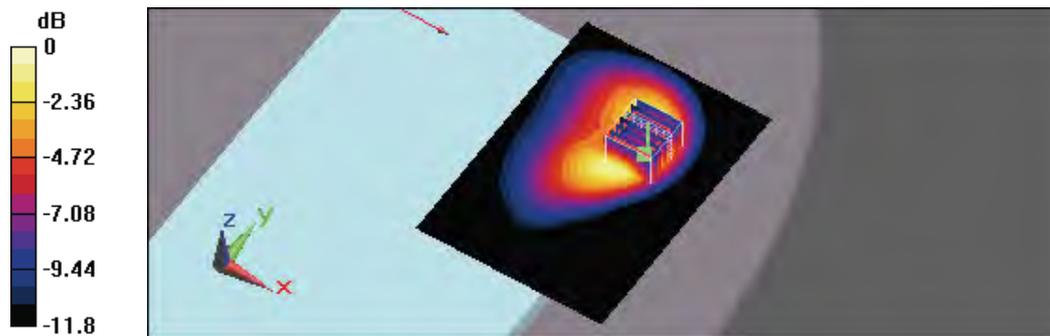
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.33 V/m; Power Drift = -0.016 dB

Peak SAR (extrapolated) = 2.14 W/kg

SAR(1 g) = 1.19 mW/g; SAR(10 g) = 0.677 mW/g

Maximum value of SAR (measured) = 1.43 mW/g



0 dB = 1.43mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 3:02:21 PM

Flat_WCDMA Band V CH4233_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band V; Frequency: 846.6 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 847 \text{ MHz}$; $\sigma = 0.997 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.54 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

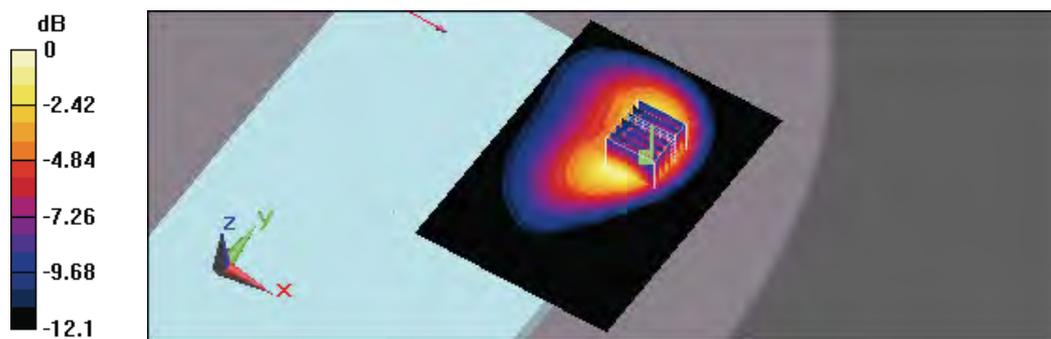
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.57 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 2.34 W/kg

SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.733 mW/g

Maximum value of SAR (measured) = 1.6 mW/g



0 dB = 1.6mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 3:18:38 PM

Flat_HSDPA Band V CH4132_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA HSDPA Band V; Frequency: 826.4 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 826.4$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 54.7$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

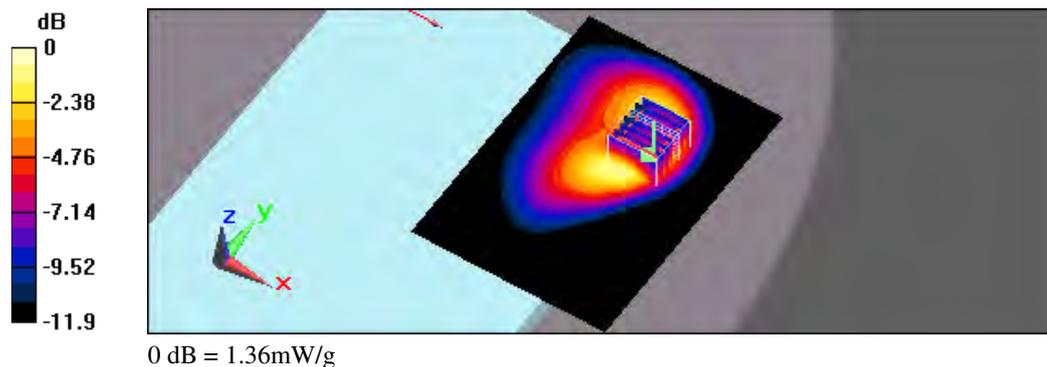
- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15$ mm, $dy=15$ mm
Maximum value of SAR (interpolated) = 1.35 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=3$ mm
Reference Value = 4.38 V/m; Power Drift = -0.122 dB
Peak SAR (extrapolated) = 2.11 W/kg
SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.644 mW/g
Maximum value of SAR (measured) = 1.36 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 10:36:38 PM

Flat_HSDPA Band V CH4183_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA HSDPA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 837 \text{ MHz}$; $\sigma = 0.983 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.32 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

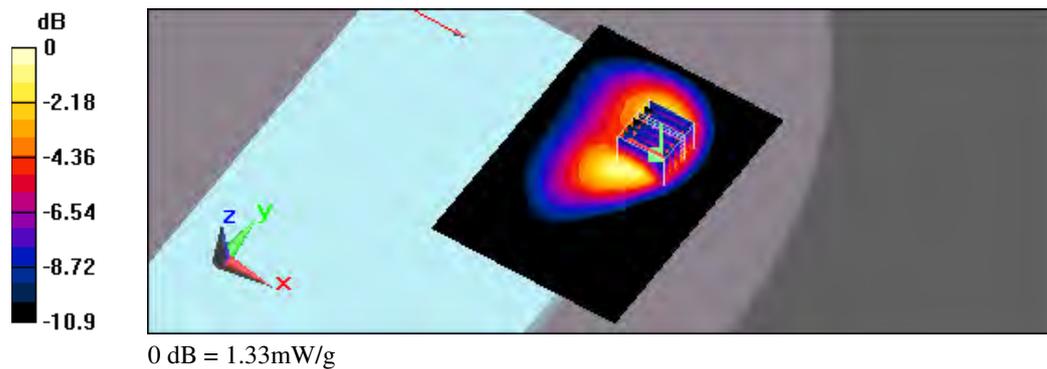
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.39 V/m; Power Drift = -0.111 dB

Peak SAR (extrapolated) = 2.14 W/kg

SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.643 mW/g

Maximum value of SAR (measured) = 1.33 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 11:32:42 PM

Flat_HSDPA Band V CH4233_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA HSDPA Band V; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 847 \text{ MHz}$; $\sigma = 0.997 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 1.32 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

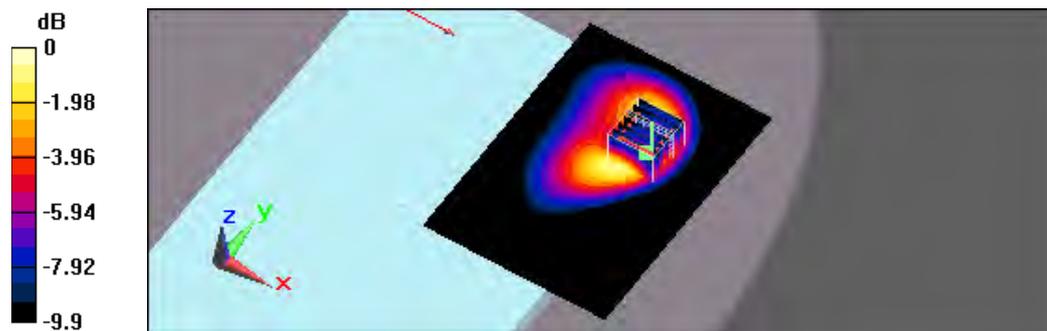
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 4.28 V/m; Power Drift = -0.066 dB

Peak SAR (extrapolated) = 2.18 W/kg

SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.641 mW/g

Maximum value of SAR (measured) = 1.29 mW/g



0 dB = 1.29mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 3:55:44 AM

Flat_HSUPA Band V CH4132_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: HSUPA WCDMA Band V; Frequency: 826.4 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 826.4$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 54.7$; $\rho = 1000$ kg/m³
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

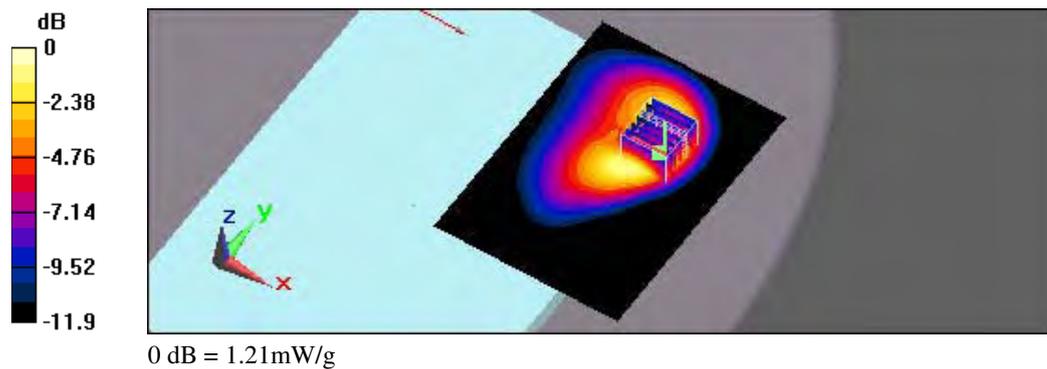
- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 1.39 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=3mm
 Reference Value = 4.31 V/m; Power Drift = -0.16 dB
 Peak SAR (extrapolated) = 1.66 W/kg
SAR(1 g) = 0.964 mW/g; SAR(10 g) = 0.548 mW/g
 Maximum value of SAR (measured) = 1.21 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 4:25:41 AM

Flat_HSUPA Band V CH4183_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: HSUPA WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 837 \text{ MHz}$; $\sigma = 0.983 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

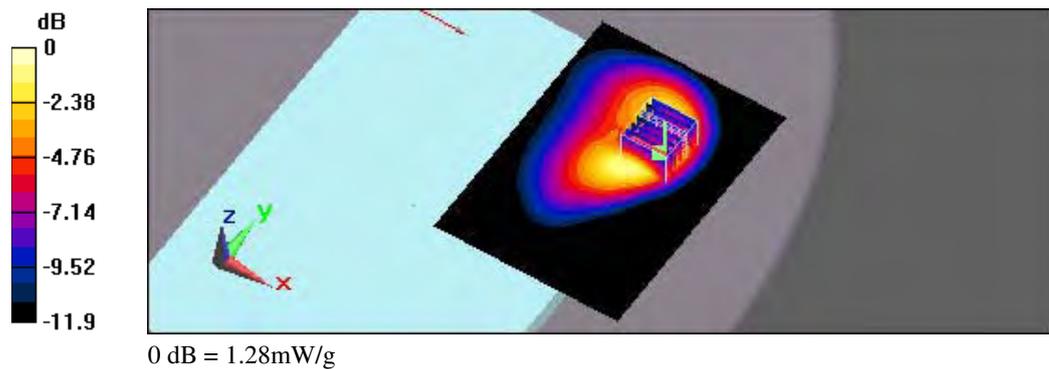
- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 1.43 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 4.36 V/m; Power Drift = -0.133 dB
 Peak SAR (extrapolated) = 1.66 W/kg
SAR(1 g) = 0.985 mW/g; SAR(10 g) = 0.559 mW/g
 Maximum value of SAR (measured) = 1.28 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/29/2010 4:50:41 AM

Flat_HSUPA Band V CH4233_Sub-test1_Bottom Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: HSUPA WCDMA Band V; Frequency: 846.6 MHz; Duty Cycle: 1:1
 Medium parameters used (interpolated): $f = 847 \text{ MHz}$; $\sigma = 0.997 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

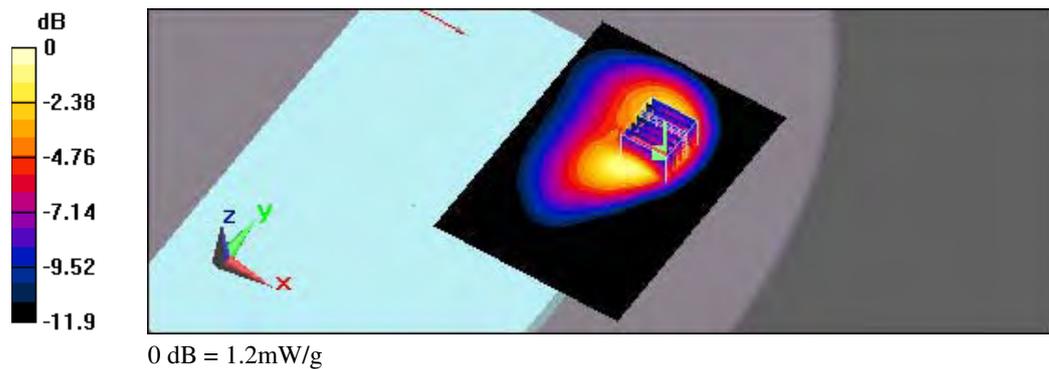
- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (81x111x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 1.36 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 4.26 V/m; Power Drift = -0.034 dB
 Peak SAR (extrapolated) = 1.58 W/kg
SAR(1 g) = 0.952 mW/g; SAR(10 g) = 0.547 mW/g
 Maximum value of SAR (measured) = 1.2 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 11:47:36 AM

Flat_WCDMA Band V CH4183_Tip Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 837 \text{ MHz}$; $\sigma = 0.983 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (71x121x1):

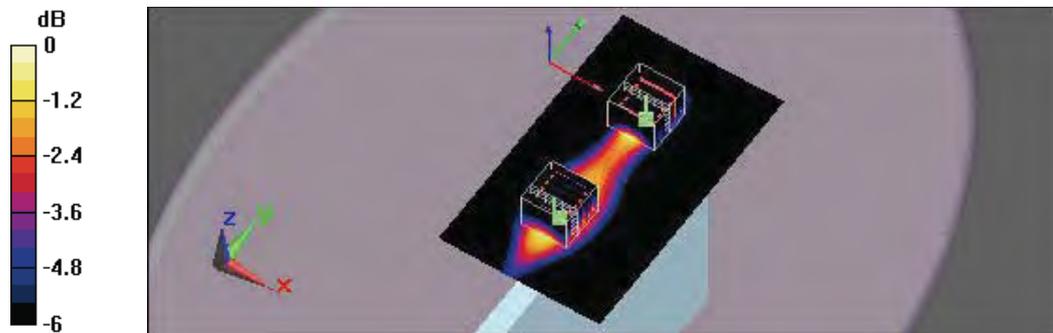
Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 0.845 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 20.2 V/m; Power Drift = 0.091 dB
 Peak SAR (extrapolated) = 1.75 W/kg
SAR(1 g) = 0.772 mW/g; SAR(10 g) = 0.366 mW/g
 Maximum value of SAR (measured) = 1.04 mW/g

Flat/Zoom Scan (7x7x9)/Cube 1:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 20.2 V/m; Power Drift = 0.091 dB
 Peak SAR (extrapolated) = 1.06 W/kg
SAR(1 g) = 0.625 mW/g; SAR(10 g) = 0.398 mW/g
 Maximum value of SAR (measured) = 0.756 mW/g



0 dB = 0.756mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 8/28/2010 12:36:15 PM

Flat_WCDMA Band V CH4183_Right Side edge Close Body

DUT: EM770W ; Type: HSPA Module; FCC ID: QISEM770W

Communication System: WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1
 Medium parameters used: $f = 837 \text{ MHz}$; $\sigma = 0.983 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: EX3DV4 - SN3632; ConvF(9.17, 9.17, 9.17); Calibrated: 1/26/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 1/21/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1036
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (71x121x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.215 mW/g

Flat/Zoom Scan (7x7x9)/Cube 0:

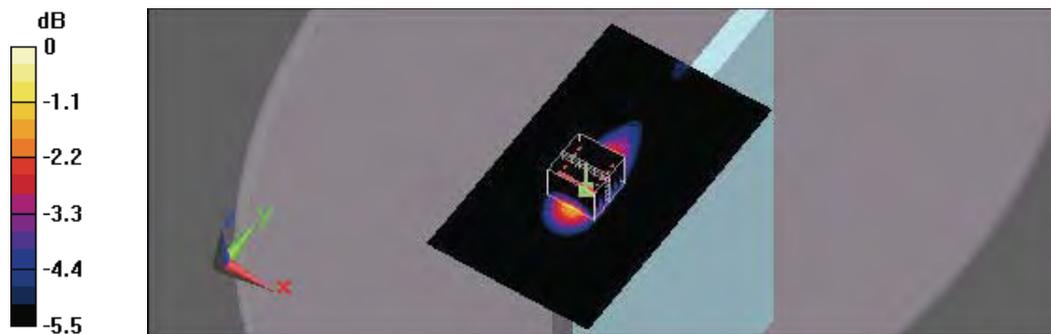
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 8.8 V/m; Power Drift = 0.087 dB

Peak SAR (extrapolated) = 0.352 W/kg

SAR(1 g) = 0.190 mW/g; SAR(10 g) = 0.111 mW/g

Maximum value of SAR (measured) = 0.239 mW/g



0 dB = 0.239mW/g



Appendix C - Calibration

All of the instruments Calibration information are listed below.

- Dipole _ D835V2 SN:4d082 Calibration No.D835V2-4d082 _Jul10
- Dipole _ D1900V2 SN:5d111 Calibration No.D1900V2-5d111_Jul10
- Probe _ EX3DV4 SN:3632 Calibration No.EX3-3632_Jan10
- DAE _ DAE4 SN:779 Calibration No.DAE4-779_ Jan10



**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**

Client **ATL (Auden)**

Certificate No: **D835V2-4d082_Jul10**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d082**

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

Calibration date: **July 20, 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	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

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

Issued: July 20, 2010

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
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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	V52.2
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 ± 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 ± 0.2) °C	42.0 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature during test	(23.1 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 mW / g
SAR normalized	normalized to 1W	9.60 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.65 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 mW / g
SAR normalized	normalized to 1W	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.26 mW / g ± 16.5 % (k=2)



Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	1.01 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	2.58 mW / g
SAR normalized	normalized to 1W	10.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	10.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.69 mW / g
SAR normalized	normalized to 1W	6.76 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.60 mW / g ± 16.5 % (k=2)



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω - 3.2 j Ω
Return Loss	- 29.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.3 Ω - 4.6 j Ω
Return Loss	- 26.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389ns
----------------------------------	---------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 17, 2008

DASY5 Validation Report for Head TSL

Date/Time: 20.07.2010 15:48:57

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d082

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

Medium: HSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.9 \text{ mho/m}$; $\epsilon_r = 42.4$; $\rho = 1000 \text{ kg/m}^3$

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: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

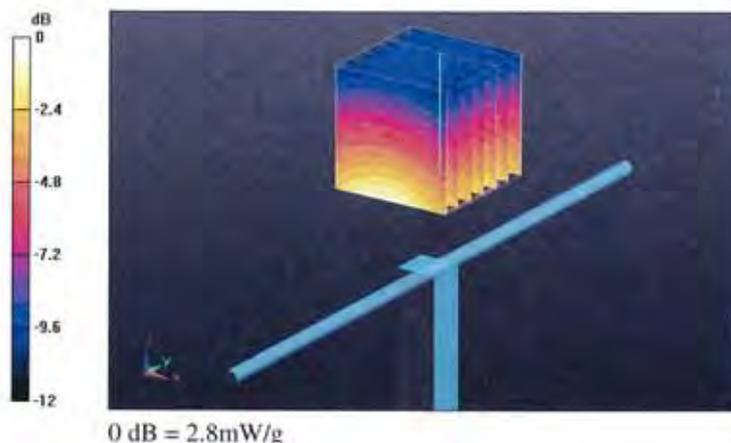
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.1 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 3.63 W/kg

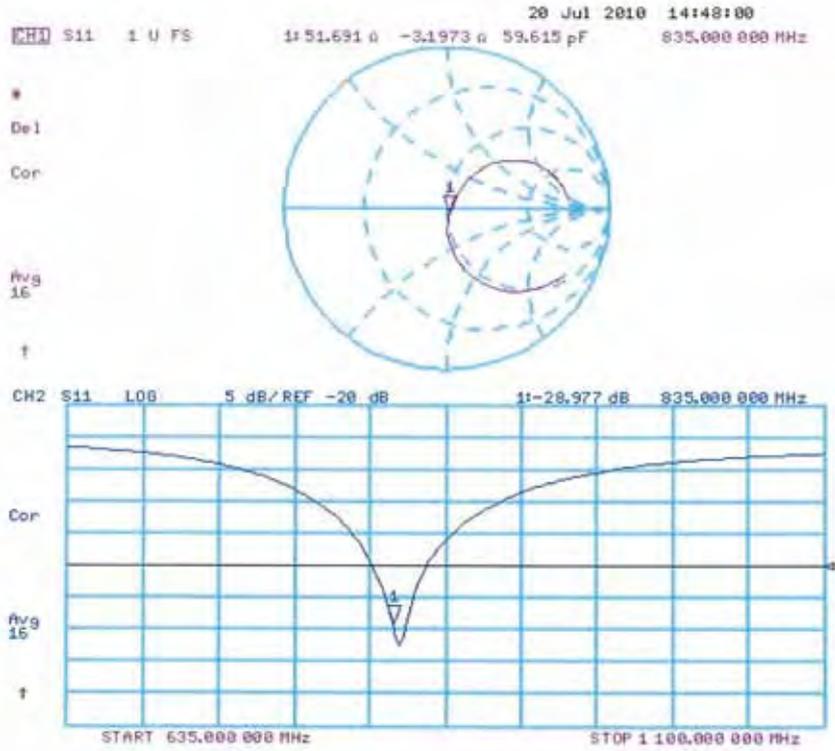
SAR(1 g) = 2.4 mW/g; SAR(10 g) = 1.56 mW/g

Maximum value of SAR (measured) = 2.8 mW/g





Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 20.07.2010 12:03:13

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d082

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

Medium: MSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1.01 \text{ mho/m}$; $\epsilon_r = 55$; $\rho = 1000 \text{ kg/m}^3$

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: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

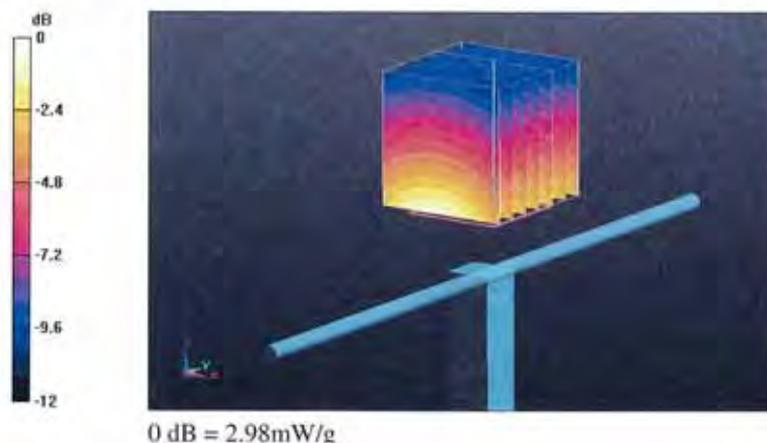
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.1 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 3.81 W/kg

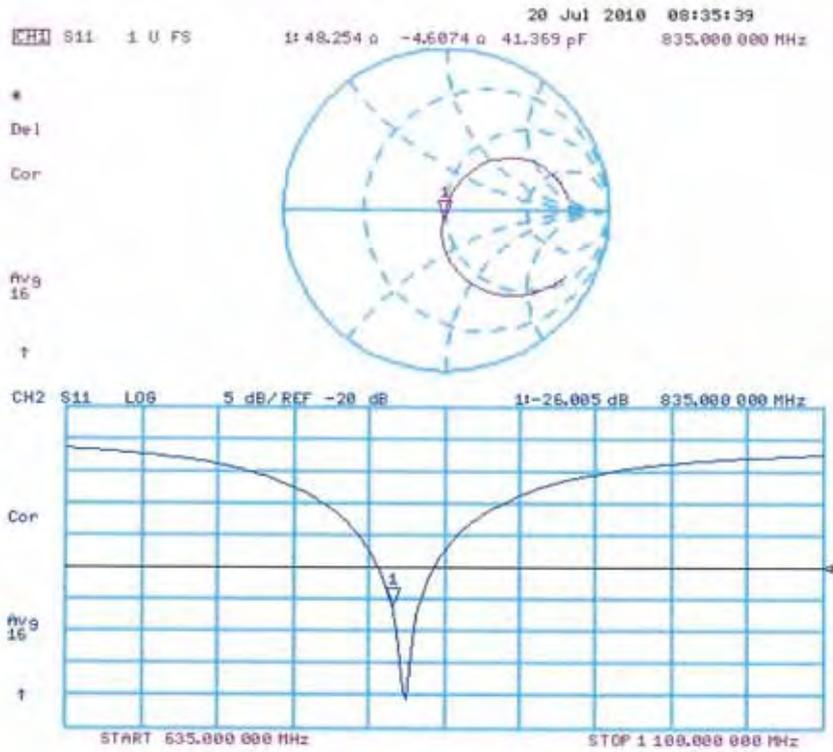
SAR(1 g) = 2.58 mW/g; SAR(10 g) = 1.69 mW/g

Maximum value of SAR (measured) = 2.98 mW/g





Impedance Measurement Plot for Body TSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **D1900V2-5d111_Jul10**

CALIBRATION CERTIFICATE																																															
Object	D1900V2 - SN: 5d111																																														
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits																																														
Calibration date:	July 16, 2010																																														
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter EPM-442A</td> <td>GB37480704</td> <td>06-Oct-09 (No. 217-01086)</td> <td>Oct-10</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>US37292783</td> <td>06-Oct-09 (No. 217-01086)</td> <td>Oct-10</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: 5086 (20g)</td> <td>30-Mar-10 (No. 217-01158)</td> <td>Mar-11</td> </tr> <tr> <td>Type-N mismatch combination</td> <td>SN: 5047.2 / 06327</td> <td>30-Mar-10 (No. 217-01162)</td> <td>Mar-11</td> </tr> <tr> <td>Reference Probe ES3DV3</td> <td>SN: 3205</td> <td>30-Apr-10 (No. ES3-3205_Apr10)</td> <td>Apr-11</td> </tr> <tr> <td>DAE4</td> <td>SN: 601</td> <td>10-Jun-10 (No. DAE4-601_Jun10)</td> <td>Jun-11</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>Power sensor HP 8481A</td> <td>MY41092317</td> <td>18-Oct-02 (in house check Oct-09)</td> <td>In house check: Oct-11</td> </tr> <tr> <td>RF generator R&S SMT-06</td> <td>100005</td> <td>4-Aug-99 (in house check Oct-09)</td> <td>In house check: Oct-11</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585 S4206</td> <td>18-Oct-01 (in house check Oct-09)</td> <td>In house check: Oct-10</td> </tr> </tbody> </table>				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	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11	Secondary Standards	ID #	Check Date (in house)	Scheduled Check	Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11	RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11	Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10
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Calibrated by:	Name Dimce Iliev	Function Laboratory Technician	Signature 																																												
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 																																												
			Issued: July 19, 2010																																												
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.																																															

Certificate No: D1900V2-5d111_Jul10

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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:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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



Measurement Conditions

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

DASY Version	DASY5	V52.2
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	40.3 \pm 6 %	1.43 mho/m \pm 6 %
Head TSL temperature during test	(22.4 \pm 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR normalized	normalized to 1W	40.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.9 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 mW / g
SAR normalized	normalized to 1W	21.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.0 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	53.3 ± 6 %	1.55 mho/m ± 6 %
Body TSL temperature during test	(22.4 ± 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	10.6 mW / g
SAR normalized	normalized to 1W	42.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	41.9 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.66 mW / g
SAR normalized	normalized to 1W	22.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	22.5 mW / g ± 16.5 % (k=2)



Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.7 Ω + 6.6 $\mu\Omega$
Return Loss	- 23.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 Ω + 6.5 $\mu\Omega$
Return Loss	- 22.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 28, 2008

DASY5 Validation Report for Head TSL

Date/Time: 16.07.2010 13:15:00

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d111

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

Medium: HSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ 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: 10.06.2010
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

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

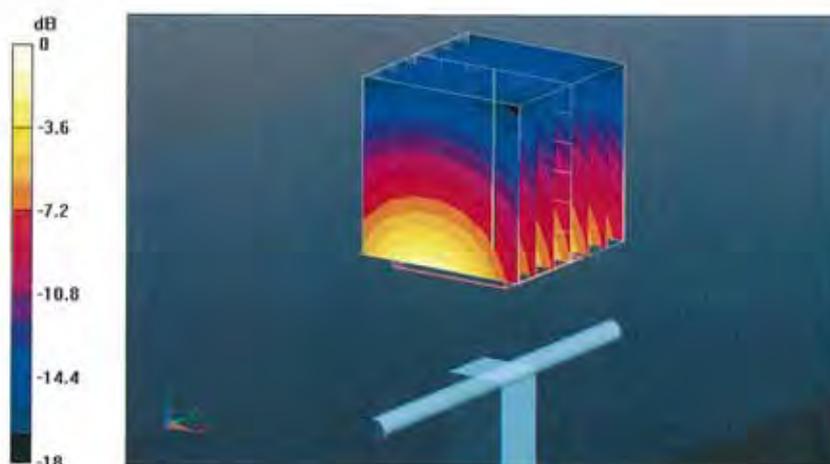
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.6 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.28 mW/g

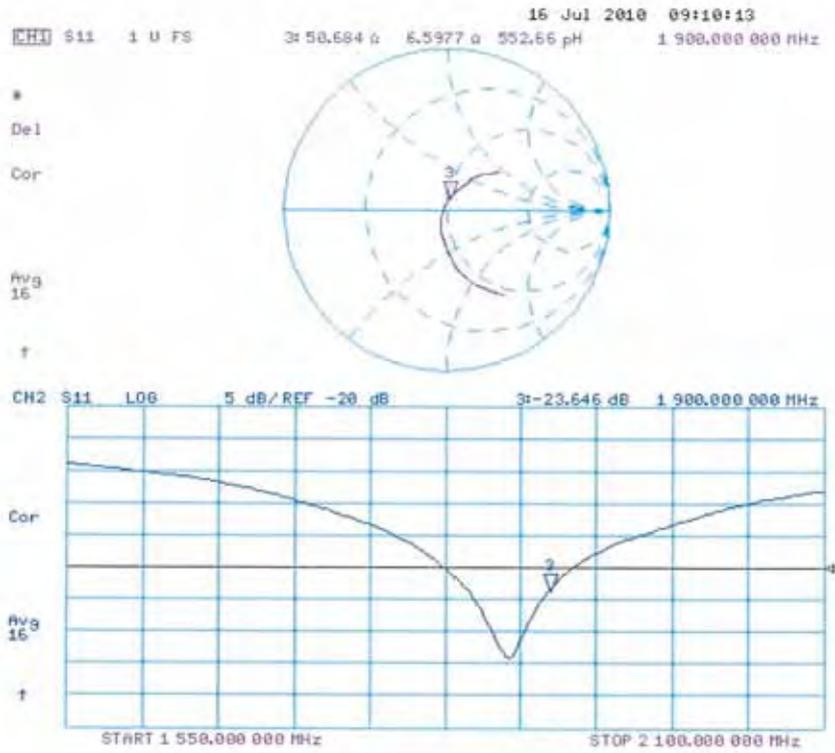
Maximum value of SAR (measured) = 12.4 mW/g



0 dB = 12.4mW/g



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 13.07.2010 12:57:16

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d111

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

Medium: MSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.55$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ 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: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

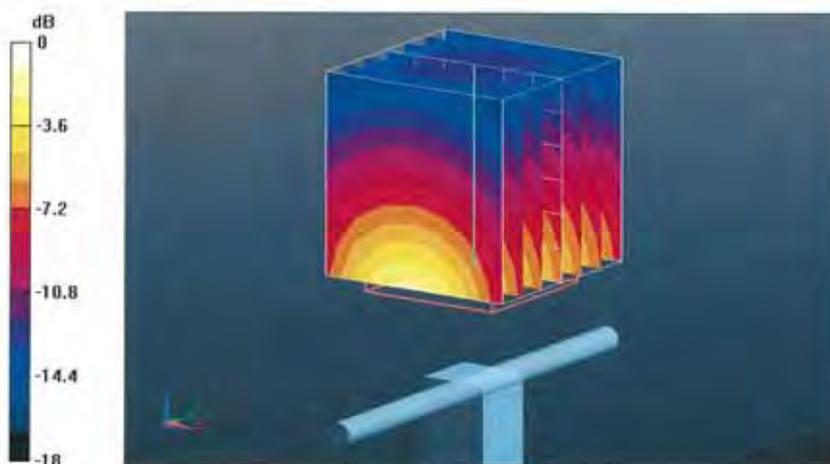
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.7 V/m; Power Drift = 0.00345 dB

Peak SAR (extrapolated) = 17.7 W/kg

SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.66 mW/g

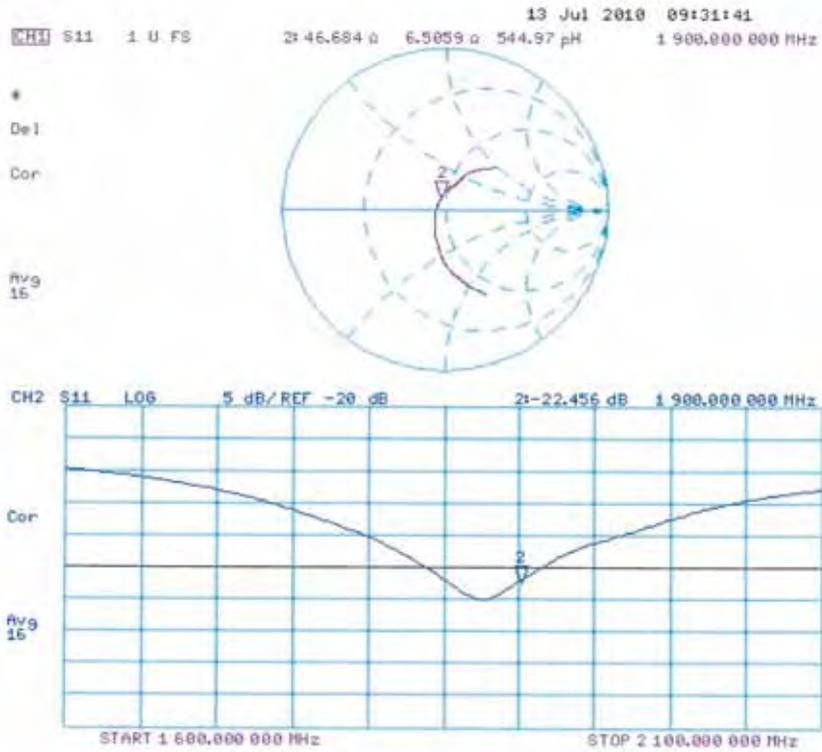
Maximum value of SAR (measured) = 13.3 mW/g



0 dB = 13.3mW/g



Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **EX3-3632_Jan10**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3632**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-12.v6, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes**

Calibration date: **January 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 E4419B	GB41293874	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. 217-01026)	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	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

Calibrated by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	
Approved by:	Fin Bornholt	R&D Director	

Issued: January 26, 2010

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Certificate No: EX3-3632_Jan10

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- **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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- **A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- **ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- **Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- **Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.



EX3DV4 SN:3632

January 26, 2010

Probe EX3DV4

SN:3632

Manufactured:	November 1, 2007
Last calibrated:	January 13, 2009
Recalibrated:	January 26, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)



EX3DV4 SN:3632

January 26, 2010

DASY - Parameters of Probe: EX3DV4 SN:3632

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	0.46	0.44	0.39	± 10.1%
DCP (mV) ^B	88.1	83.7	91.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5%
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

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

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

^B Numerical linearization parameter; uncertainty not required.

^E Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



EX3DV4 SN:3632

January 26, 2010

DASY - Parameters of Probe: EX3DV4 SN:3632

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz] ^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	9.64	9.64	9.64	0.24	1.00 ± 13.3%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	9.11	9.11	9.11	0.63	0.67 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.80	7.80	7.80	0.64	0.66 ± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.81	7.81	7.81	0.76	0.59 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.16	7.16	7.16	0.41	0.82 ± 11.0%

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



EX3DV4 SN:3632

January 26, 2010

DASY - Parameters of Probe: EX3DV4 SN:3632

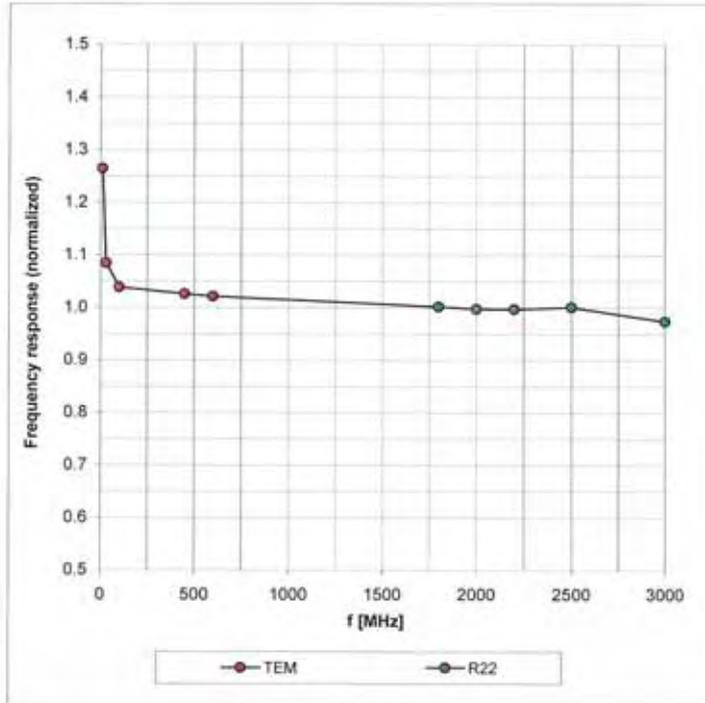
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz] ^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	10.57	10.57	10.57	0.32	0.47 ± 13.3%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	9.17	9.17	9.17	0.59	0.73 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.84	7.84	7.84	0.68	0.68 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.57	7.57	7.57	0.82	0.60 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	7.40	7.40	7.40	0.45	0.80 ± 11.0%

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

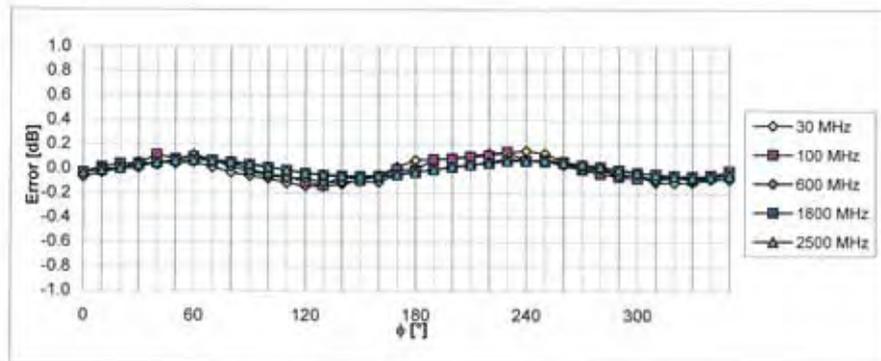
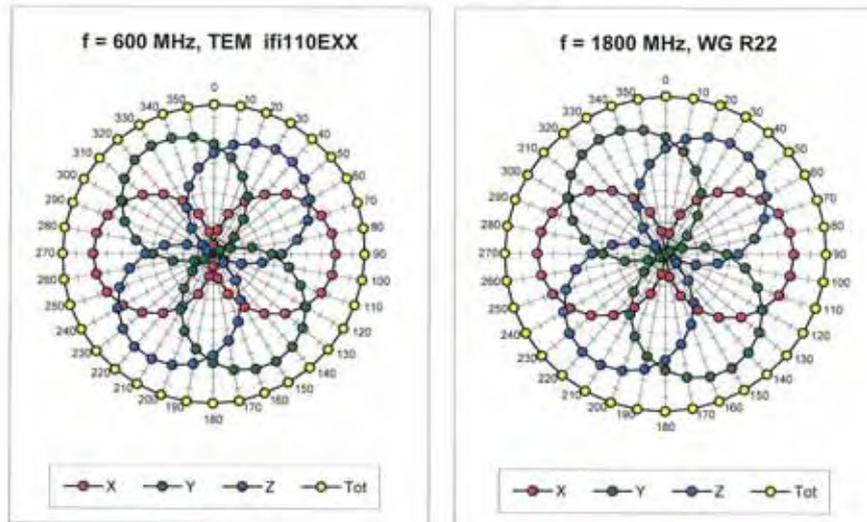
Frequency Response of E-Field

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



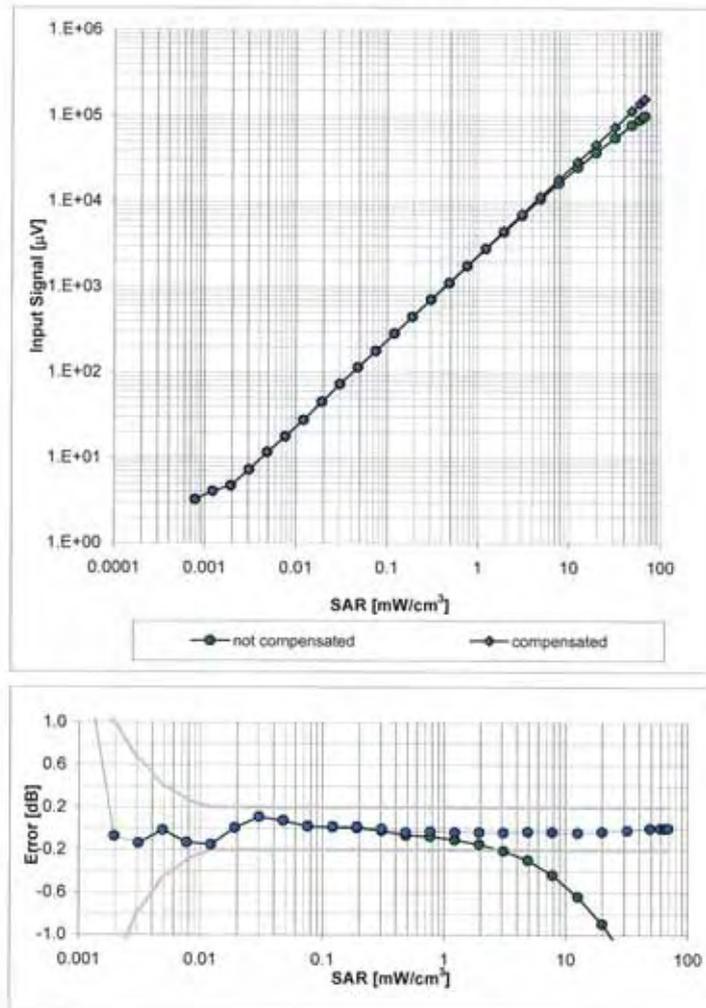
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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



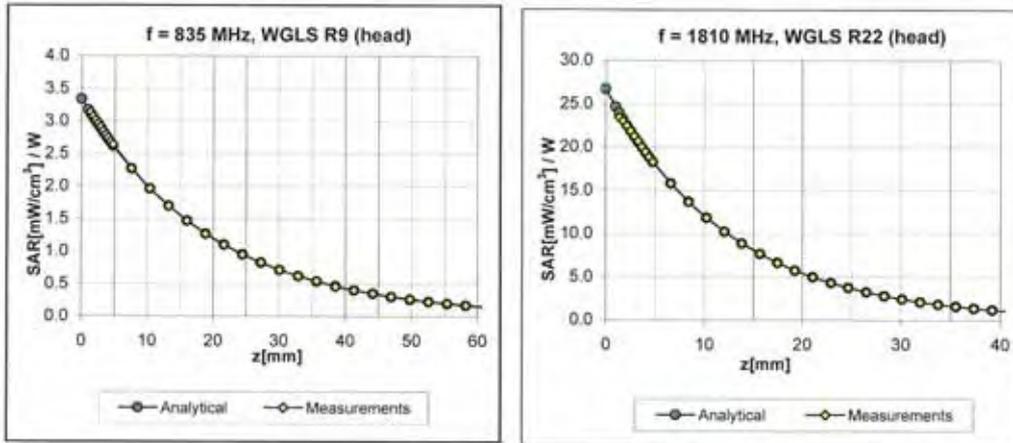
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(SAR_{head})$ (Waveguide R22, $f = 1800$ MHz)



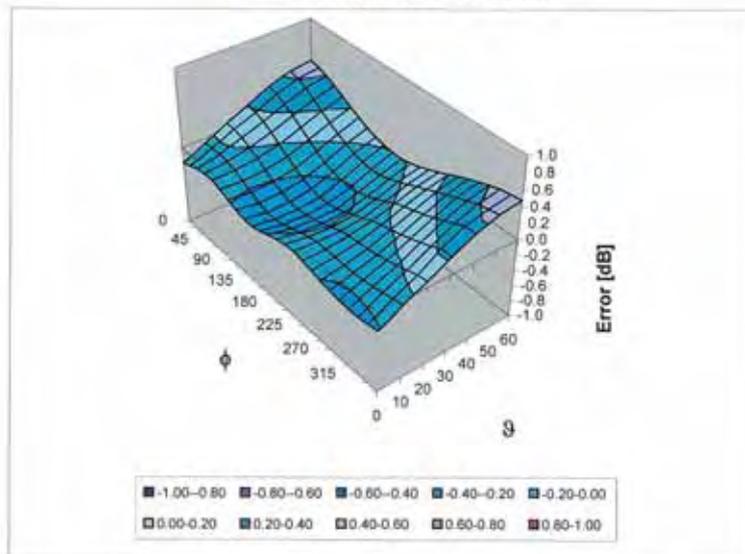
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in HSL

Error (ϕ, θ), f = 900 MHz



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



EX3DV4 SN:3632

January 26, 2010

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm



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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **DAE4-779_Jan10**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 779**

Calibration procedure(s) **QA CAL-06.v12
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **January 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
Keithley Multimeter Type 2001	SN: 0810278	1-Oct-09 (No: 9055)	Oct-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	05-Jun-09 (in house check)	In house check: Jun-10

Calibrated by:	Name Andrea Guntli	Function Technician	Signature
Approved by:	Name Fin Bornholt	Function R&D Director	Signature

Issued: January 21, 2010

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

**Calibration Laboratory of
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Engineering AG**
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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*: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage*: Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption*: Typical value for information. Supply currents in various operating modes.



DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	404.487 \pm 0.1% (k=2)	403.723 \pm 0.1% (k=2)	403.948 \pm 0.1% (k=2)
Low Range	3.97046 \pm 0.7% (k=2)	3.98719 \pm 0.7% (k=2)	4.00014 \pm 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	84.5 $^{\circ}$ \pm 1 $^{\circ}$
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Appendix

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200010.5	1.14	0.00
Channel X + Input	20003.28	3.68	0.02
Channel X - Input	-19997.24	3.06	-0.02
Channel Y + Input	200009.6	0.87	0.00
Channel Y + Input	19999.83	0.43	0.00
Channel Y - Input	-19998.10	2.10	-0.01
Channel Z + Input	199998.4	0.15	0.00
Channel Z + Input	20000.44	1.04	0.01
Channel Z - Input	-19997.62	-0.01	-0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	1999.6	-0.33	-0.02
Channel X + Input	199.84	-0.16	-0.08
Channel X - Input	-200.02	-0.22	0.11
Channel Y + Input	2000.1	0.05	0.00
Channel Y + Input	198.87	-1.13	-0.56
Channel Y - Input	-201.72	-1.62	0.81
Channel Z + Input	2000.2	0.14	0.01
Channel Z + Input	199.12	-1.18	-0.59
Channel Z - Input	-200.60	-0.60	0.30

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	-3.75	-5.42
	- 200	6.52	4.96
Channel Y	200	14.47	13.94
	- 200	-14.47	-14.52
Channel Z	200	3.70	3.28
	- 200	-3.73	-3.84

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	-	2.60	0.09
Channel Y	200	1.31	-	3.04
Channel Z	200	2.43	-2.04	-

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	15621	15863
Channel Y	15831	16095
Channel Z	16132	15816

5. Input Offset Measurement

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

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	-0.14	-1.27	1.10	0.43
Channel Y	-0.91	-2.36	0.81	0.61
Channel Z	-1.02	-1.92	0.28	0.44

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.1999	202.7
Channel Y	0.1999	202.5
Channel Z	0.2000	202.7

8. Low Battery Alarm Voltage (verified during pre test)

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

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9



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IMPORTANT NOTICE

USAGE OF THE DAE 4

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

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

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

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

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

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

Important Note:

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

Important Note:

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

Important Note:

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

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TN_BR040315AD DAE4.doc

11.12.2009