

# SAR TEST REPORT

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

<b>Equipment Under Test</b>	PDA Scanner
<b>Model Name</b>	PA969
<b>Brand Name</b>	unitech
<b>Company Name</b>	unitech electronics co., ltd.
<b>Company Address</b>	5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan
<b>Standards</b>	OET 65 supplement C, IEEE /ANSI C95.1, C95.3, IEEE 1528
<b>FCC ID</b>	HLEPA969BTP
<b>Date of Receipt</b>	Nov. 21, 2011
<b>Date of Test(s)</b>	Dec. 18, 2011
<b>Date of Issue</b>	Apr. 26, 2012

In the configuration tested, the EUT complied with the standards specified above.

## Remarks:

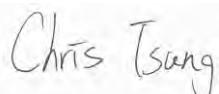
This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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## Signed for on the behalf of SGS

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Engineer



Chris Tsung

Date : Apr. 26, 2012

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Supervisor



Kelly Tsai

Date : Apr. 26, 2012

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## Version

Report Number	Revision	Date	Memo
EN/2011/B0009	00	2012/01/02	Initial creation of test report.
EN/2011/B0009	01	2012/04/19	1 <sup>st</sup> modification
EN/2011/B0009	02	2012/04/24	2 <sup>nd</sup> modification
EN/2011/B0009	03	2012/04/26	3 <sup>rd</sup> modification

**This test report contains a reference to the previous version test report that it replaces.**

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## 1. General Information

### 1.1 Testing Laboratory

SGS Taiwan Ltd. Electronics & Communication Laboratory	
134, Wu Kung Road, Wuku industrial zone	
Taipei county, Taiwan, R.O.C.	
Telephone	+886-2-2299-3279
Fax	+886-2-2298-0488
Internet	<a href="http://www.tw.sgs.com/">http://www.tw.sgs.com/</a>
Testing Location	1F, No.8, Alley 15, Lane 120, Sec .1, NeiHu Road NeiHu District Taipei City 114, Taiwan

### 1.2 Details of Applicant

Company Name	unitech electronics co., ltd.
Company Address	5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan
Contact Person	Eric
TEL	02-8912-1122
Fax	02-8912-1391

### 1.3 Description of EUT

EUT Name	PDA Scanner			
Model Name	PA969			
Brand Name	unitech			
IMEI Code	354114013286100			
FCC ID	HLEPA969BTP			
Mode of Operation	<input checked="" type="checkbox"/> GPRS <input checked="" type="checkbox"/> EDGE <input checked="" type="checkbox"/> WCDMA <input checked="" type="checkbox"/> HSDPA			
Definition	Production unit			
Duty Cycle	GPRS/EDGE		1/4.1	
	WCDMA		1	
	Bluetooth		1	

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TX Frequency Range (MHz)	GPRS850	824.2	—	848.8
	GPRS1900	1850.2	—	1909.8
	WCDMA Band II	1852.4	—	1907.6
	WCDMA Band V	826.4	—	846.6
	Bluetooth	2402	—	2480
Channel Number (ARFCN)	GPRS850	128	—	251
	GPRS1900	512	—	810
	WCDMA Band II	9262	—	9538
	WCDMA Band V	4132	—	4233
	Bluetooth	0	—	78
VOIP Function	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO			
Max. SAR Measured(1 g) (Unit: mW/g)	Body worn	GPRS 850	0.501	<input checked="" type="checkbox"/> Front <input type="checkbox"/> Back 190 Channel
		GPRS 1900	0.391	<input checked="" type="checkbox"/> Front <input type="checkbox"/> Back 661 Channel
		WCDMA Band II	1.01	<input checked="" type="checkbox"/> Front <input type="checkbox"/> Back 9400 Channel
		WCDMA Band V	0.347	<input checked="" type="checkbox"/> Front <input type="checkbox"/> Back 4183 Channel

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**#. GPRS/EDGE conducted power table:**

Burst average power				
1Dn2UP				
EUT mode	Frequency (MHz)	CH	Peak (dBm)	Avg. (dBm)
GPRS 850	824.2	128	30.90	30.70
	836.6	190	30.90	30.80
	848.8	251	30.90	30.80
Source-based time average power				
GPRS 850	824.2	128	24.88	24.68
	836.6	190	24.88	24.78
	848.8	251	24.88	24.78
The division factor compared to the number of TX time slot				
Division factor		2 TX time slot		
		-6.02		

Burst average power				
1Dn2UP				
EUT mode	Frequency (MHz)	CH	Peak (dBm)	Avg. (dBm)
EGPRS 850	824.2	128	28.60	25.50
	836.6	190	28.80	25.60
	848.8	251	28.60	25.50
Source-based time average power				
EGPRS 850	824.2	128	22.58	19.48
	836.6	190	22.78	19.58
	848.8	251	22.58	19.48
The division factor compared to the number of TX time slot				
Division factor		2 TX time slot		
		-6.02		

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Burst average power				
1Dn2UP				
EUT mode	Frequency (MHz)	CH	Peak (dBm)	Avg. (dBm)
GPRS 1900	1850.2	512	27.20	27.00
	1880	661	27.60	27.40
	1909.8	810	27.60	27.40
Source-based time average power				
GPRS 1900	1850.2	512	21.18	20.98
	1880	661	21.58	21.38
	1909.8	810	21.58	21.38
The division factor compared to the number of TX time slot				
Division factor		2 TX time slot		
		-6.02		

Burst average power				
1Dn2UP				
EUT mode	Frequency (MHz)	CH	Peak (dBm)	Avg. (dBm)
EGPRS 1900	1850.2	512	26.60	23.40
	1880	661	27.10	23.80
	1909.8	810	27.10	23.90
Source-based time average power				
EGPRS 1900	1850.2	512	20.58	17.38
	1880	661	21.08	17.78
	1909.8	810	21.08	17.88
The division factor compared to the number of TX time slot				
Division factor		2 TX time slot		
		-6.02		

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### #. WCDMA Band II & V HSDPA/HSUPA conducted power table:

		Rel99	HSDPA			
		Rel99	1	2	3	4
WCDMA Band II	9262	22.62	22.79	22.50	22.31	22.38
	9400	22.48	22.37	22.34	21.92	21.93
	9538	21.78	21.64	21.63	21.11	21.23
WCDMA Band V	4132	24.03	23.82	23.96	23.36	23.41
	4183	23.74	23.60	23.63	23.12	23.16
	4233	23.79	23.91	23.66	23.42	23.48

### #. Tune-up procedure

During manufacturing each PDA Scanner will be individually calibrated.

The measurement is done in a fully calibrated setup, which is based on a Agilent 8960 base station simulator (system tester). Furthermore, the highest power level is verified afterwards in a call measurement on three channels (low, mid and high).

Procedure:

1. Set the PDA Scanner to operational voltage and on one certain channel in a special service mode by means of company proprietary software.
2. The actual power is measured at several power levels.
3. The gain factors of each individual PDA Scanner are adjusted until the target value is met.

The appropriate gain control settings are stored in each PDA Scanner individually (for each power level).

The user has no possibility to change these settings later on.

For model name: PA969

Average output Power

GPRS 850 Class 10 / GPRS 1900 Class 10

CH Conducted Output Power / CH Conducted Output Power

128 [+32dBm +/-3dB] / 512 [+29dBm +3/-4dB]

190 [+32dBm +/-3dB] / 661 [+29dBm +3/-4dB]

251 [+32dBm +/-3dB] / 810 [+29dBm +3/-4dB]

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EDGE 850 Class 10 / EDGE 1900 Class 10

CH Conducted Output Power / CH Conducted Output Power

128 [+26dBm +/-3dB] / 512 [+26dBm +3/-4dB]

190 [+26dBm +/-3dB] / 661 [+26dBm +3/-4dB]

251 [+26dBm +/-3dB] / 810 [+26dBm +3/-4dB]

WCDMA, HSDPA B2 / WCDMA, HSDPA B5

CH Conducted Output Power / CH Conducted Output Power

9262 [+22dBm +1/-3dB] / 4132 [+23dBm +1/-3dB]

9400 [+22dBm +1/-3dB] / 4183 [+23dBm +1/-3dB]

9538 [+22dBm +1/-3dB] / 4233 [+23dBm +1/-3dB]

## 1.4 Test Environment

Ambient Temperature :  $22 \pm 2^\circ \text{C}$

Tissue Simulating Liquid:  $22 \pm 2^\circ \text{C}$

## 1.5 Operation description

1. The EUT is controlled by using a Radio Communication Tester (Agilent 8960), and the communication between the EUT and the tester is established by air link.
2. During the SAR testing, the DASY5 system checks power drift by comparing the e-field strength of one specific location measured at the beginning with that measured at the end of the SAR testing.
3. Testing body-worn SAR by separating 0 cm between the front of the EUT and the flat phantom.
4. When the maximum transmitter and antenna output power are  $\leq 60/f(\text{GHz})$  (mW) SAR evaluation is typically not required for FCC or TCB approval (BT power= 1.79 dBm).

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## 1.6 EVALUATION PROCEDURES

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

1. The extraction of the measured data (grid and values) from the Zoom Scan.
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters).
3. The generation of a high-resolution mesh within the measured volume.
4. The interpolation of all measured values from the measurement grid to the high-resolution grid.
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface.
6. The calculation of the averaged SAR within masses of 1g and 10g.

The probe is calibrated at the center of the dipole sensors that 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. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within -2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g

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and 10 g cubes, the extrapolation distance should not be larger than 5mm.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7x7x7 scans.

The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30x30x30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is moved around until the highest averaged SAR is found.

If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

## 1.7 The SAR Measurement System

A photograph of the SAR measurement System is given in Fig. a. This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY 5 professional system). A Model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation  $SAR = \sigma (|E_i|^2) / \rho$  where  $\sigma$  and  $\rho$  are the conductivity and mass density of the tissue-simulant.

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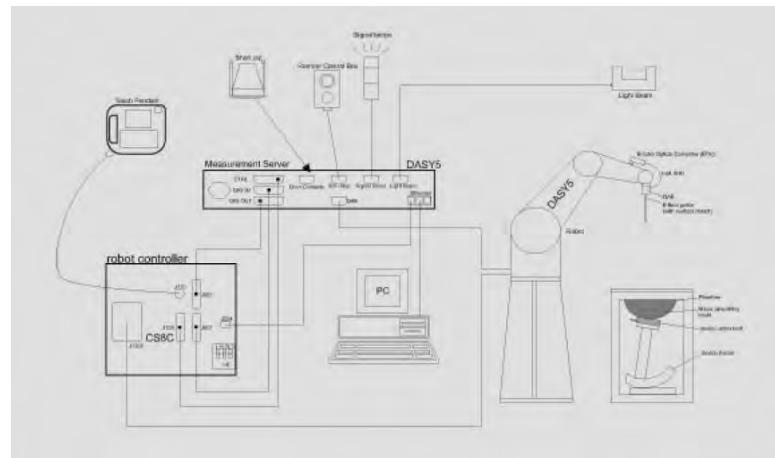


Fig.a The block diagram of SAR system

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

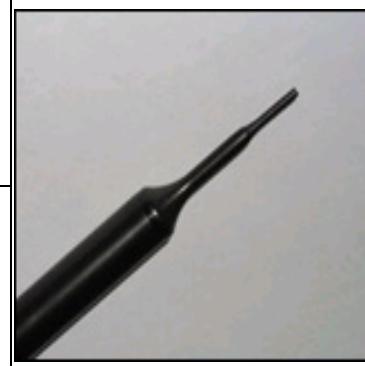
- A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.

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- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validate the proper functioning of the system.

## 1.8 System Components

### EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL835/1900MHz Additional CF for other liquids and frequencies upon request	EX3DV4 E-Field Probe
Frequency	10 MHz to > 6 GHz; Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)	
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 $\mu$ W/g to > 100 mW/g; Linearity: $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

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### SAM PHANTOM V4.0C

Construction:	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness:	2 ± 0.2 mm
Filling Volume:	Approx. 25 liters
Dimensions:	Height: 251 mm; Length: 1000 mm; Width: 500 mm



### DEVICE HOLDER

Construction	In combination with the Twin SAM Phantom V4.0/V4.0C or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).	 Device Holder
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## 1.9 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 5% from the target SAR values.

These tests were done at 835/1900 MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1. During the tests, the ambient temperature of the laboratory was in the range 22.1°C, the relative humidity was in the range 62% and the liquid depth above the ear reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

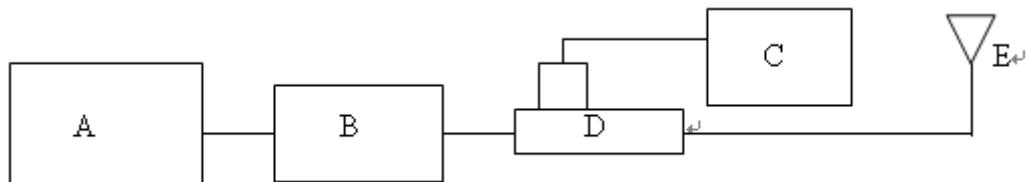
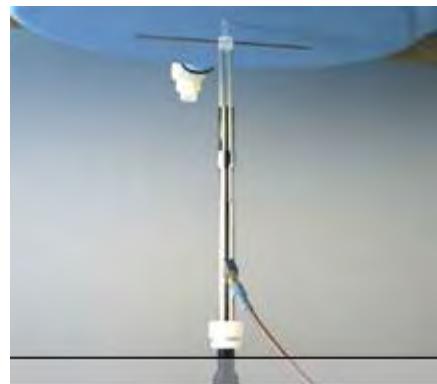


Fig.b The block diagram of system verification

- A. Agilent Model 8648D Signal Generator
- B. Mini circuits Model ZHL-42 Amplifier
- C. Agilent Model U2001B Power Sensor
- D. Agilent Model 778D Dual directional coupling
- E. Reference dipole antenna



Photograph of the dipole Antenna

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Validation Kit	S/N	Frequency (MHz)	Target SAR (1g) (Pin=250mW) (mW/g)	Measured SAR (1g) (mW/g)	Measured Date
D835V2	4d063	835	2.43	2.46	Dec. 18, 2011
D1900V2	5d027	1900	9.93	9.61	Dec. 18, 2011

Table 1. System validation (follow manufacture target value)

### 1.10 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this Head-simulant fluid were measured by using the HP Model 85070D Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with HP 8753D Network Analyzer (30 KHz-6000MHz).

All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the flat section of the phantom was 15cm±5mm during all tests. (Appendix Fig .2)

Frequency (MHz)	Tissue type	Dielectric Parameters	Recommended Limits	Measured	Measurement date
835	Body	$\rho$	51.21-56.60	52.307	Dec. 18, 2011
		$\sigma$ (S/m)	0.95-1.05	0.981	
		Simulated Tissue Temperature(°C)	20-24	21.7	
1900	Body	$\rho$	48.55-53.66	50.181	Dec. 18, 2011
		$\sigma$ (S/m)	1.44-1.60	1.577	
		Simulated Tissue Temperature(° C)	20-24	21.7	

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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The composition of the brain tissue simulating liquid:

Frequency (MHz)	Mode	Ingredient						Total amount
		DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	
850	Body	—	633.91	11.76	1.20	—	602.12	1.0L(g)
1900	Body	300.03	697.94	2.03	—	—	—	1.0L(g)

Table 3. Recipes for tissue simulating liquid (Unit: g)

## 1.11 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter.

Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

(1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the

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whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube).

Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(2) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube).

Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube).

General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure.

Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.(Table .6)

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

Table 4. RF exposure limits

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

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## 2. Summary of Results

### GPRS 850

Model Name	Mode	EUT Position	Test Configuration	Averaged SAR over 1g (W/kg)			SAR Limit 1g (W/kg)
				CH 128	CH 190	CH 251	
				824.20 MHz	836.60 MHz	848.80 MHz	
GPRS 850	GPRS class 10	Body Worn	Front	—	0.501	—	1.6

- # According to section 6.3.1 and 6.3.1.2 of KDB941225 D03 to exclude SAR test requirements for EDGE modes due to the source-based time-averaged output power(page 7's conducted power table) for edge mode is lower than that in the GPRS mode.
- # According to KDB447498 the 1-g SAR for the highest output channel is less than 0.8 W/kg, where the transmission band corresponding to all channels is  $\leq$  100 MHz, testing for the other channels is not required.

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## GPRS 1900 MHz

Model Name	Mode	EUT Position	Test Configuration	Averaged SAR over 1g (W/kg)			SAR Limit 1g (W/kg)
				CH 512	CH 661	CH 810	
				1850.20 MHz	1800.00 MHz	1909.80 MHz	
GPRS 1900	GPRS class 10	Body Worn	Front	—	0.391	—	1.6

- # Using KDB941225 D03 and KDB941225 D04 to exclude SAR test requirements for EDGE modes due to the source-based time-averaged output power for edge mode is lower than that in the GPRS mode.
- # According to KDB447498 the 1-g SAR for the highest output channel is less than 0.8 W/kg, where the transmission band corresponding to all channels is  $\leq$  100 MHz, testing for the other channels is not required.

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**WCDMA Band II**

Model Name	Mode	EUT Position	Test Configuration	Averaged SAR over 1g (W/kg)			SAR Limit 1g (W/kg)
				CH 9262	CH 9400	CH 9538	
				1852.40 MHz	1880.00 MHz	1907.60 MHz	
WCDMA Band II	R99	Body Worn	Front	0.943	1.01	0.883	1.6
			- with Bluetooth	—	0.878	—	1.6
			Back	—	0.148	—	1.6

- # Using KDB941225 D01 to exclude SAR test requirements for HSPA modes due to the maximum average output power of HSPA active is less than 1/4 dB higher than that measured without HSPA using 12.2kbps RMC
- # According to KDB447498 the 1-g SAR for the highest output channel is less than 0.8 W/kg, where the transmission band corresponding to all channels is  $\leq$  100 MHz, testing for the other channels is not required.

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**WCDMA Band V**

Model Name	Mode	EUT Position	Test Configuration	Averaged SAR over 1g (W/kg)			SAR Limit 1g (W/kg)
				CH 4132	CH 4183	CH 4233	
				826.40 MHz	836.60 MHz	846.60 MHz	
WCDMA Band V	R99	Body Worn	Front	—	0.347	—	1.6

- # Using KDB941225 D01 to exclude SAR test requirements for HSPA modes due to the maximum average output power of HSPA active is less than 1/4 dB higher than that measured without HSPA using 12.2kbps RMC
- # According to KDB447498 the 1-g SAR for the highest output channel is less than 0.8 W/kg, where the transmission band corresponding to all channels is  $\leq$  100 MHz, testing for the other channels is not required.

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### 3. Instruments List

Device	Manufacturer	Type	Serial number	Date of last calibration	Date of next calibration
Dosimetric E-Field Probe	Schmid & Partner Engineering AG	EX3DV4	3770	Apr.19.2011	Apr.19.2011
835/1900/ MHz System Validation Dipole	Schmid & Partner Engineering AG	D835V2	4d063	May.25.2011	May.24.2012
		D1900V2	5d027	Apr.19.2011	Apr.18.2012
Data acquisition Electronics	Schmid & Partner Engineering AG	DAE4	856	May.18.2011	May.17.2012
Software	Schmid & Partner Engineering AG	DASY 5 V52.6	N/A	Calibration not required	
Phantom	Schmid & Partner Engineering AG	SAM	N/A	Calibration not required	
Network Analyzer	HP	E5071C	MY46107530	Jan.12.2011	Jan.11.2012
Dielectric Probe Kit	HP	85070E	MY44300554	Calibration not required	
Dual-directional coupler	Agilent	778D	MY48220468	May.29.2011	May.28.2012
RF Signal Generator	Agilent	8648D	3847M00432	Jun.01.2011	Jun.01.2012
Power Sensor	Agilent	U2001B	MY48100169	Apr.28.2011	Apr.27.2012
Radio Communication Test	Agilent	E5515C	GB44051912	Jul.27.2010	Jul.26.2012

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## 4. Measurements

Date: 12/18/2011

### Body\_CH190

Communication System: GPRS(Class 10); Frequency: 836.6 MHz

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.983$  mho/m;  $\epsilon_r = 52.293$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(9.3, 9.3, 9.3); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid:  $dx=15$ mm,

$dy=15$ mm

Maximum value of SAR (interpolated) = 0.644 mW/g

**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement

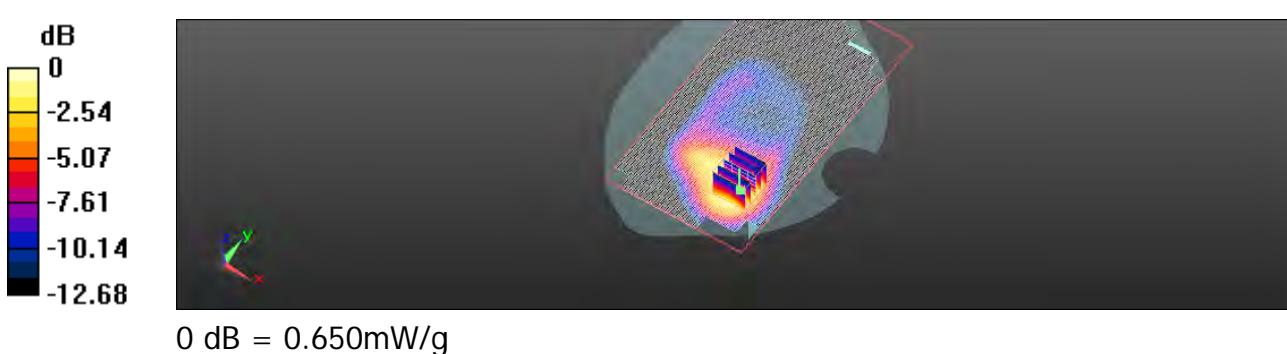
grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 7.256 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.797 W/kg

**SAR(1 g) = 0.501 mW/g; SAR(10 g) = 0.310 mW/g**

Maximum value of SAR (measured) = 0.653 mW/g



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Date: 12/18/2011

## Body\_CH661

Communication System: GPRS(Class 10); Frequency: 1880 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.553$  mho/m;  $\epsilon_r = 49.921$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.51, 7.51, 7.51); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.520 mW/g

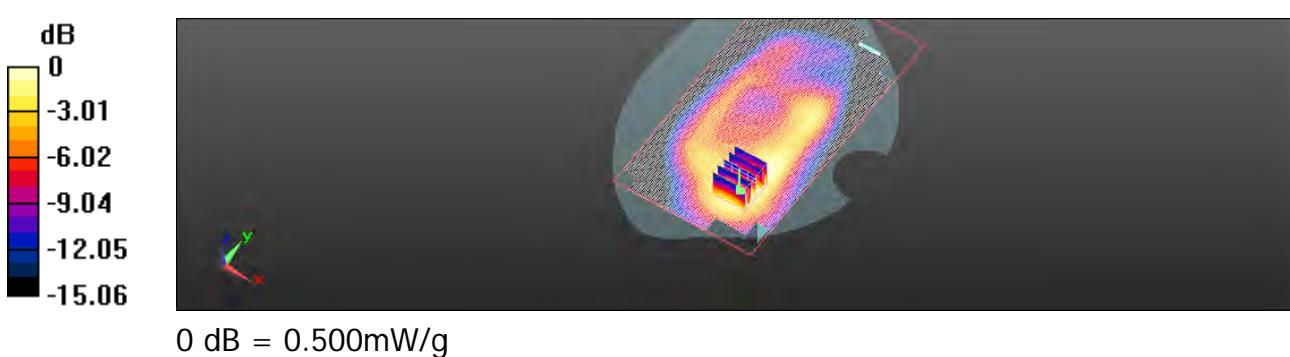
**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.730 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.621 W/kg

**SAR(1 g) = 0.391 mW/g; SAR(10 g) = 0.241 mW/g**

Maximum value of SAR (measured) = 0.501 mW/g



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Date: 12/18/2011

## Body\_CH9262

Communication System: WCDMA; Frequency: 1852.4 MHz

Medium parameters used (interpolated):  $f = 1852.4$  MHz;  $\sigma = 1.515$  mho/m;  $\epsilon_r = 49.977$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.51, 7.51, 7.51); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid:  $dx=15$  mm,  $dy=15$  mm

Maximum value of SAR (interpolated) = 1.202 mW/g

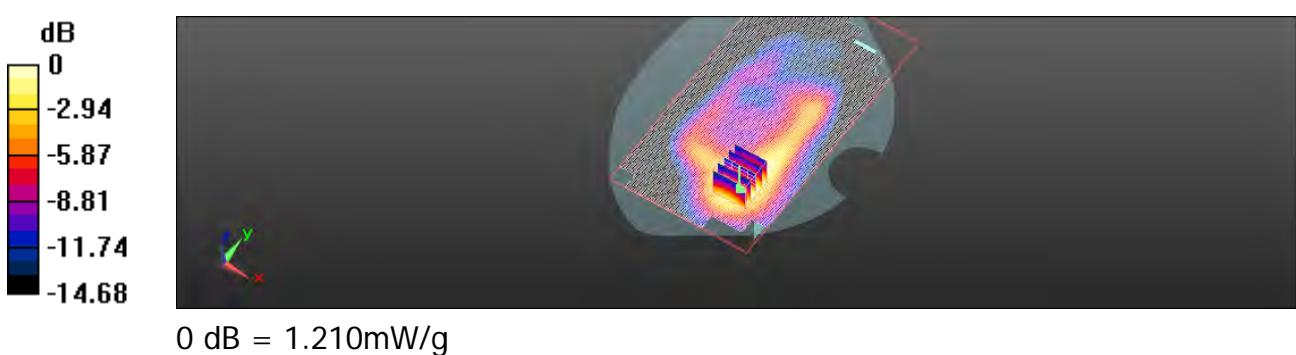
**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm

Reference Value = 10.170 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 1.460 W/kg

**SAR(1 g) = 0.943 mW/g; SAR(10 g) = 0.583 mW/g**

Maximum value of SAR (measured) = 1.213 mW/g



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Date: 12/18/2011

## Body\_CH9400

Communication System: WCDMA; Frequency: 1880 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.553$  mho/m;  $\epsilon_r = 49.921$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.51, 7.51, 7.51); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid:  $dx=15$  mm,

$dy=15$  mm

Maximum value of SAR (interpolated) = 1.357 mW/g

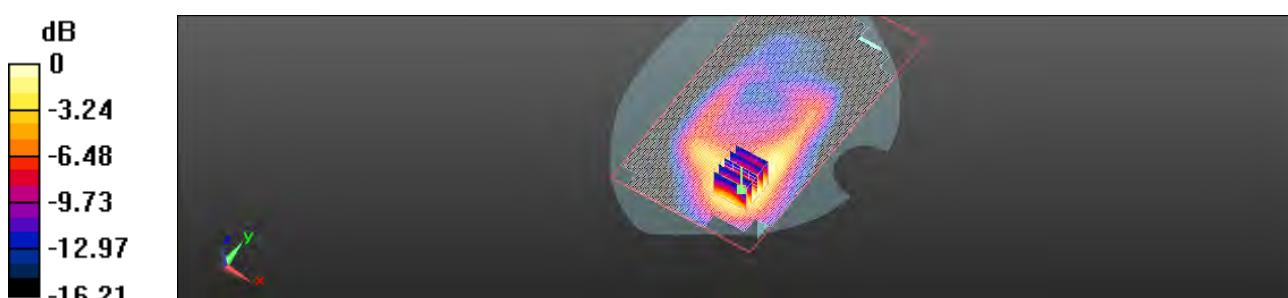
**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm

Reference Value = 9.286 V/m; Power Drift = -0.13 dB

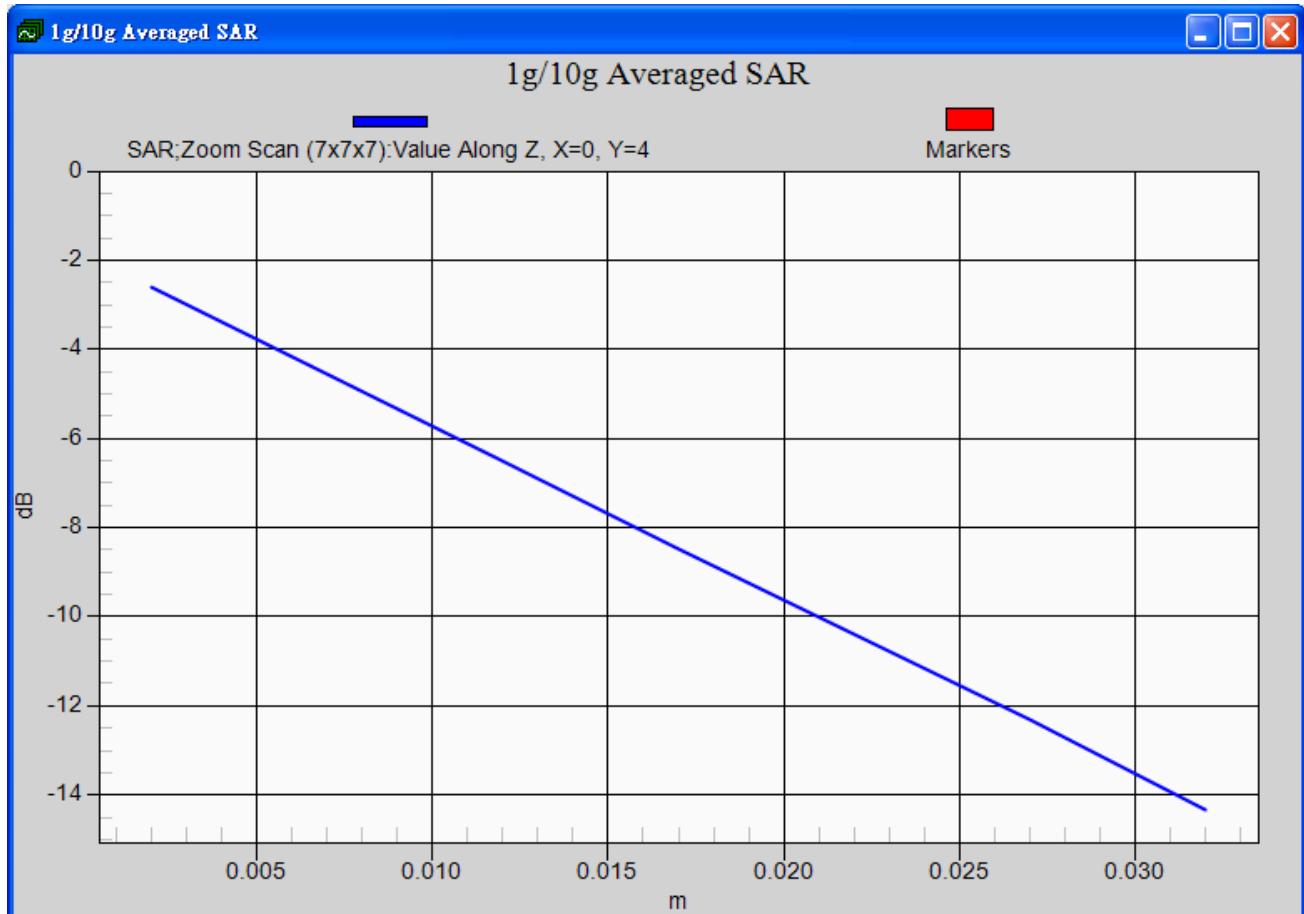
Peak SAR (extrapolated) = 1.659 W/kg

**SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.597 mW/g**

Maximum value of SAR (measured) = 1.336 mW/g



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Date: 12/18/2011

## Body\_CH9538

Communication System: WCDMA; Frequency: 1907.6 MHz

Medium parameters used:  $f = 1908$  MHz;  $\sigma = 1.585$  mho/m;  $\epsilon_r = 50.273$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.51, 7.51, 7.51); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid: dx=15mm,

dy=15mm

Maximum value of SAR (interpolated) = 1.144 mW/g

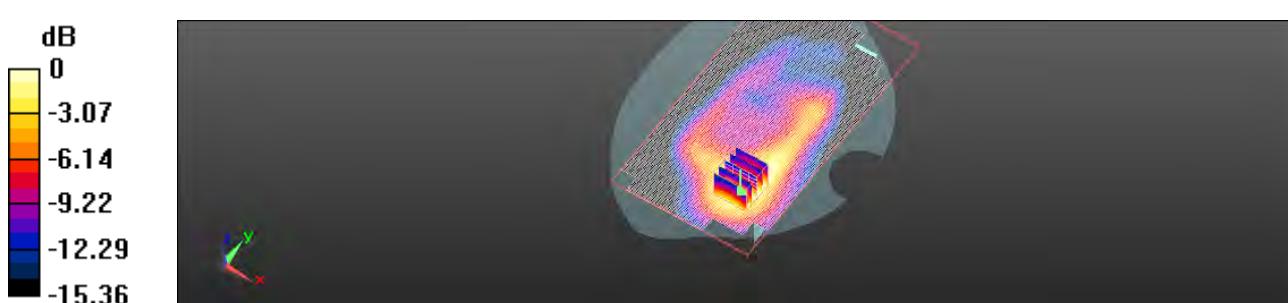
**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.780 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.401 W/kg

**SAR(1 g) = 0.883 mW/g; SAR(10 g) = 0.541 mW/g**

Maximum value of SAR (measured) = 1.150 mW/g



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Date: 12/18/2011

## Body\_CH9400\_repeated with Bluetooth active

Communication System: WCDMA; Frequency: 1880 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.553$  mho/m;  $\epsilon_r = 49.921$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.51, 7.51, 7.51); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid: dx=15mm,

dy=15mm

Maximum value of SAR (interpolated) = 1.169 mW/g

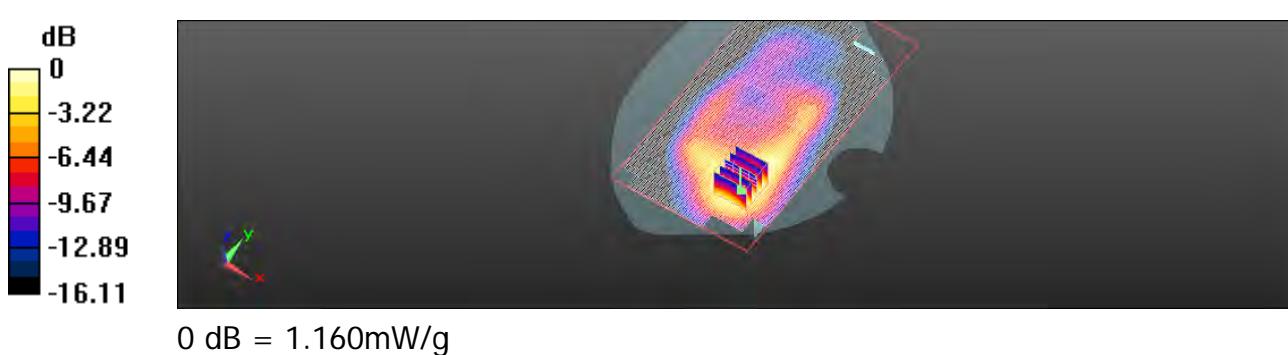
**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.752 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 1.426 W/kg

**SAR(1 g) = 0.878 mW/g; SAR(10 g) = 0.527 mW/g**

Maximum value of SAR (measured) = 1.157 mW/g



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Date: 12/18/2011

## **Body\_CH9400\_\_repeated for EUT back to phantom**

Communication System: WCDMA; Frequency: 1880 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.553$  mho/m;  $\epsilon_r = 49.921$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.51, 7.51, 7.51); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid: dx=15mm,

dy=15mm

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

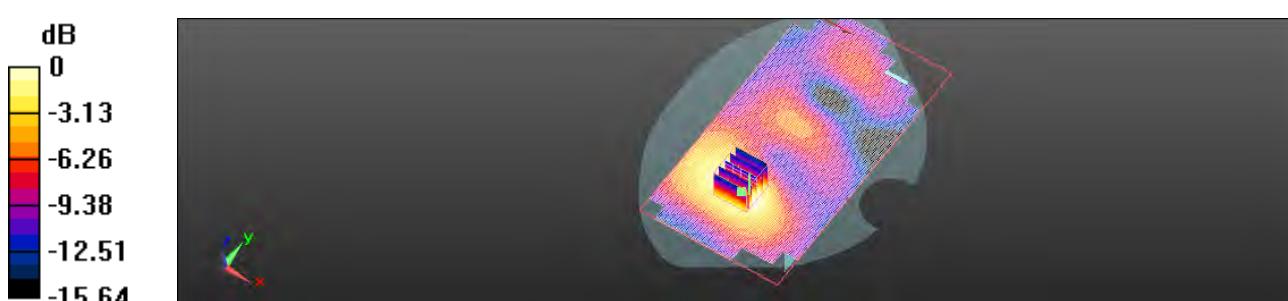
**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.339 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.239 W/kg

**SAR(1 g) = 0.148 mW/g; SAR(10 g) = 0.089 mW/g**

Maximum value of SAR (measured) = 0.194 mW/g



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Date: 12/18/2011

## Body\_CH4183

Communication System: WCDMA; Frequency: 836.6 MHz

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.983$  mho/m;  $\epsilon_r = 52.293$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(9.3, 9.3, 9.3); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/Body/Area Scan (91x171x1):** Measurement grid:  $dx=15$  mm,

$dy=15$  mm

Maximum value of SAR (interpolated) = 0.431 mW/g

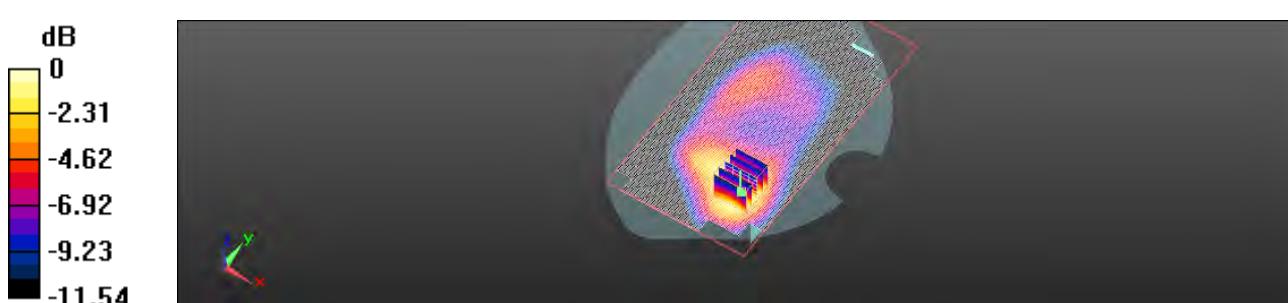
**Configuration/Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm

Reference Value = 8.516 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.517 W/kg

**SAR(1 g) = 0.347 mW/g; SAR(10 g) = 0.226 mW/g**

Maximum value of SAR (measured) = 0.437 mW/g



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## 5. System Verification

Date: 12/18/2011

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.981$  mho/m;  $\epsilon_r = 52.307$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(9.3, 9.3, 9.3); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/d=15mm, Pin=250mW, dist=2mm:** Measurement grid:

dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.112 mW/g

**Configuration/d=15mm, Pin=250mW, dist=2mm:** Measurement grid:

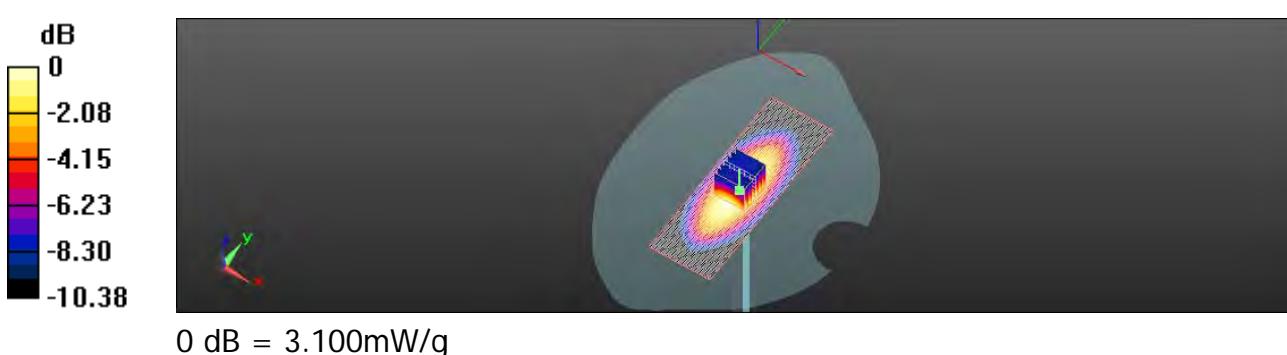
dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.661 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.641 W/kg

**SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g**

Maximum value of SAR (measured) = 3.102 mW/g



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Date: 12/18/2011

Communication System: CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.577$  mho/m;  $\epsilon_r = 50.181$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.51, 7.51, 7.51); Calibrated: 4/19/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 5/18/2011
- Phantom: SAM2; Type: SAM
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

**Configuration/d=10mm, Pin=250mW, dist=2mm:** Measurement grid:

dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 14.811 mW/g

**Configuration/d=10mm, Pin=250mW, dist=2mm:** Measurement grid:

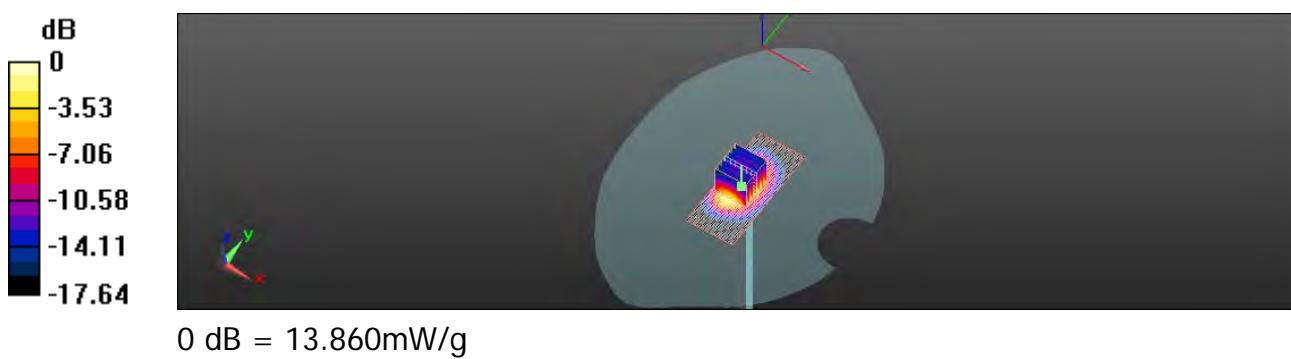
dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.887 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 17.790 W/kg

**SAR(1 g) = 9.61 mW/g; SAR(10 g) = 4.95 mW/g**

Maximum value of SAR (measured) = 13.859 mW/g



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## 6. DAE & Probe Calibration certificate

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 SGS-TW (Auden)

Certificate No: DAE4-856\_May11

### CALIBRATION CERTIFICATE

Object DAE4 - SD 000 D04 BJ - SN: 856

Calibration procedure(s) QA CAL-06.v23  
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: May 18, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	28-Sep-10 (No:10376)	Sep-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

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

Issued: May 18, 2011

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Certificate No: DAE4-856\_May11

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Accreditation No.: SCS 108

Client SGS-TW (Auden)

Certificate No: EX3-3770\_Apr11

## CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3770

Calibration procedure(s) QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v3  
Calibration procedure for dosimetric E-field probes

Calibration date: April 19, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41495277	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: April 19, 2011

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Certificate No: EX3-3770\_Apr11

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#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

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

#### Methods Applied and Interpretation of Parameters:

- $NORM_{x,y,z}$ : Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- $NORM(f)x,y,z = NORM_{x,y,z} * frequency\_response$  (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- $DCP_{x,y,z}$ : DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- $PAR$ : PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- $A_{x,y,z}$ ;  $B_{x,y,z}$ ;  $C_{x,y,z}$  are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- $VR$ : VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- 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  $\pm 50$  MHz to  $\pm 100$  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.

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EX3DV4 – SN:3770

April 19, 2011

# Probe EX3DV4

SN:3770

Manufactured: July 6, 2010  
Calibrated: April 19, 2011

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

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Certificate No: EX3-3770\_Apr11

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EX3DV4- SN:3770

April 19, 2011

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3770

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu$ V/(V/m) <sup>2</sup> ) <sup>A</sup>	0.32	0.62	0.40	$\pm$ 10.1 %
DCP (mV) <sup>B</sup>	106.6	98.3	102.8	

### Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>E</sup> (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	120.8	$\pm$ 2.7 %
			Y	0.00	0.00	1.00	134.3	
			Z	0.00	0.00	1.00	133.5	

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6)

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EX3DV4- SN:3770

April 19, 2011

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3770

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>d</sup>	Conductivity (S/m) <sup>d</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	9.58	9.58	9.58	0.80	0.70	± 12.0 %
835	41.5	0.90	9.25	9.25	9.25	0.80	0.67	± 12.0 %
900	41.5	0.97	9.06	9.06	9.06	0.76	0.71	± 12.0 %
1750	40.1	1.37	7.97	7.97	7.97	0.80	0.61	± 12.0 %
1900	40.0	1.40	7.78	7.78	7.78	0.71	0.62	± 12.0 %
2000	40.0	1.40	7.79	7.79	7.79	0.75	0.58	± 12.0 %
2450	39.2	1.80	6.99	6.99	6.99	0.80	0.56	± 12.0 %
2600	39.0	1.96	6.95	6.95	6.95	0.66	0.62	± 12.0 %

<sup>c</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>d</sup> At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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EX3DV4- SN:3770

April 19, 2011

## DASY/EASY - Parameters of Probe: EX3DV4- SN:3770

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>f</sup>	Conductivity (S/m) <sup>f</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	9.42	9.42	9.42	0.73	0.72	± 12.0 %
835	55.2	0.97	9.30	9.30	9.30	0.72	0.72	± 12.0 %
900	55.0	1.05	9.12	9.12	9.12	0.73	0.75	± 12.0 %
1750	53.4	1.49	7.84	7.84	7.84	0.80	0.68	± 12.0 %
1900	53.3	1.52	7.51	7.51	7.51	0.80	0.62	± 12.0 %
2000	53.3	1.52	7.44	7.44	7.44	0.80	0.66	± 12.0 %
2450	52.7	1.95	6.96	6.96	6.96	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.78	6.78	6.78	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.42	4.42	4.42	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.12	4.12	4.12	0.52	1.90	± 13.1 %
5600	48.5	5.77	3.54	3.54	3.54	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.80	3.80	3.80	0.60	1.90	± 13.1 %

<sup>c</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

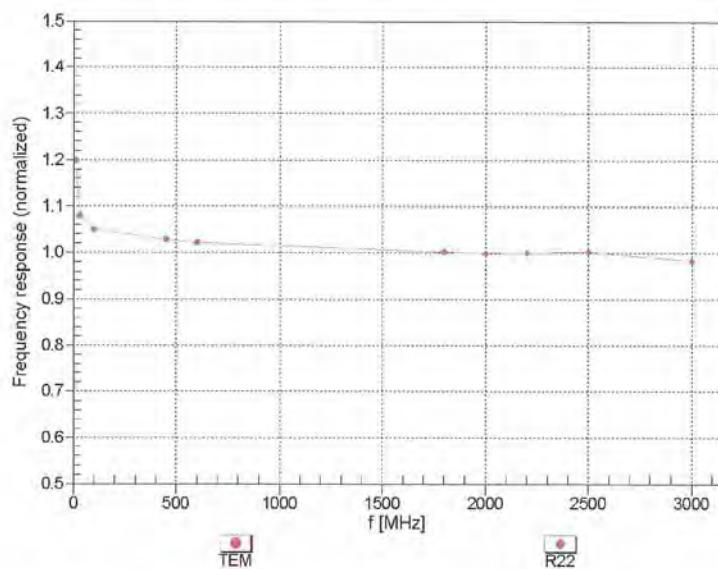
<sup>f</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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EX3DV4- SN:3770

April 19, 2011

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



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

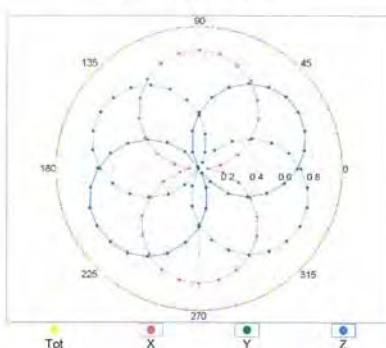
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EX3DV4- SN:3770

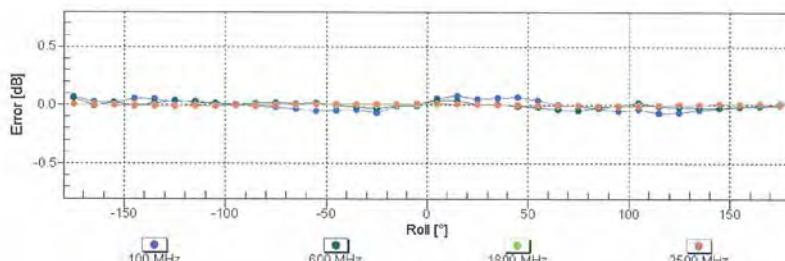
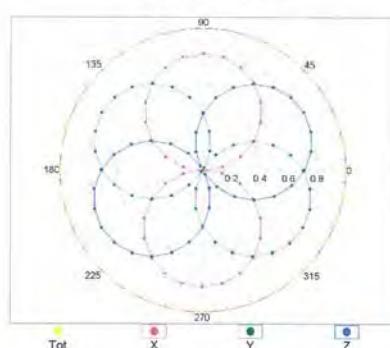
April 19, 2011

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

f=600 MHz, TEM



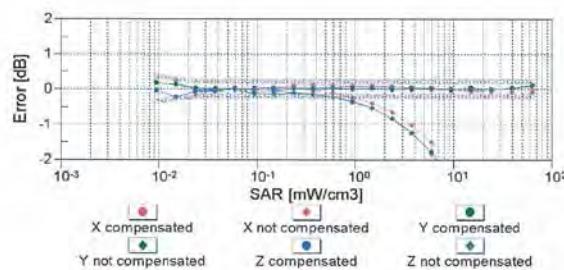
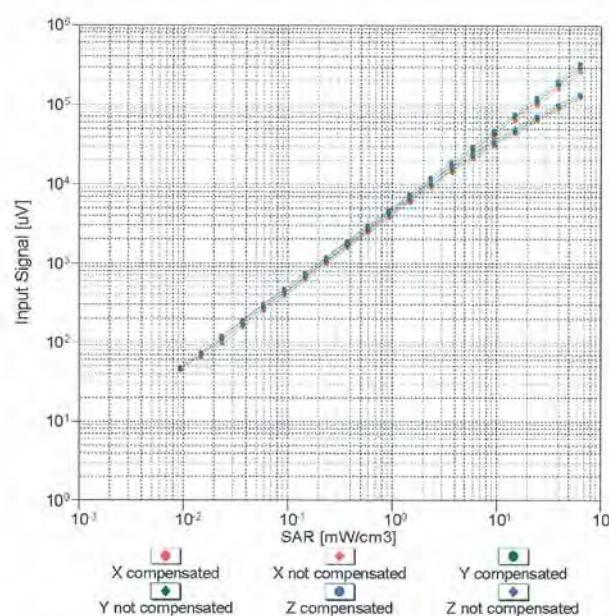
f=1800 MHz, R22



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

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**Dynamic Range f(SAR<sub>head</sub>)**  
(TEM cell, f = 900 MHz)



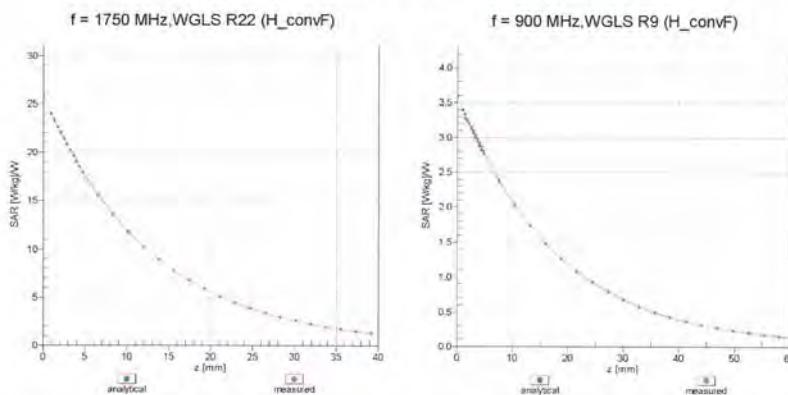
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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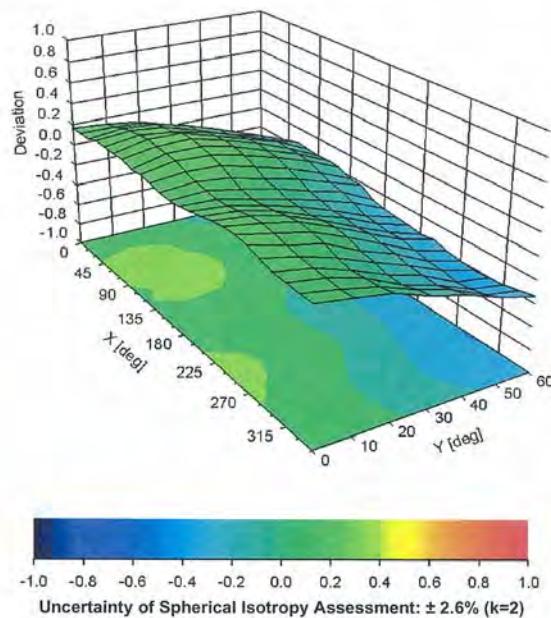
April 19, 2011

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid

Error ( $\phi, \theta$ ), f = 900 MHz



Certificate No: EX3-3770\_Apr11

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EX3DV4- SN:3770

April 19, 2011

### DASY/EASY - Parameters of Probe: EX3DV4 - SN:3770

#### 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

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## 7. Uncertainty Budget

Measurement Uncertainty evaluation template for DUT SAR test

IEEE 1528

A	c	D	e	f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty %	Probability Distribution	Div	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi. or Veff
<b>Measurement system</b>								
Probe calibration (Frequency below 2GHz)	6.0%	N	1	1	1	6.0%	6.0%	$\infty$
<i>Isotropy, Axial</i>	4.7%	R	$\sqrt{3}$	1	1	2.7%	2.7%	$\infty$
<i>Isotropy, Hemispherical</i>	9.6%	R	$\sqrt{3}$	1	1	5.5%	5.5%	$\infty$
Boundary Effect	1.0%	R	$\sqrt{3}$	1	1	0.6%	0.6%	$\infty$
Linearity	4.7%	R	$\sqrt{3}$	1	1	2.7%	2.7%	$\infty$
Detection Limits	1.0%	R	$\sqrt{3}$	1	1	0.6%	0.6%	$\infty$
Readout Electronics	0.3%	N	1	1	1	0.3%	0.3%	$\infty$
Response time	0.8%	R	$\sqrt{3}$	1	1	0.5%	0.5%	$\infty$
Integration Time	2.6%	R	$\sqrt{3}$	1	1	1.5%	1.5%	$\infty$
<i>Measurement drift (class A evaluation)</i>	1.8%	R	$\sqrt{3}$	1	1	1.0%	1.0%	$\infty$
RF ambient condition - noise	3.0%	R	$\sqrt{3}$	1	1	1.7%	1.7%	$\infty$
RF ambient conditions -reflections	3.0%	R	$\sqrt{3}$	1	1	1.7%	1.7%	$\infty$
Probe positioner Mechanical restrictions	0.4%	R	$\sqrt{3}$	1	1	0.2%	0.2%	$\infty$
Probe Positioning with respect to phantom	2.9%	R	$\sqrt{3}$	1	1	1.7%	1.7%	$\infty$
Post-processing	1.0%	R	$\sqrt{3}$	1	1	0.6%	0.6%	$\infty$
Max SAR Eval	1.0%	R	$\sqrt{3}$	1	1	0.6%	0.6%	$\infty$
<b>Test Sample related</b>								
Test sample	2.9%	N	1	1	1	2.9%	2.9%	M-1
Device Holder Uncertainty	3.6%	N	1	1	1	3.6%	3.6%	M-1
Drift of output power	5.0%	R	$\sqrt{3}$	1	1	2.9%	2.9%	$\infty$
<b>Phantom and Setup</b>								
Phantom Uncertainty	4.0%	R	$\sqrt{3}$	1	1	2.3%	2.3%	$\infty$
Liquid conductivity(meas.) Max at 1900 band	4.6%	N	1	0.64	0.43	2.9%	2.0%	M
Liquid permittivity(meas.) Max at 835 band	2.2%	N	1	0.6	0.49	1.3%	1.1%	M
Combined standard uncertainty		RSS				11.9%	11.6%	
Expant uncertainty (95% confidence interval), K=2						23.7%	23.3%	

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## 8. Phantom description

Schmid & Partner Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland  
Phone +41 1 245 9700, Fax +41 1 245 9779  
info@speag.com, http://www.speag.com

**s p e a g**

### Certificate of Conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer	SPEAG Zeughausstrasse 43 CH-8004 Zurich Switzerland

#### Tests

The series production process used allows the limitation to test of first articles.  
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been reflected using further series items (called samples) or are tested at each item.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'S CAD File (*)	First article, Samples
Material thickness of shell	Compliant with the requirements according to the standards	2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff.
Material thickness at ERP	Compliant with the requirements according to the standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz – 6 GHz: Relative permittivity < 5, Loss tangent < 0.05	Material samples
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility.	DEGMBe based simulating liquids	Pre-series, First article, Material samples
Sagging	Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid.	< 1% typical < 0.8% if filled with 155mm of HSL900 and without DUT below	Prototypes, Sample testing

#### Standards

- [1] CENELEC EN 60361
- [2] IEEE Std 1528-2003
- [3] IEC 62209 Part 1
- [4] FCC OET Bulletin 65, Supplement C, Edition 01-01

(\*) The IT'S CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

#### Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4].

Date 07.07.2005

Signature / Stamp

**s p e a g**

Schmid & Partner Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland  
Phone +41 1 245 9700, Fax +41 1 245 9779  
info@speag.com, http://www.speag.com

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## 9. System Validation from Original equipment supplier

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 **SGS-TW (Auden)**

Certificate No: **D835V2-4d063\_May11**

### CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d063**

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

Calibration date: **May 25, 2011**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: May 25, 2011

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

Certificate No: **D835V2-4d063\_May11**

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## DASY5 Validation Report for Body TSL

Date: 25.05.2011

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d063**

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

Medium: MSL900

Medium parameters used:  $f = 835$  MHz;  $\sigma = 1$  mho/m;  $\epsilon_r = 53.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 29.04.2011
- 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, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Cube 0:

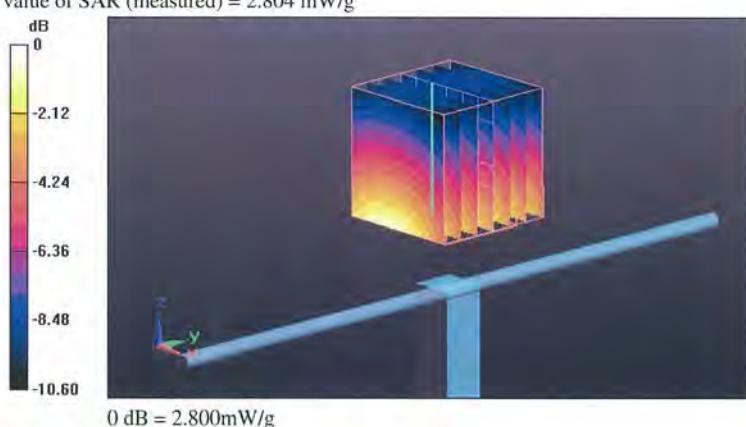
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.297 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.530 W/kg

**SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.6 mW/g**

Maximum value of SAR (measured) = 2.804 mW/g



Certificate No: D835V2-4d063\_May11

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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 SGS TW (Auden)

Certificate No: D1900V2-5d027\_Apr11

## CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d027
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits
Calibration date:	April 19, 2011

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: April 19, 2011

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

Certificate No: D1900V2-5d027\_Apr11

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### DASY5 Validation Report for Body TSL

Date/Time: 19.04.2011 12:53:51

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d027

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

Medium: MSL U12 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.52$  mho/m;  $\epsilon_r = 51.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2829)

#### Pin=250 mW, Cube 0:

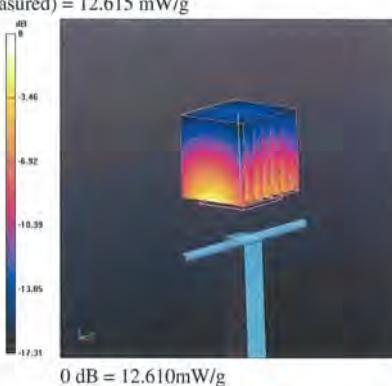
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.170 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.156 W/kg

SAR(1 g) = 9.93 mW/g; SAR(10 g) = 5.18 mW/g

Maximum value of SAR (measured) = 12.615 mW/g



**End of 1<sup>st</sup> part of report**

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