



A Test Lab Techno Corp.

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SAR EVALUATION REPORT

Test Report No.	:	0906FS12-02
Applicant	:	Huawei Technologies Co., Ltd
Product Type	:	GSM 850/1900 Mobile Phone
FCC ID	:	QISG3500
Trade Name	:	HUAWEI
Model Number	:	HUAWEI G3500
Dates of Test	:	Jun. 08 ~ Jun. 09, 2009
Test Environment	:	Ambient Temperature : 22 ± 2 ° 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]
Max. SAR	:	1.220 W/kg Head SAR 1.370 W/kg Body SAR
Test Lab	:	Chang-an Lab



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1. Description of Equipment Under Test (EUT)

Applicant :

Huawei Technologies Co., Ltd

Huawei Base BanTian Longgang Shenzhen 518129 P.R.C

Manufacturer	:	Huawei Technologies Co., Ltd
Manufacturer Address	:	Huawei Base BanTian Longgang Shenzhen 518129 P.R.C
Product Type	:	GSM 850/1900 Mobile Phone
FCC ID	:	QISG3500
Trade Name	:	HUAWEI
Model Number	:	HUAWEI G3500
Test Device	:	Production Unit
Tx Frequency	:	824.2 - 848.8 MHz (GSM/GPRS 850) 1850.2 - 1909.8 MHz (PCS/GPRS 1900)
RF Conducted Power (Avg.)	:	1.660 W (32.20 dBm) GSM/GPRS 850 0.832 W (29.20 dBm) PCS/GPRS 1900
Max. SAR Measurement	:	1.220 W/kg Head SAR 1.370 W/kg Body SAR
HW Version	:	N/A
SW Version	:	N/A
Antenna Type	:	Internal Type
Antenna Gain	:	0.23 dBi (GSM/GPRS 850) 1.28 dBi (PCS/GPRS 1900)
Device Category	:	Portable
RF Exposure Environment	:	General Population / Uncontrolled
Battery Option	:	Standard
Application Type	:	Certification

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 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) : HUAWEI G3500**. The test procedures, as described in American National Standards, Institute C95.1 - 2005 [1], FCC/OET Bulletin 65 Supplement C [July 2001] 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 5).

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

Figure 2. SAR Mathematical Equation

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

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

Where :

- σ = conductivity of the tissue (S/m)
- ρ = mass density of the tissue (kg/m^3)
- 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

These measurements were performed with the automated near-field scanning system DASY5 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than $\pm 0.02\text{mm}$. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines (length = 300mm) to the data acquisition unit.

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Measurement Server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with either the DAE4 (or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The PC consists of the Intel Core(TM)2 CPU @1.86GHz computer with Windows XP system and SAR Measurement Software DASY5, Post Processor SEMCAD, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection...etc. is connected to the Electro-optical converter (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the Measurement Server.

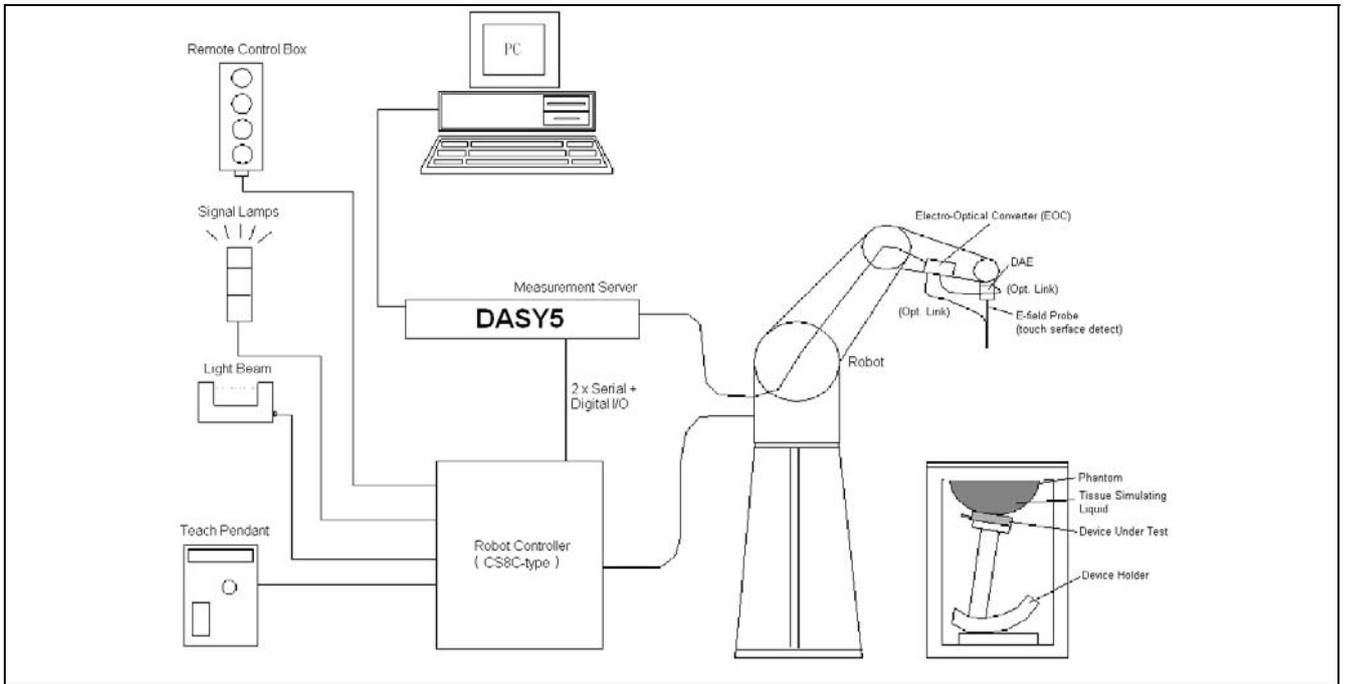


Figure 3. SAR Lab Test Measurement Setup

The DAE4 (or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [3] .



5. System Components

5.1 DASYS E-Field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 or ET3DV6 (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASYS software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

5.1.1 E-Field Probe Specification

Construction	<p>Symmetrical design with triangular core</p> <p>Built-in optical fiber for surface detection System</p> <p>Built-in shielding against static charges</p> <p>PEEK enclosure material</p> <p>(resistant to organic solvents, e.q., glycol)</p>
Calibration	<p>In air from 10 MHz to 6 GHz</p> <p>In brain and muscle simulating tissue at frequencies of 835MHz, 1950MHz (accuracy $\pm 8\%$)</p> <p>Calibration for other liquids and frequencies upon request</p>
Frequency	<p>10 MHz to > 6 GHz; Linearity: ± 0.2 dB</p> <p>(30 MHz to 3 GHz)</p>
Directivity	<p>± 0.3 dB in brain tissue (rotation around probe axis)</p> <p>± 0.5 dB in brain tissue (rotation normal probe axis)</p>
Dynamic Range	<p>10 μ W/g to > 100mW/g; Linearity: ± 0.2dB</p>
Surface Detection	<p>± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surface(EX3DV3 only)</p>
Dimensions	<p>Overall length: 330mm</p> <p>Tip length: 20mm</p> <p>Body diameter: 12mm</p> <p>Tip diameter: 2.5mm</p> <p>Distance from probe tip to dipole centers: 1.0mm</p>
Application	<p>General dosimetry up to 6GHz</p> <p>Compliance tests of mobile phones</p> <p>Fast automatic scanning in arbitrary phantoms</p>



Figure 4. E-field Probe



Figure 5. Probe setup on robot



5.1.2 E-Field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure described in [4] with accuracy better than $\pm 10\%$. The spherical isotropy was evaluated with the procedure described in [5] and found to be better than $\pm 0.25\text{dB}$. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1GHz, and in a wave guide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C \frac{\Delta T}{\Delta t}$$

Where :

Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (head or body),

ΔT = Temperature increase due to RF exposure.

Or

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

Where :

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).



5.2 Data Acquisition Electronic (DAE) System

Cell Controller

Processor : Intel Core(TM)2 CPU
Clock Speed : @ 1.86GHz
Operating System : Windows XP Professional

Data Converter

Features : Signal Amplifier, multiplexer, A/D converter, and control logic
Software : DASY5 v5.0 (Build 125) & SEMCAD X Version 13.4 Build 125
Connecting Lines : Optical downlink for data and status info
Optical uplink for commands and clock

5.3 Robot

Positioner : Stäubli Unimation Corp. Robot Model: TX90XL
Repeatability : ± 0.02 mm
No. of Axis : 6

5.4 Measurement Server

Processor : PC/104 with a 400MHz intel ULV Celeron
I/O-board : Link to DAE4(or DAE3)
16-bit A/D converter for surface detection system
Digital I/O interface
Serial link to robot
Direct emergency stop output for robot

5.5 Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device (POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeat ably positioned according to the IEEE SCC34-SC2 and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

***Note :** A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [6] . To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Larger DUT cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values. Therefore those devices are normally only tested at the flat part of the SAM.



Figure 6. Device Holder

5.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.



Figure 7. SAM Twin Phantom

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	810×1000×500 mm (H×L×W)

Table 1. Specification of SAM v4.0

5.7 Data Storage and Evaluation

5.7.1 Data Storage

The DASY5 software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension .DA4. The post processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.



5.7.2 Data Evaluation

The DASY5 post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software :

Probe parameters :	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	dcp _i
Device parameters :	- Frequency	f
	- Crest factor	cf
Media parameters :	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as :

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

- with V_i = compensated signal of channel i ($i = x, y, z$)
- U_i = input signal of channel i ($i = x, y, z$)
- cf = crest factor of exciting field (DASY parameter)
- dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated :

E-field probes :

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$



H-field probes :

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

- with V_i = compensated signal of channel i ($i = x, y, z$)
 $Norm_i$ = sensor sensitivity of channel i ($i = x, y, z$)
 $\mu V/(V/m)^2$ for E-field Probes
 $ConvF$ = sensitivity enhancement in solution
 a_{ij} = sensor sensitivity factors for H-field probes
 f = carrier frequency [GHz]
 E_i = electric field strength of channel i in V/m
 H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude) :

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

- with SAR = local specific absorption rate in mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in [mho/m] or [Siemens/m]
 ρ = equivalent tissue density in g/cm^3

***Note :** That the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = \frac{H_{tot}^2}{37.7}$$

- with P_{pwe} = equivalent power density of a plane wave in mW/cm^2
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in A/m



6. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Field Probe	ES3DV3	3150	Apr. 28, 2009	Apr. 28, 2010
SPEAG	835MHz System Validation Kit	D835V2	4d063	May 25, 2009	May 25, 2010
SPEAG	1900MHz System Validation Kit	D1900V2	5d027	Apr. 27, 2009	Apr. 27, 2010
SPEAG	Data Acquisition Electronics	DAE4	779	Nov. 11, 2008	Nov. 11, 2009
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	Phantom	SAM V4.0	TP-1150	NCR	NCR
SPEAG	Robot	Staubli TX90XL	F07/564ZA1/C/01	NCR	NCR
SPEAG	Software	DASY5 V5.0 Build 125	N/A	NCR	NCR
SPEAG	Software	SEMCAD X V13.4 Build 125	N/A	NCR	NCR
SPEAG	Measurement Server	SE UMS 011 AA	1025	NCR	NCR
R&S	Wireless Communication Test Set	CMU200	112387	Oct. 31, 2008	Oct. 31, 2009
Agilent	Wireless Communication Test Set	E5515C	GB47020167	May 25, 2009	May 25, 2010
Agilent	ENA Series Network Analyzer	E5071B	MY42402996	Nov. 04, 2008	Nov. 04, 2009
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	NCR
R&S	Power Sensor	NRP-Z22	100179	May 17, 2009	May 17, 2010
Agilent	Signal Generator	E8257D	MY44320425	Jul. 03, 2008	Jul. 03, 2009
Agilent	Dual Directional Coupler	778D	50334	NCR	NCR
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	NCR
Mini-Circuits	Power Amplifier	ZVE-8G-SMA	D042005 671800514	NCR	NCR

Table 2. Test Equipment List



7. 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 8720ES 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 s

pecified 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 (MHz)	Head		Body	
	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 3. Tissue dielectric parameters for head and body phantoms



7.1 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-monobutyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

7.2 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 $\pm 5\%$ for σ .

Liquid type	HSL 900-B	
Ingredient	Weight (g)	Weight (%)
Water	532.63	40.29
Sugar	765.49	57.90
Cellulose	3.20	0.24
Salt	18.29	1.38
Preventol	2.40	0.18
Total amount	1,322.00	100.00
Goal dielectric parameters		
Frequency [MHz]	835	900
Relative Permittivity	41.5	41.5
Conductivity [S/m]	0.90	0.97



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	HSL 1950-B	
Ingredient	Weight (g)	Weight (%)
Water	554.12	55.41
DGBE	445.08	44.51
Salt	0.80	0.08
Total amount	1,000.00	100.00
Goal dielectric parameters		
Frequency [MHz]	1950	2000
Relative Permittivity	40.0	40.0
Conductivity [S/m]	1.40	1.40

Liquid type	MSL 1950-B	
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



7.3 Liquid Confirmation

7.3.1 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 Head	800MHz	22.0	ϵ_r	41.5	41.6	0.24%	± 5	Jun. 08, 2009
			σ	0.90	0.86	-4.44%	± 5	
835MHz Body	800MHz	22.0	ϵ_r	55.2	55.8	1.09%	± 5	Jun. 08, 2009
			σ	0.97	0.93	-4.12%	± 5	
835MHz Head	835MHz	22.0	ϵ_r	41.5	41.2	-0.72%	± 5	Jun. 08, 2009
			σ	0.90	0.897	-0.33%	± 5	
835MHz Body	835MHz	22.0	ϵ_r	55.2	55.5	0.54%	± 5	Jun. 08, 2009
			σ	0.97	0.96	-1.03%	± 5	
835MHz Head	850MHz	22.0	ϵ_r	41.5	41.1	-0.96%	± 5	Jun. 08, 2009
			σ	0.90	0.91	1.11%	± 5	
835MHz Body	850MHz	22.0	ϵ_r	55.2	55.4	0.36%	± 5	Jun. 08, 2009
			σ	0.97	0.97	0.00%	± 5	
1950MHz Head	1850MHz	22.0	ϵ_r	40.0	40.31	0.78%	± 5	Jun. 08, 2009
			σ	1.40	1.35	-3.57%	± 5	
1950MHz Body	1850MHz	22.0	ϵ_r	53.3	53.13	-0.32%	± 5	Jun. 08, 2009
			σ	1.52	1.462	-3.82%	± 5	
1950MHz Head	1900MHz	22.0	ϵ_r	40.0	40.1	0.25%	± 5	Jun. 08, 2009
			σ	1.40	1.38	-1.43%	± 5	
1950MHz Body	1900MHz	22.0	ϵ_r	53.3	53.0	-0.56%	± 5	Jun. 08, 2009
			σ	1.52	1.50	-1.32%	± 5	
1950MHz Head	1950MHz	22.0	ϵ_r	40.0	40.06	0.15%	± 5	Jun. 08, 2009
			σ	1.40	1.438	2.71%	± 5	
1950MHz Body	1950MHz	22.0	ϵ_r	53.3	52.91	-0.73%	± 5	Jun. 08, 2009
			σ	1.52	1.56	2.63%	± 5	

Table 4. Measured Tissue dielectric parameters for head and body phantoms

7.3.2 Liquid Depth

The liquid level was during measurement 15cm \pm 0.5cm.

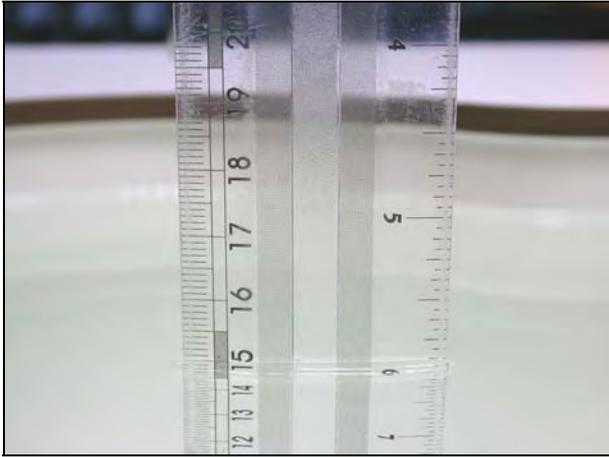


Figure 8. Head-Tissue-Simulating-Liquid



Figure 9. Body-Tissue-Simulating-Liquid



8. Measurement Process

8.1 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 **GSM 850** (#128=824.2MHz, #190=836.6MHz, #251=848.8MHz) and **PCS 1900** (#512=1850.2MHz, #661=1880.0MHz, #810=1909.8MHz) systems.

Usage	Operates with a Normal mode by client (GSM/PCS)
Simulating human Head/Body	Head & Body
EUT Battery	Fully-charged with Li-ion batteries.

Band	Mode	CH	Frequency (MHz)	Average Conducted power (dBm)		Worst
				before	After	
GSM850	-----	Lowest	824.2	32.20	32.18	■
		Middle	836.6	32.00	31.99	□
		Highest	848.8	31.90	31.88	□
GPRS 850	4Down1Up	Lowest	824.2	32.20	32.18	□
		Middle	836.6	32.00	31.97	□
		Highest	848.8	31.80	31.79	□
	3Down2Up	Lowest	824.2	32.10	32.08	□
		Middle	836.6	32.00	31.97	□
		Highest	848.8	31.80	31.77	□
PCS1900	-----	Lowest	1850.2	29.20	29.18	■
		Middle	1880.0	28.80	28.79	□
		Highest	1909.8	28.50	28.47	□
GPRS 1900	4Down1Up	Lowest	1850.2	29.20	29.18	□
		Middle	1880.0	28.70	28.68	□
		Highest	1909.8	28.50	28.47	□
	3Down2Up	Lowest	1850.2	29.10	29.08	□
		Middle	1880.0	28.70	28.68	□
		Highest	1909.8	28.40	28.39	□

Comment: The SAR test mode is chosen by the max conducted power.

8.2 System Performance Check

8.2.1 Symmetric Dipoles for System Validation

Construction	Symmetrical dipole with 1/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Frequency	835, 1900 MHz
Return Loss	> 20 dB at specified validation position
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request
Dimensions	D835V2 : dipole length 150 mm; overall height 330 mm D1900V2 : dipole length 62 mm; overall height 300 mm



Figure 10. Validation Kit



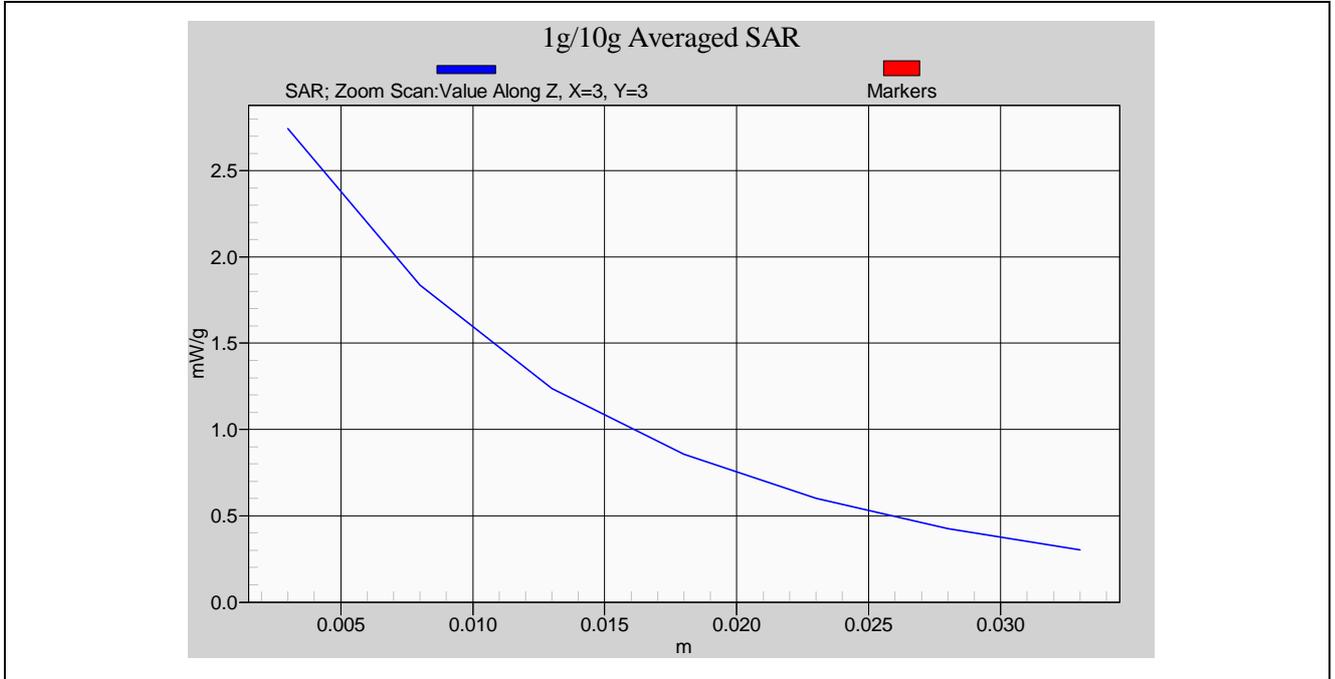
8.2.2 Validation

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.

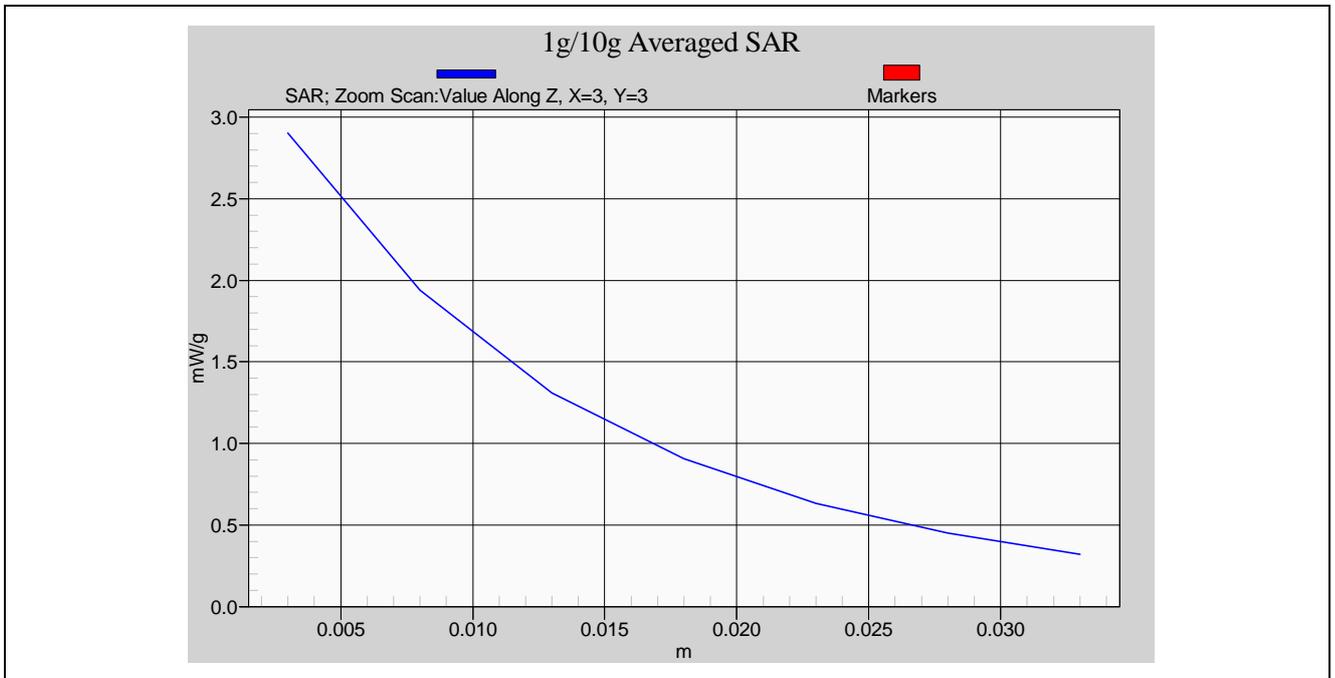
Validation kit		Mixture Type	SAR _{1g} [mW/g]		SAR _{10g} [mW/g]		Date of Calibration
D835V2-SN4d063		Head	9.52		6.24		May 25, 2009
		Body	10.2		6.72		
D1900V2-SN5d027		Head	42.0		21.52		Apr. 27, 2009
		Body	42.4		22.32		
Frequency (MHz)	Power (dBm)	SAR _{1g} (mW/g)	SAR _{10g} (mW/g)	Drift (dB)	Difference percentage		Date
					1g	10g	
835 (Head)	250mW	2.34	1.52	-0.053	-1.7 %	-2.6 %	Feb. 17, 2009
	Normalize to 1 Watt	9.36	6.08				
835 (Body)	250mW	2.47	1.61	0.0035	-3.1 %	-4.2 %	Feb. 17, 2009
	Normalize to 1 Watt	9.88	6.44				
1900 (Head)	250mW	10.2	5.34	0.049	-2.9 %	-0.7 %	Feb. 17, 2009
	Normalize to 1 Watt	40.8	21.36				
1900 (Body)	250mW	10.5	5.49	0.017	-0.9 %	-1.6 %	Feb. 18, 2009
	Normalize to 1 Watt	42.0	21.96				



Z-axis Plot of System Performance Check



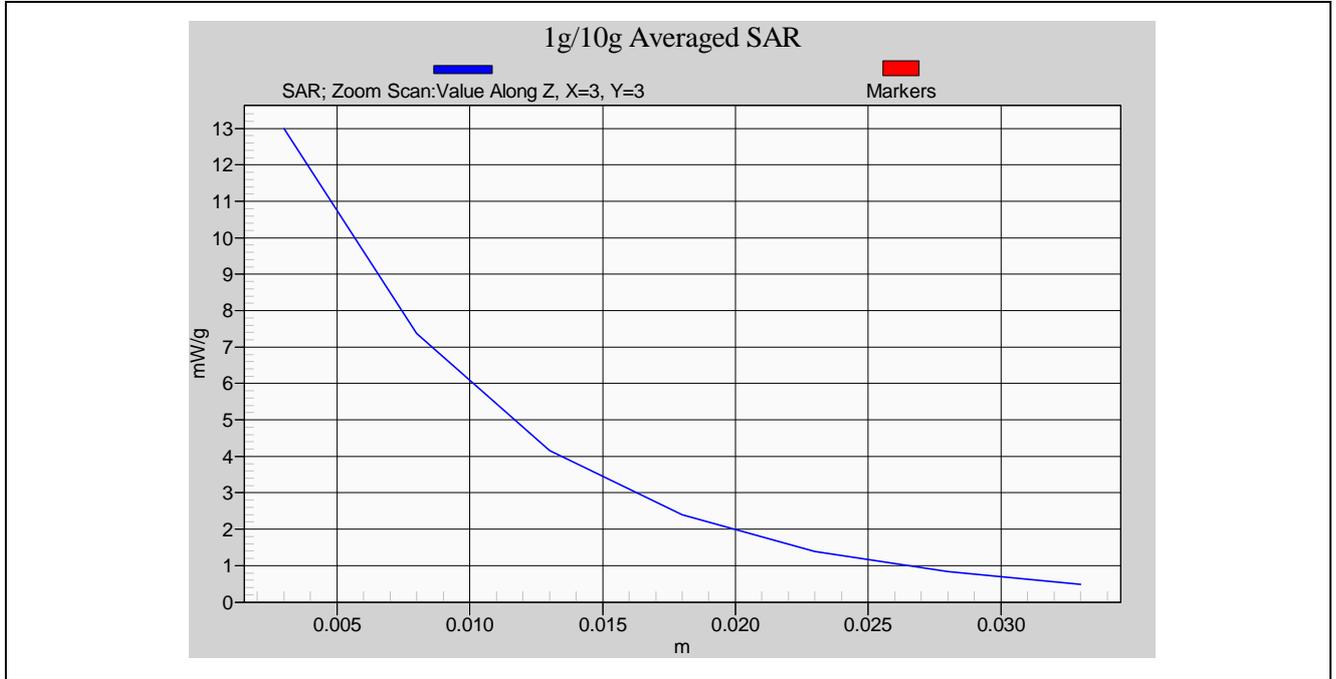
Head-Tissue-Simulating-Liquid 835MHz



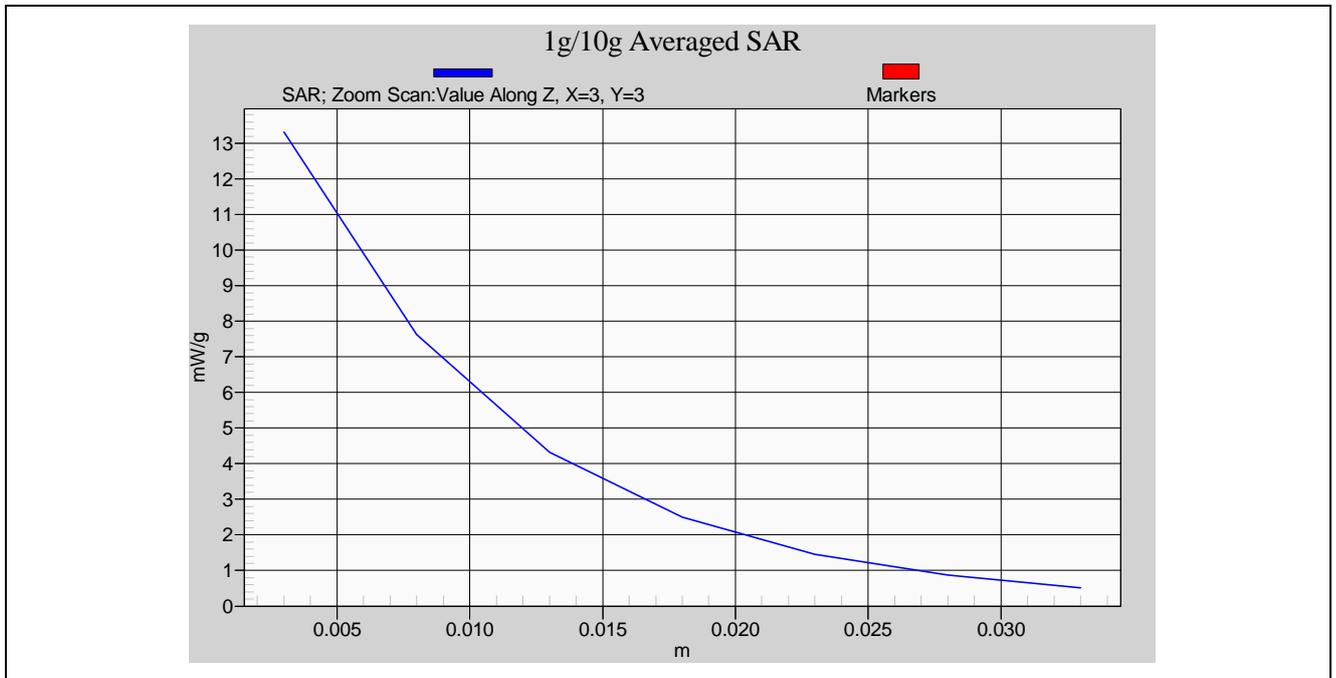
Body-Tissue-Simulating-Liquid 835MHz



Z-axis Plot of System Performance Check



Head-Tissue-Simulating-Liquid 1900MHz



Body-Tissue-Simulating-Liquid 1900MHz



8.3 Dosimetric Assessment Setup

8.3.1 Body Test Position

Body - Worn Configuration

Body - Worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device.

Body - Worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 15 mm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances.

For this test :

- The EUT is placed into the holster/belt clip and the holster is positioned against the surface of the phantom in a normal operating position.

- Since this EUT doesn't supply any body-worn accessory to the end user, for **GSM850 band** and **PCS1900** the distance of **15 mm** was tested to confirm the necessary "minimum SAR separation distance".
(* Note : This distance includes the 2 mm phantom shell thickness.)



8.3.2 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 5 x 5 x 7 points in a 32 x 32 x 30 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.



8.4 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].



9. 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 $\pm 21.9\%$ [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 _i) 1g	(c _i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v _i) v _{eff}
Measurement System								
Probe Calibration	± 5.9 %	N	1	1	1	± 5.9 %	± 5.9 %	
Axial Isotropy	± 4.7 %	R		0.7	0.7	± 1.9 %	± 1.9 %	∞
Hemispherical Isotropy	± 9.6 %	R	√3	0.7	0.7	± 3.9 %	± 3.9 %	∞
Boundary Effects	± 1.0 %	R	√3	1	1	± 0.6 %	± 0.6 %	∞
Linearity	± 4.7 %	R	√3	1	1	± 2.7 %	± 2.7 %	∞
System Detection Limits	± 1.0 %	R	√3	1	1	± 0.6 %	± 0.6 %	∞
Readout Electronics	± 0.3 %	N	1	1	1	± 0.3 %	± 0.3 %	∞
Response Time	± 0.8 %	R	√3	1	1	± 0.5 %	± 0.5 %	∞
Integration Time	± 2.6 %	R	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Noise	± 3.0 %	R	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Reflections	± 3.0 %	R	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.4 %	R	√3	1	1	± 0.2 %	± 0.2 %	∞
Probe Positioning	± 2.9 %	R	√3	1	1	± 1.7 %	± 1.7 %	∞
Max. SAR Eval.	± 1.0 %	R	√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	√3	1	1	± 2.9 %	± 2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	± 4.0 %	R	√3	1	1	± 2.3 %	2.3 %	∞
Liquid Conductivity (target)	± 5.0 %	R	√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	√3	0.6	0.49	± 1.7 %	1.4 %	∞
Liquid Permittivity (meas.)	± 2.5 %	N	1	0.6	0.49	± 1.5 %	1.2 %	∞
Combined Std. Uncertainty						± 10.9 %	± 10.7 %	387
Expanded STD Uncertainty						± 21.9 %	± 21.4 %	

Table 5. Uncertainty Budget of DASY



10. SAR Test Results Summary

10.1 GSM 850 - Head SAR

Ambient :

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

Liquid :

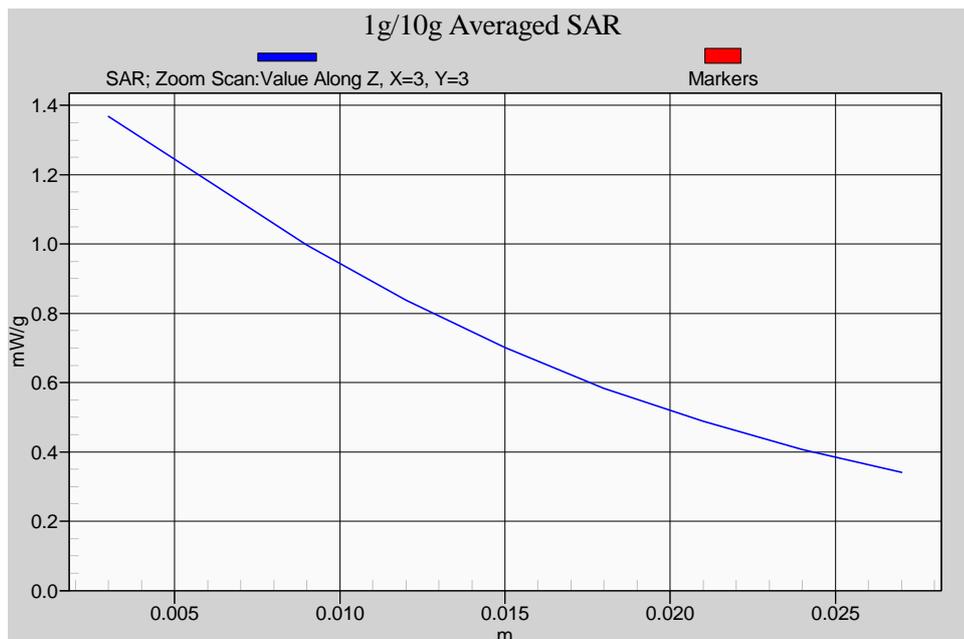
Mixture Type : HSL835 Liquid Temperature (°C) : 22.0
 Depth of liquid (cm) : 15

Measurement :

Crest Factor : 8.3 Probe S/N : 3150

Frequency		Band	Power (dBm)	Phantom Position	Antenna Position	Accessory	SAR _{1g} [mW/g]	Power Drift (dB)	Remark
MHz	CH								
824.2	128	GSM 850	32.20	Right-cheek	Internal	N/A	1.150	-0.0330	----
824.2	128	GSM 850	32.20	Right-Tilted	Internal	N/A	0.529	0.0280	----
824.2	128	GSM 850	32.20	Left-cheek	Internal	N/A	1.220	0.0470	----
836.6	190	GSM 850	32.00	Left-cheek	Internal	N/A	0.761	0.0880	----
848.8	251	GSM 850	31.90	Left-cheek	Internal	N/A	0.532	0.0710	----
824.2	128	GSM 850	32.20	Left-Tilted	Internal	N/A	0.548	0.0670	----
Std. C95.1-2005 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

Z-axis Plot of SAR Measurement



Z-axis Plot of Left-Cheek GSM850 CH 128



10.2 PCS 1900 - Head SAR

Ambient :

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

Liquid :

Mixture Type : HSL1900 Liquid Temperature (°C) : 22.0
 Depth of liquid (cm) : 15

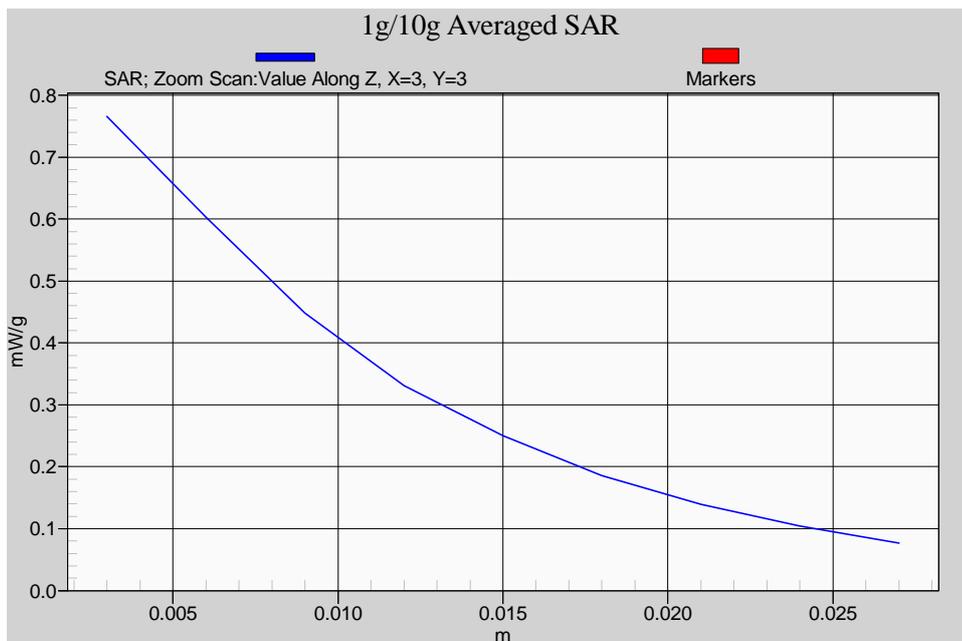
Measurement :

Crest Factor : 8.3 Probe S/N : 3150

Frequency		Band	Power (dBm)	Phantom Position	Antenna Position	Accessory	SAR _{1g} [mW/g]	Power Drift (dB)	Remark
MHz	CH								
1850.2	512	PCS	29.20	Right-cheek	Internal	N/A	0.626	0.0340	----
1850.2	512	PCS	29.20	Right-Tilted	Internal	N/A	0.189	0.0540	----
1850.2	512	PCS	29.20	Left-cheek	Internal	N/A	0.573	0.0360	----
1850.2	512	PCS	29.20	Left-Tilted	Internal	N/A	0.159	0.0190	----
Std. C95.1-2005 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

Detail results see Appendix B.

Z-axis Plot of SAR Measurement



Z-axis Plot of Right-Check PCS1900 CH 512



10.3 GPRS 850 - Body SAR (EUT 15 mm separation to Phantom)

Ambient :

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

Liquid :

Mixture Type : MSL835 Liquid Temperature (°C) : 22.0
 Depth of liquid (cm) : 15

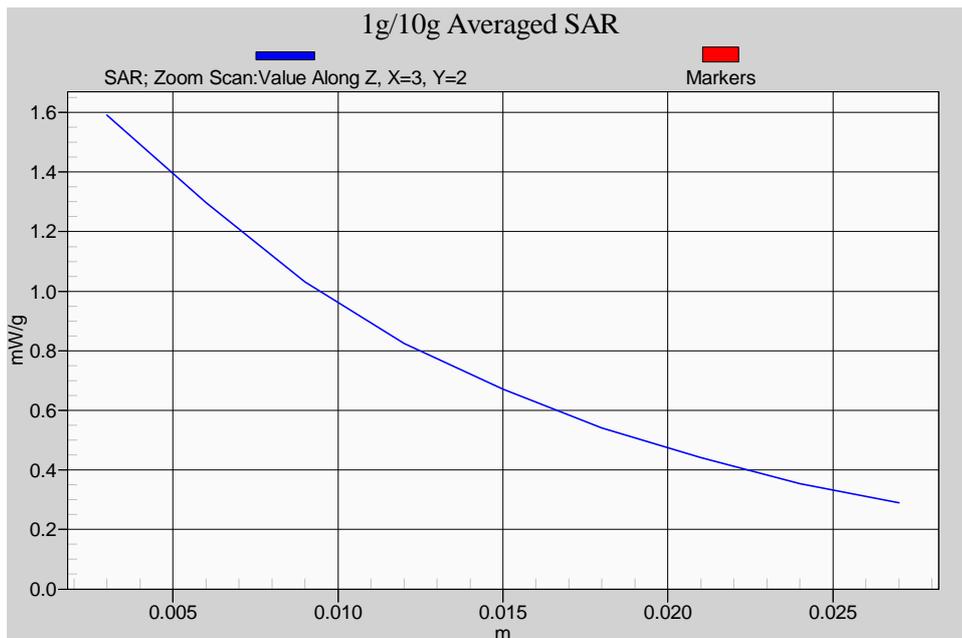
Measurement :

Crest Factor : 3Down2Up -- 4.2 Probe S/N : 3150
4Down1Up -- 8.3

Frequency		Band	Power (dBm)	Phantom Position	Antenna Position	Accessory	SAR _{1g} [mW/g]	Power Drift (dB)	Remark
MHz	CH								
824.2	128	GPRS 850	32.10	Flat	Internal	Headset	1.370	-0.0170	3Down2Up
824.2	128	GPRS 850	32.20	Flat	Internal	Headset	0.714	0.0420	4Down1Up
836.6	190	GPRS 850	32.00	Flat	Internal	Headset	0.986	-0.0170	3Down2Up
848.8	251	GPRS 850	31.80	Flat	Internal	Headset	0.888	0.0240	3Down2Up
Std. C95.1-2005 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

Detail results see Appendix B.

Z-axis Plot of SAR Measurement



Z-axis Plot of Flat GSM850 CH 128 (3Down2Up)



10.4 GPRS 1900 - Body SAR (EUT 15 mm separation to Phantom)

Ambient :

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

Liquid :

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

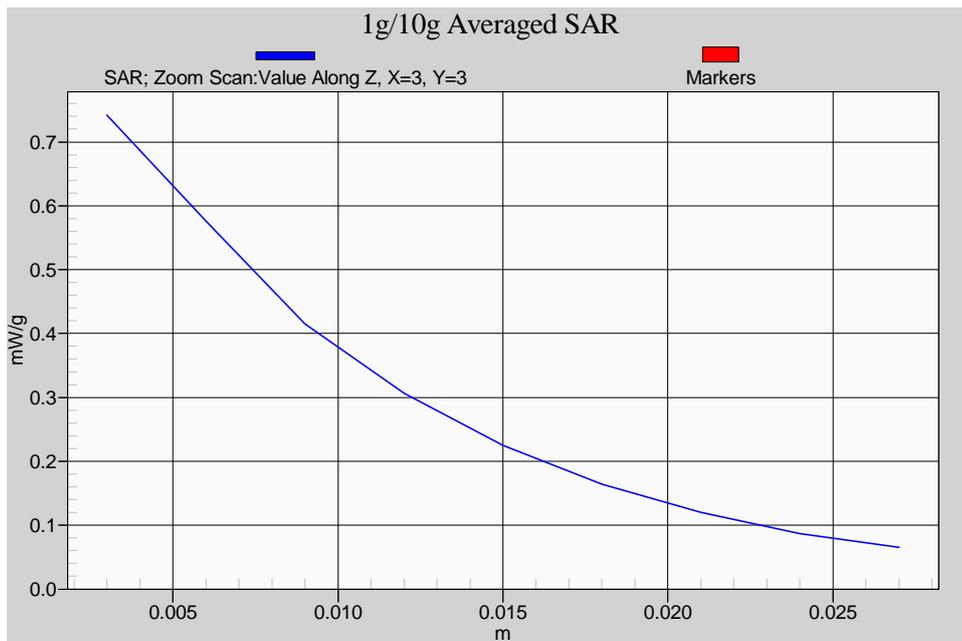
Measurement :

Crest Factor : 3Down2Up -- 4.2 Probe S/N : 3150
4Down1Up -- 8.3

Frequency		Band	Power (dBm)	Phantom Position	Antenna Position	Accessory	SAR _{1g} [mW/g]	Power Drift (dB)	Remark
MHz	CH								
1850.2	512	GPRS 1900	29.10	Flat	Internal	Headset	0.608	-0.0870	3Down2Up
1850.2	512	GPRS 1900	29.20	Flat	Internal	Headset	0.316	0.0710	4Down1Up
1880.0	661	GPRS 1900	28.70	Flat	Internal	Headset	0.434	0.0250	3Down2Up
1909.8	810	GPRS 1900	28.40	Flat	Internal	Headset	0.406	0.0057	3Down2Up
Std. C95.1-2005 - Safety Limit Spatial Peak Uncontrolled Exposure/General Population					1.6 W/kg (mW/g) Averaged over 1 gram				

Detail results see Appendix B.

Z-axis Plot of SAR Measurement



Z-axis Plot of Flat GPRS 1900 CH 512 (3Down2Up)

10.5 Setup Photo

Head Setup



Figure 11. Right Head SAR Test Setup (Cheek)



Figure 12. Right Head SAR Test Setup (Tilted)

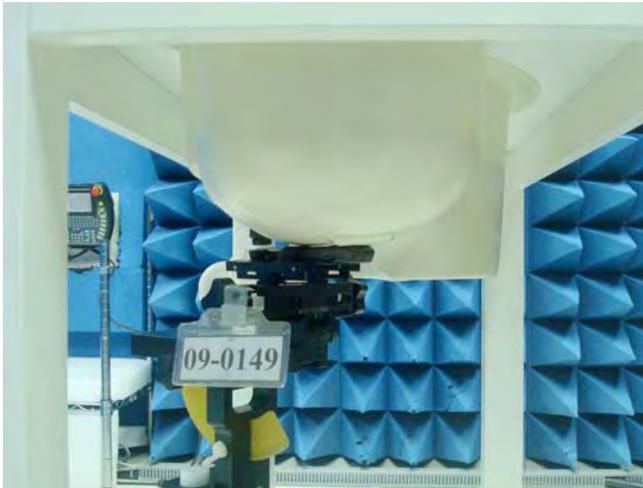
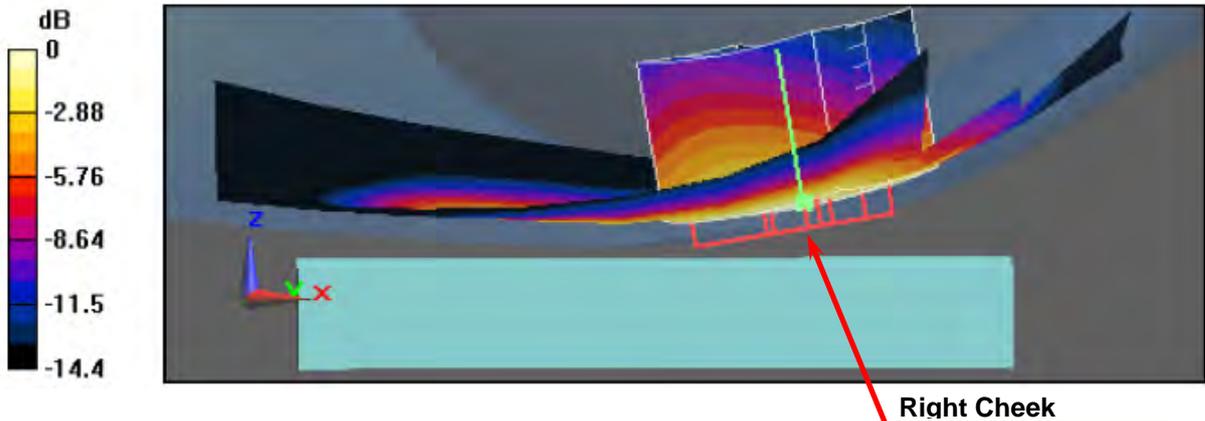


Figure 13. Left Head SAR Test Setup (Cheek)



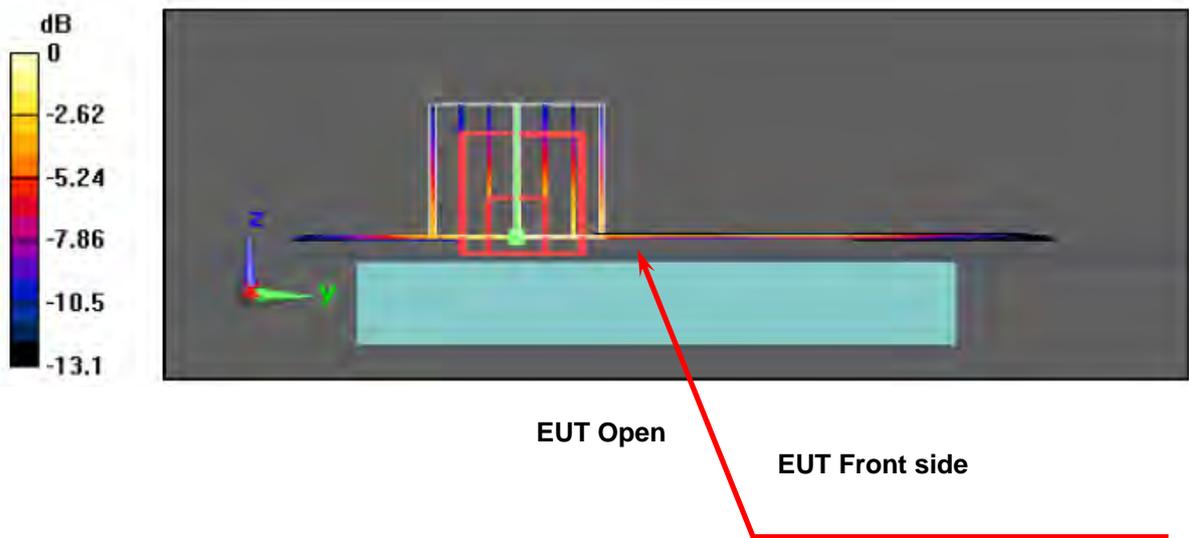
Figure 14. Left Head SAR Test Setup (Tilted)



Body Setup (15 mm separation to phantom)



Figure 15. Body SAR Test Setup (Flat Section)





10.6 Std. C95.1-2005 RF Exposure Limit

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

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).



11. Conclusion

The SAR test values found for the portable mobile phone **Huawei Technologies Co., Ltd Trade Name : HUAWEI Model(s) : HUAWEI G3500** is below the maximum recommended level of 1.6 W/kg (mW/g).

12. 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.
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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

See following Attached Pages for System Performance Check.

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 8:47:02 PM

System Performance Check at 835MHz_20090608_Head

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

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

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.897 \text{ mho/m}$; $\epsilon_r = 41.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(6.05, 6.05, 6.05); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- 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) = 2.9 mW/g

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

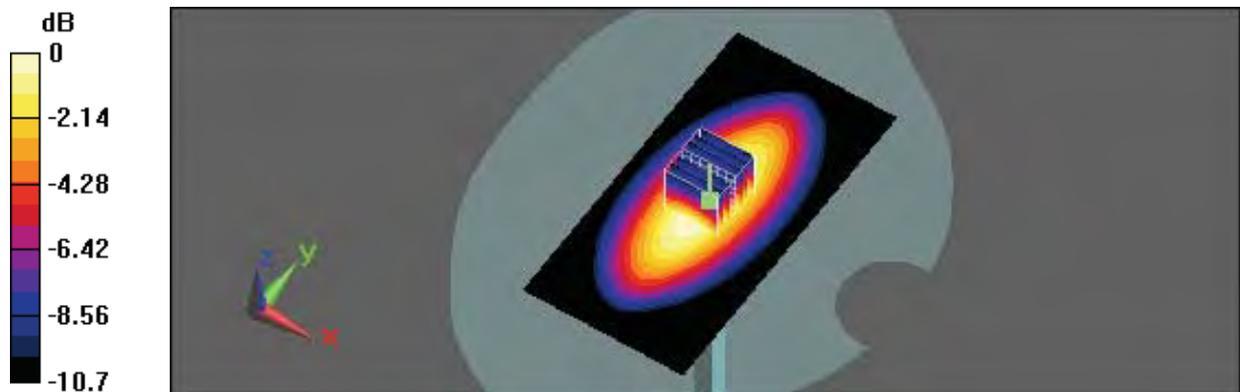
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 58.9 V/m; Power Drift = -0.053 dB

Peak SAR (extrapolated) = 3.47 W/kg

SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.52 mW/g

Maximum value of SAR (measured) = 2.74 mW/g



0 dB = 2.74mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 1:32:55 PM

System Performance Check at 1900MHz_20090608_Head

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

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.38$ mho/m; $\epsilon_r = 40.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(5.12, 5.12, 5.12); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- 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=15mm, dy=15mm

Maximum value of SAR (interpolated) = 12.6 mW/g

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

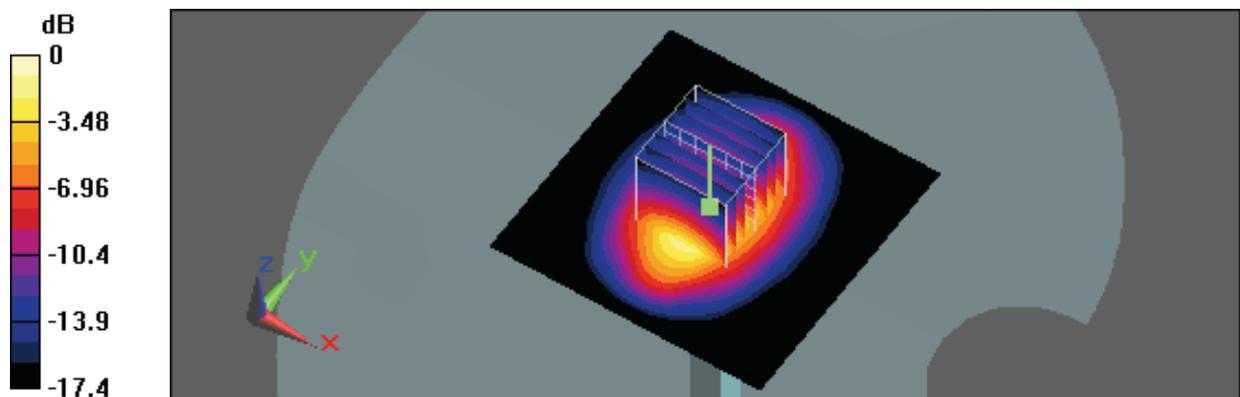
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98 V/m; Power Drift = 0.049 dB

Peak SAR (extrapolated) = 18.1 W/kg

SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.34 mW/g

Maximum value of SAR (measured) = 13 mW/g



0 dB = 13mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/9/2009 1:01:09 AM

System Performance Check at 835MHz_20090608_Body

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

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

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.96 \text{ mho/m}$; $\epsilon_r = 55.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(6.02, 6.02, 6.02); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- 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) = 2.95 mW/g

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

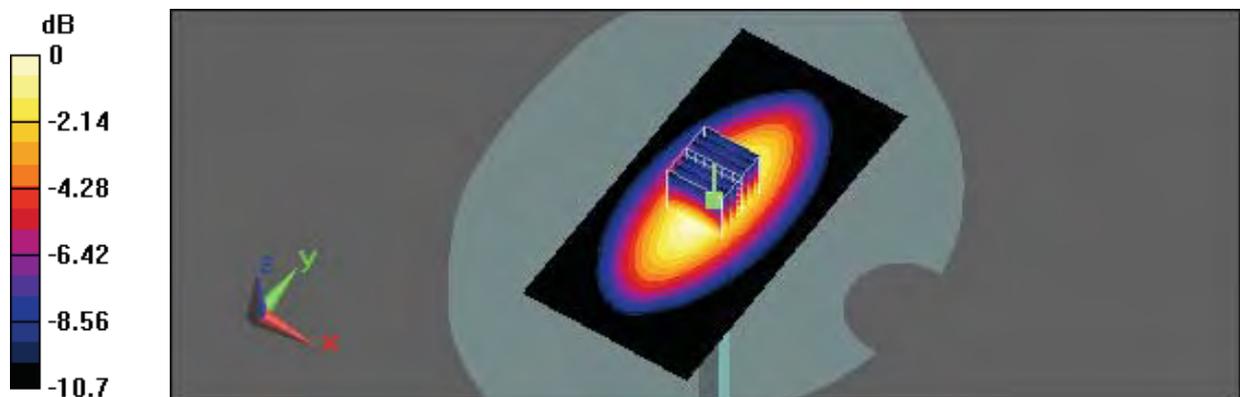
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 57.3 V/m; Power Drift = 0.0035 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.61 mW/g

Maximum value of SAR (measured) = 2.9 mW/g



0 dB = 2.9mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 6:30:38 PM

System Performance Check at 1900MHz_20090608_Body

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

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

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.5 \text{ mho/m}$; $\epsilon_r = 53$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(4.81, 4.81, 4.81); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- 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) = 13.4 mW/g

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

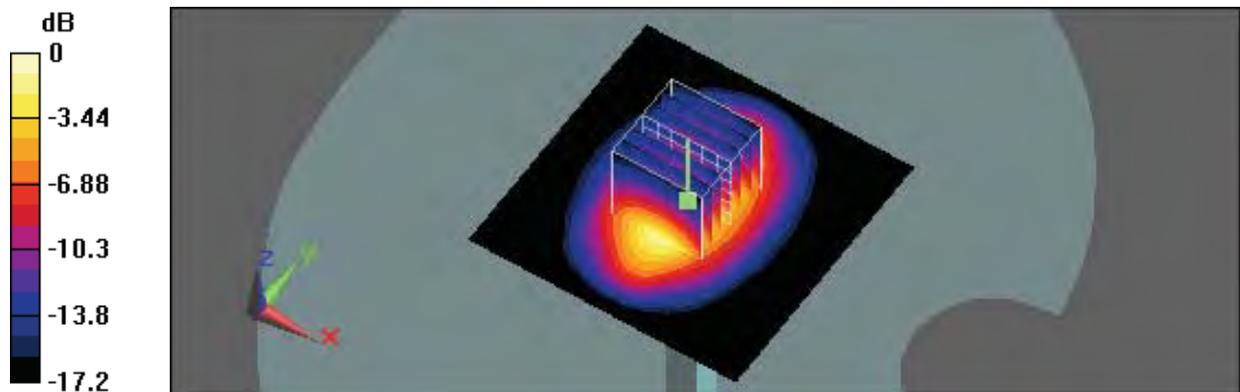
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 99.4 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.49 mW/g

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



0 dB = 13.3mW/g



Appendix B - SAR Measurement Data

See following Attached Pages for SAR Measurement Data.



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 9:33:22 PM

RC_GSM850 CH128

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.883$ mho/m; $\epsilon_r = 41.3$; $\rho = 1000$ kg/m³
Phantom section: Right Section
Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

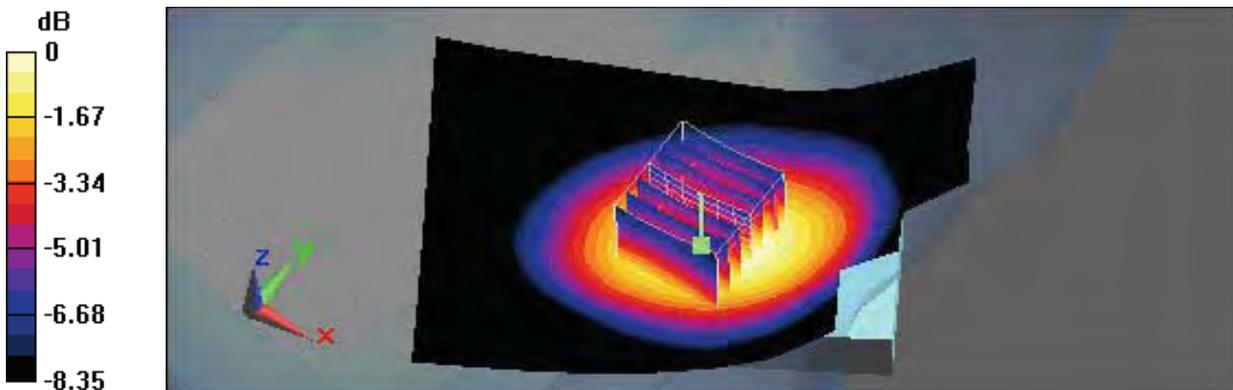
- Probe: ES3DV3 - SN3150 add; ConvF(6.05, 6.05, 6.05); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Right Cheek/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.29 mW/g

Right Cheek/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 16 V/m; Power Drift = -0.033 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.813 mW/g
Maximum value of SAR (measured) = 1.28 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 10:12:36 PM

RT_GSM850 CH128

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3
 Medium parameters used (interpolated): $f = 824.2 \text{ MHz}$; $\sigma = 0.883 \text{ mho/m}$; $\epsilon_r = 41.3$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Right Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

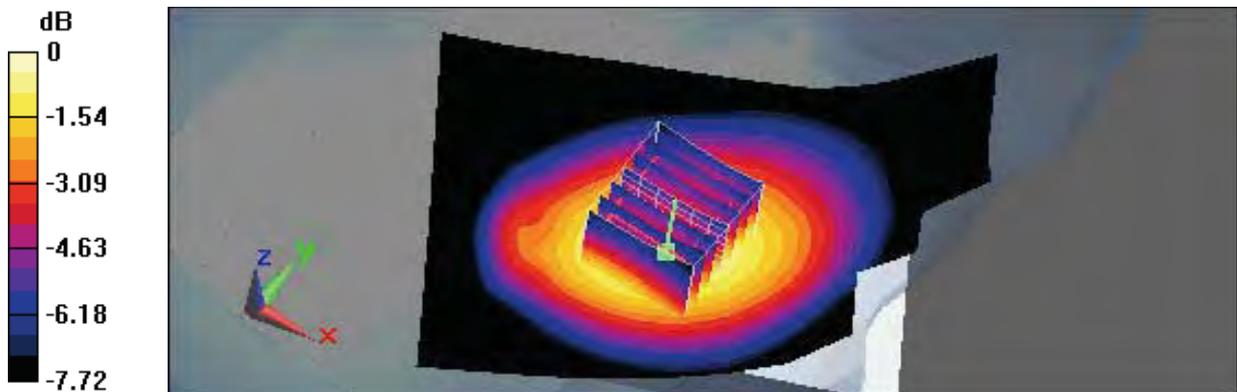
- Probe: ES3DV3 - SN3150 add; ConvF(6.05, 6.05, 6.05); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Right Tilted/Area Scan (61x91x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 0.581 mW/g

Right Tilted/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 18.4 V/m; Power Drift = 0.028 dB
 Peak SAR (extrapolated) = 0.668 W/kg
SAR(1 g) = 0.529 mW/g; SAR(10 g) = 0.380 mW/g
 Maximum value of SAR (measured) = 0.596 mW/g



0 dB = 0.596mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 10:38:29 PM

LC_GSM850 CH128

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.883$ mho/m; $\epsilon_r = 41.3$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(6.05, 6.05, 6.05); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Left Cheek/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 1.38 mW/g

Left Cheek/Zoom Scan (7x7x9)/Cube 0:

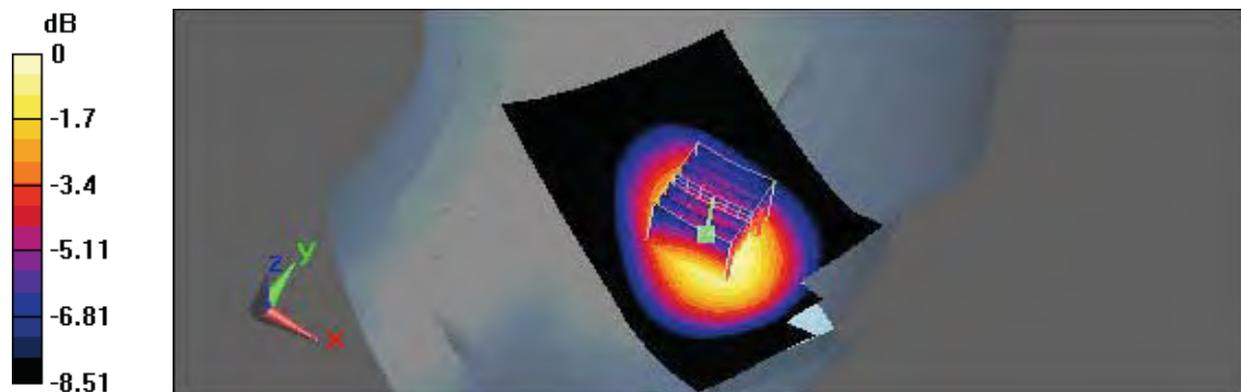
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 15.7 V/m; Power Drift = 0.047 dB

Peak SAR (extrapolated) = 1.52 W/kg

SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.863 mW/g

Maximum value of SAR (measured) = 1.37 mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 11:32:09 PM

LC_GSM850 CH190

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 837$ MHz; $\sigma = 0.899$ mho/m; $\epsilon_r = 41.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(6.05, 6.05, 6.05); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Left Cheek/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.852 mW/g

Left Cheek/Zoom Scan (7x7x9)/Cube 0:

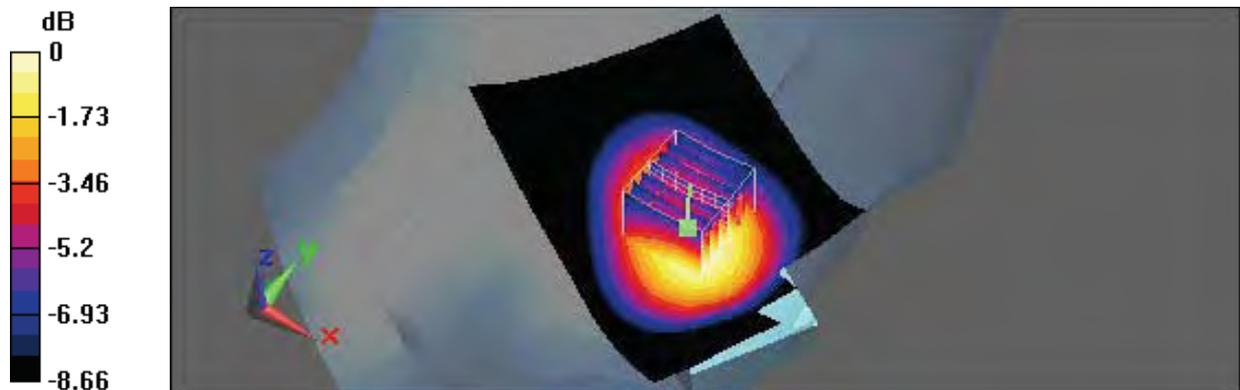
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 11.6 V/m; Power Drift = 0.088 dB

Peak SAR (extrapolated) = 0.950 W/kg

SAR(1 g) = 0.761 mW/g; SAR(10 g) = 0.535 mW/g

Maximum value of SAR (measured) = 0.849 mW/g



0 dB = 0.849mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 11:56:02 PM

LC_GSM850 CH251

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 849 \text{ MHz}$; $\sigma = 0.913 \text{ mho/m}$; $\epsilon_r = 41.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(6.05, 6.05, 6.05); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Left Cheek/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.601 mW/g

Left Cheek/Zoom Scan (7x7x9)/Cube 0:

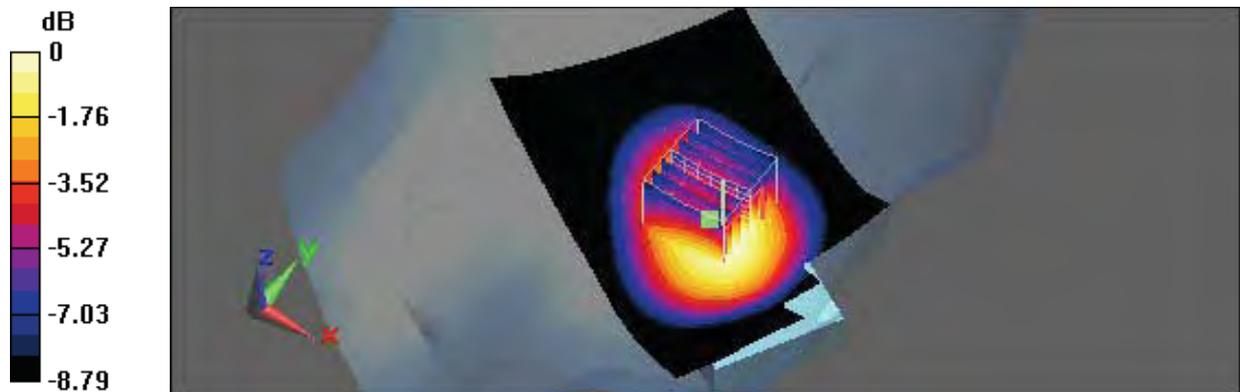
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 9.62 V/m; Power Drift = 0.071 dB

Peak SAR (extrapolated) = 0.661 W/kg

SAR(1 g) = 0.532 mW/g; SAR(10 g) = 0.376 mW/g

Maximum value of SAR (measured) = 0.593 mW/g



0 dB = 0.593mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 11:04:26 PM

LT_GSM850 CH128

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3
 Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.883$ mho/m; $\epsilon_r = 41.3$; $\rho = 1000$ kg/m³
 Phantom section: Left Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

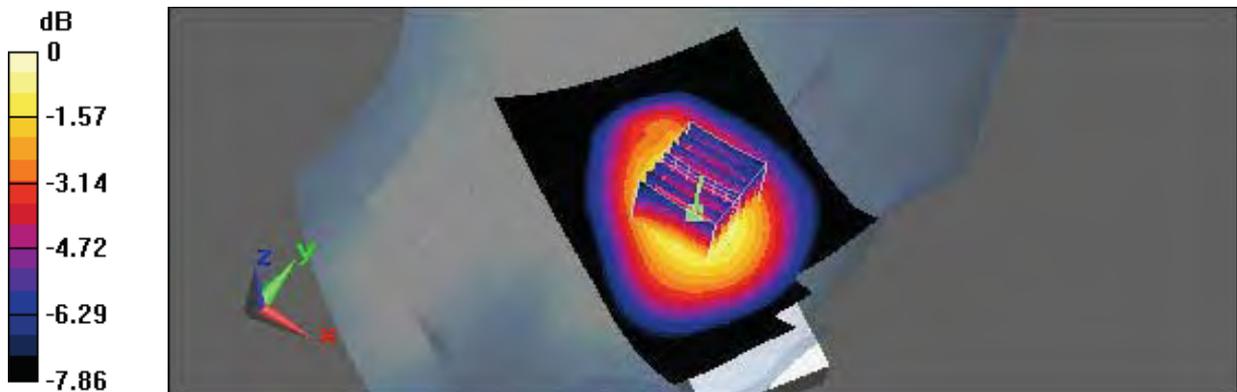
- Probe: ES3DV3 - SN3150 add; ConvF(6.05, 6.05, 6.05); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Left Tilted/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 0.609 mW/g

Left Tilted/Zoom Scan (7x7x9)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=3mm
 Reference Value = 18.5 V/m; Power Drift = 0.067 dB
 Peak SAR (extrapolated) = 0.700 W/kg
SAR(1 g) = 0.548 mW/g; SAR(10 g) = 0.392 mW/g
 Maximum value of SAR (measured) = 0.615 mW/g



0 dB = 0.615mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 2:51:05 PM

RC_PCS CH512

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: PCS; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.35$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(5.12, 5.12, 5.12); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Right Cheek/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.816 mW/g

Right Cheek/Zoom Scan (7x7x9)/Cube 0:

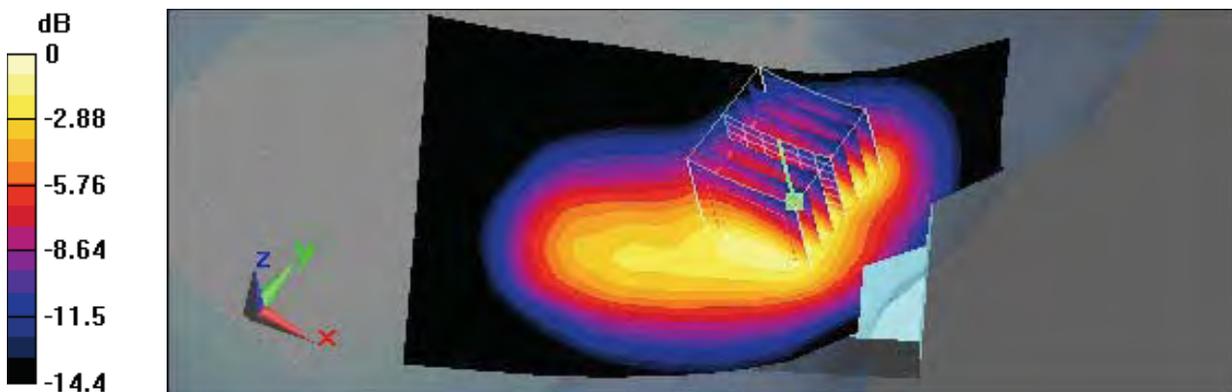
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 8.28 V/m; Power Drift = 0.034 dB

Peak SAR (extrapolated) = 0.936 W/kg

SAR(1 g) = 0.626 mW/g; SAR(10 g) = 0.364 mW/g

Maximum value of SAR (measured) = 0.766 mW/g



0 dB = 0.766mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 3:16:28 PM

RT_PCS CH512

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 86260900000020

Communication System: PCS; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.35$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(5.12, 5.12, 5.12); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Right Tilted/Area Scan (61x91x1):

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

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

Right Tilted/Zoom Scan (7x7x9)/Cube 0:

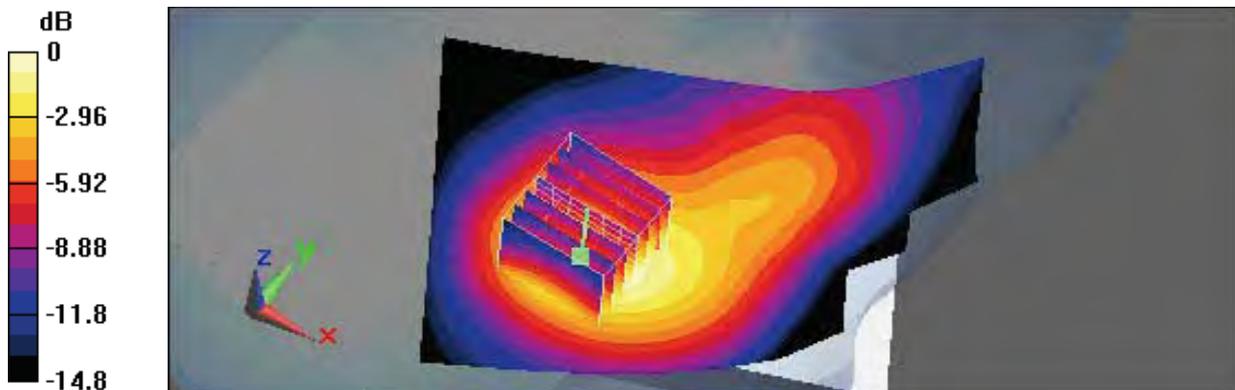
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 8.98 V/m; Power Drift = 0.054 dB

Peak SAR (extrapolated) = 0.256 W/kg

SAR(1 g) = 0.189 mW/g; SAR(10 g) = 0.117 mW/g

Maximum value of SAR (measured) = 0.224 mW/g



0 dB = 0.224mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 3:44:29 PM

LC_PCS CH512

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: PCS; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.35$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(5.12, 5.12, 5.12); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Left Cheek/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.715 mW/g

Left Cheek/Zoom Scan (7x7x9)/Cube 0:

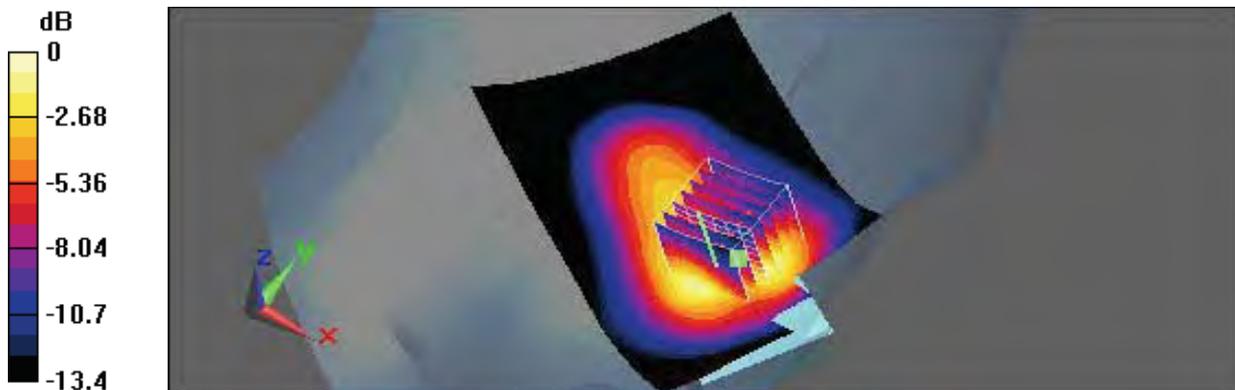
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 7.83 V/m; Power Drift = 0.036 dB

Peak SAR (extrapolated) = 0.784 W/kg

SAR(1 g) = 0.573 mW/g; SAR(10 g) = 0.349 mW/g

Maximum value of SAR (measured) = 0.673 mW/g



0 dB = 0.673mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 4:11:17 PM

LT_PCS CH512

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: PCS; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.35$ mho/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(5.12, 5.12, 5.12); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Left Tilted/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.201 mW/g

Left Tilted/Zoom Scan (7x7x9)/Cube 0:

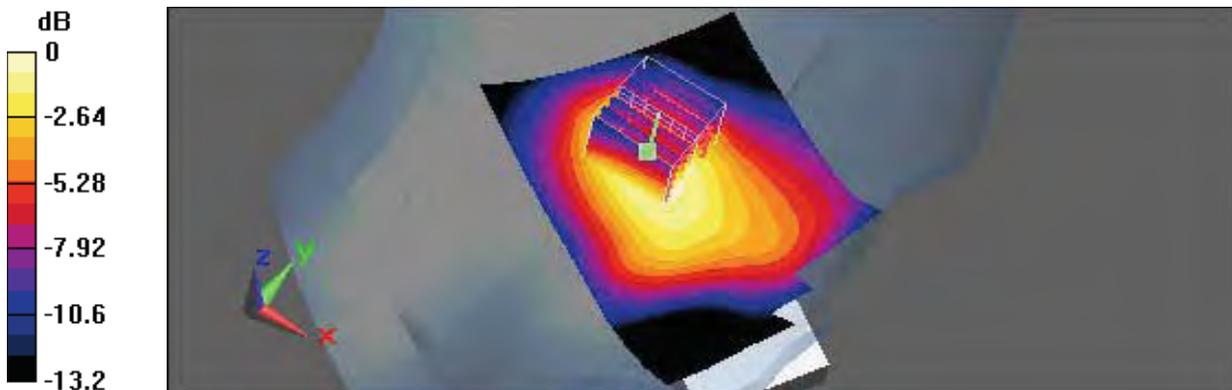
Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 9.85 V/m; Power Drift = 0.019 dB

Peak SAR (extrapolated) = 0.212 W/kg

SAR(1 g) = 0.159 mW/g; SAR(10 g) = 0.101 mW/g

Maximum value of SAR (measured) = 0.187 mW/g



0 dB = 0.187mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/9/2009 1:30:59 AM

Flat_GSM850 GPRS CH128_3Down 2Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM 850 GPRS(3Down, 2Up); Frequency: 824.2 MHz;Duty Cycle: 1:4.2
 Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.947$ mho/m; $\epsilon_r = 55.6$; $\rho = 1000$ kg/m³
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

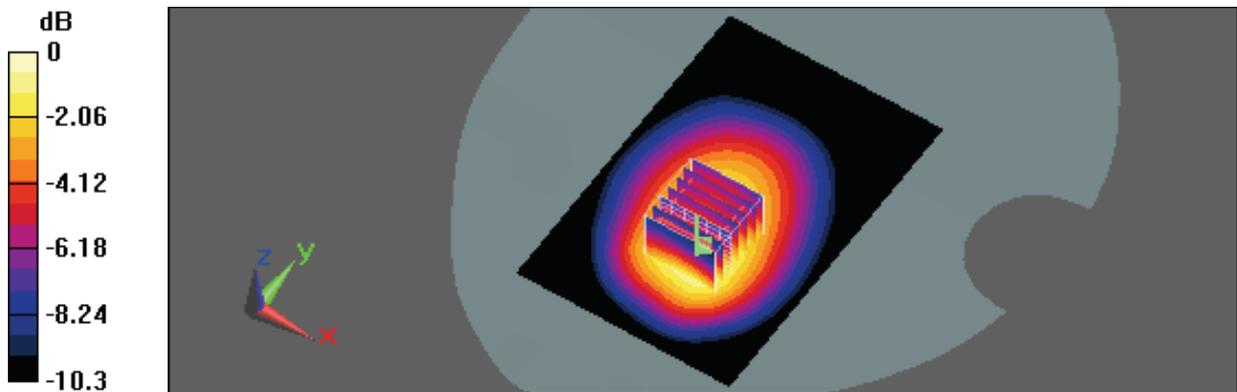
- Probe: ES3DV3 - SN3150 add; ConvF(6.02, 6.02, 6.02); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 1.55 mW/g

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

Measurement grid: dx=5mm, dy=5mm, dz=3mm
 Reference Value = 14.1 V/m; Power Drift = -0.017 dB
 Peak SAR (extrapolated) = 1.95 W/kg
SAR(1 g) = 1.37 mW/g; SAR(10 g) = 0.925 mW/g
 Maximum value of SAR (measured) = 1.59 mW/g



0 dB = 1.59mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/9/2009 3:02:28 AM

Flat_GSM850 GPRS CH128_4Down 1Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM 850 GPRS(4Down, 1Up); Frequency: 824.2 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.947$ mho/m; $\epsilon_r = 55.6$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

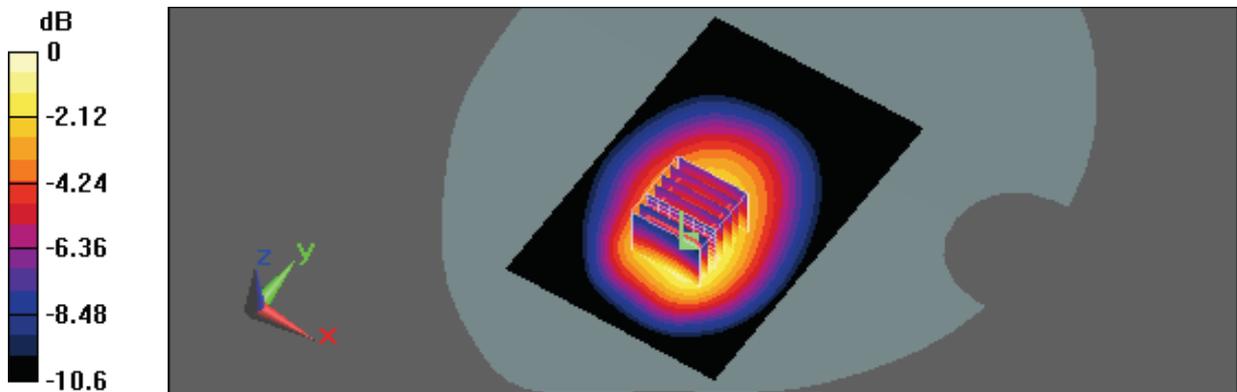
- Probe: ES3DV3 - SN3150 add; ConvF(6.02, 6.02, 6.02); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.812 mW/g

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

Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 10.2 V/m; Power Drift = 0.042 dB
Peak SAR (extrapolated) = 1.04 W/kg
SAR(1 g) = 0.714 mW/g; SAR(10 g) = 0.477 mW/g
Maximum value of SAR (measured) = 0.830 mW/g



0 dB = 0.830mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/9/2009 2:14:39 AM

Flat_GSM850 GPRS CH190_3Down 2Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM 850 GPRS(3Down, 2Up); Frequency: 836.6 MHz;Duty Cycle: 1:4.2
Medium parameters used: $f = 837$ MHz; $\sigma = 0.961$ mho/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

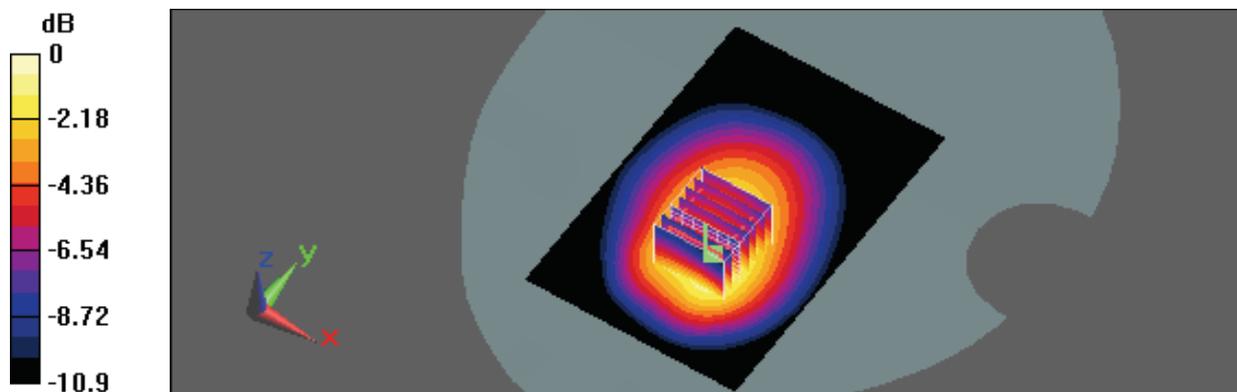
- Probe: ES3DV3 - SN3150 add; ConvF(6.02, 6.02, 6.02); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.12 mW/g

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

Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 12 V/m; Power Drift = -0.017 dB
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.986 mW/g; SAR(10 g) = 0.657 mW/g
Maximum value of SAR (measured) = 1.16 mW/g



0 dB = 1.16mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/9/2009 2:38:58 AM

Flat_GSM850 GPRS CH251_3Down 2Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: GSM 850 GPRS(3Down, 2Up); Frequency: 848.8 MHz;Duty Cycle: 1:4.2
Medium parameters used: $f = 849$ MHz; $\sigma = 0.973$ mho/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

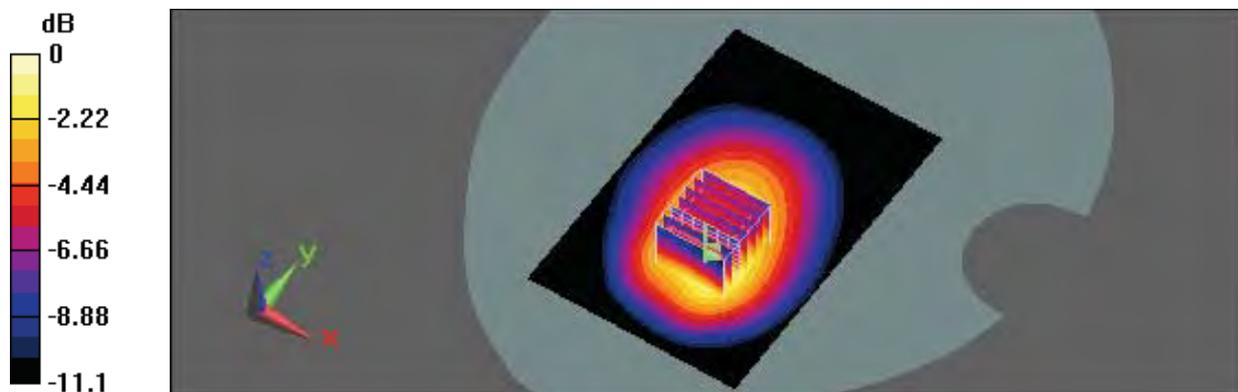
- Probe: ES3DV3 - SN3150 add; ConvF(6.02, 6.02, 6.02); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.984 mW/g

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

Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 11.2 V/m; Power Drift = 0.024 dB
Peak SAR (extrapolated) = 1.31 W/kg
SAR(1 g) = 0.888 mW/g; SAR(10 g) = 0.589 mW/g
Maximum value of SAR (measured) = 1.05 mW/g



0 dB = 1.05mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 6:56:57 PM

Flat_PCS GPRS CH512_3Down 2Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 86260900000020

Communication System: PCS GPRS(3Down,2Up); Frequency: 1850.2 MHz;Duty Cycle: 1:4.2
Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.46$ mho/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

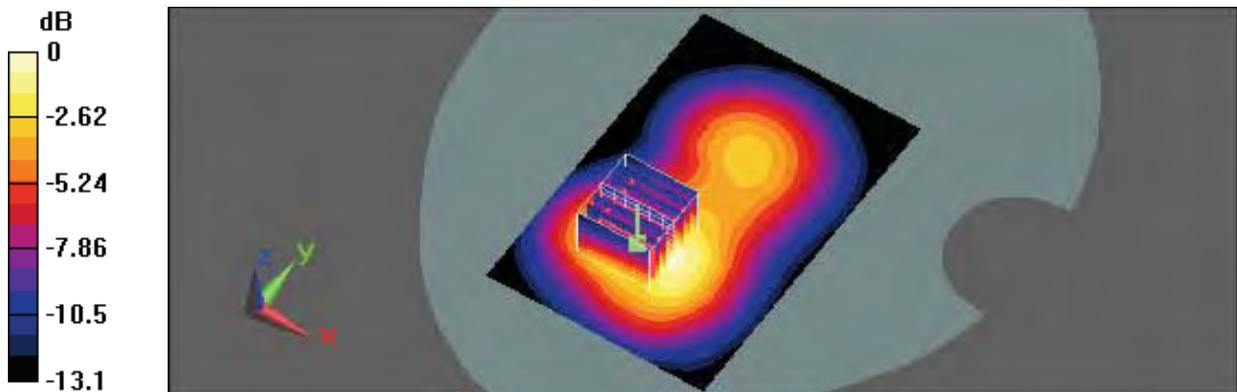
- Probe: ES3DV3 - SN3150 add; ConvF(4.81, 4.81, 4.81); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.761 mW/g

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

Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 13.4 V/m; Power Drift = -0.087 dB
Peak SAR (extrapolated) = 0.884 W/kg
SAR(1 g) = 0.608 mW/g; SAR(10 g) = 0.357 mW/g
Maximum value of SAR (measured) = 0.742 mW/g



0 dB = 0.742mW/g



Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 8:13:38 PM

Flat_PCS GPRS CH512_4Down 1Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: PCS GPRS(4Down,1Up); Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.46$ mho/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

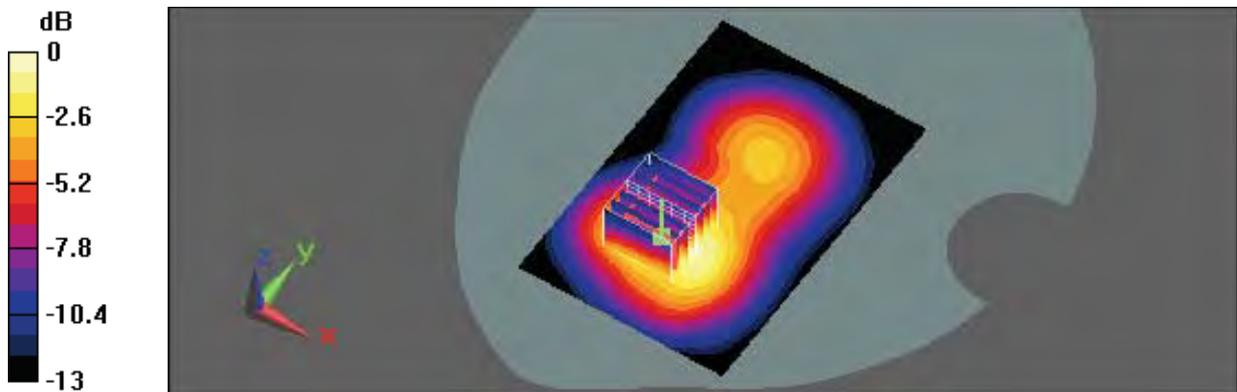
- Probe: ES3DV3 - SN3150 add; ConvF(4.81, 4.81, 4.81); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASYS, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.388 mW/g

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

Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 9.26 V/m; Power Drift = 0.071 dB
Peak SAR (extrapolated) = 0.462 W/kg
SAR(1 g) = 0.316 mW/g; SAR(10 g) = 0.186 mW/g
Maximum value of SAR (measured) = 0.384 mW/g



0 dB = 0.384mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 7:22:07 PM

Flat_PCS GPRS CH661_3Down 2Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: PCS GPRS(3Down,2Up); Frequency: 1880 MHz;Duty Cycle: 1:4.2

Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.48 \text{ mho/m}$; $\epsilon_r = 53.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3150 add; ConvF(4.81, 4.81, 4.81); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.535 mW/g

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

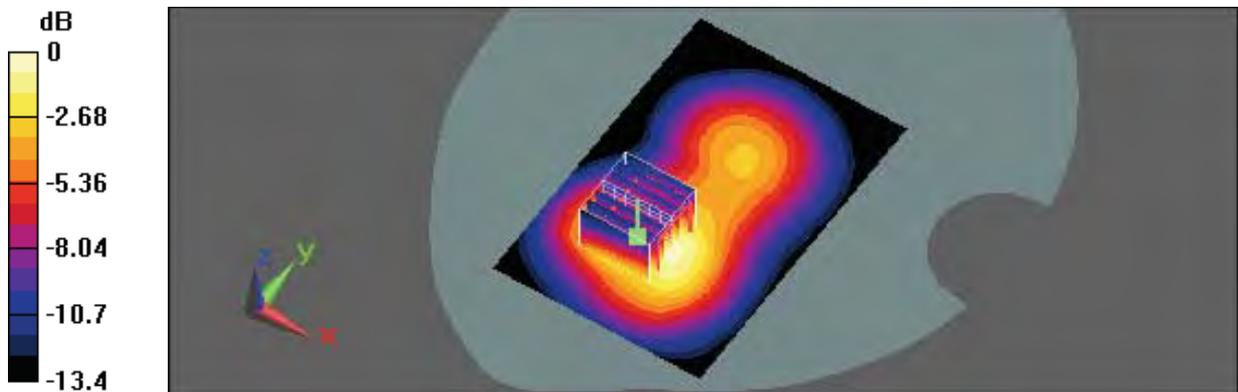
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$

Reference Value = 10.5 V/m; Power Drift = 0.025 dB

Peak SAR (extrapolated) = 0.643 W/kg

SAR(1 g) = 0.434 mW/g; SAR(10 g) = 0.255 mW/g

Maximum value of SAR (measured) = 0.534 mW/g



0 dB = 0.534mW/g

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 6/8/2009 7:46:06 PM

Flat_PCS GPRS CH810_3Down 2Up_Headset_15mm

DUT: HUAWEI G3500; Type: Mobile Phone; Serial: 862609000000020

Communication System: PCS GPRS(3Down,2Up); Frequency: 1909.8 MHz;Duty Cycle: 1:4.2
 Medium parameters used: $f = 1910 \text{ MHz}$; $\sigma = 1.51 \text{ mho/m}$; $\epsilon_r = 52.9$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

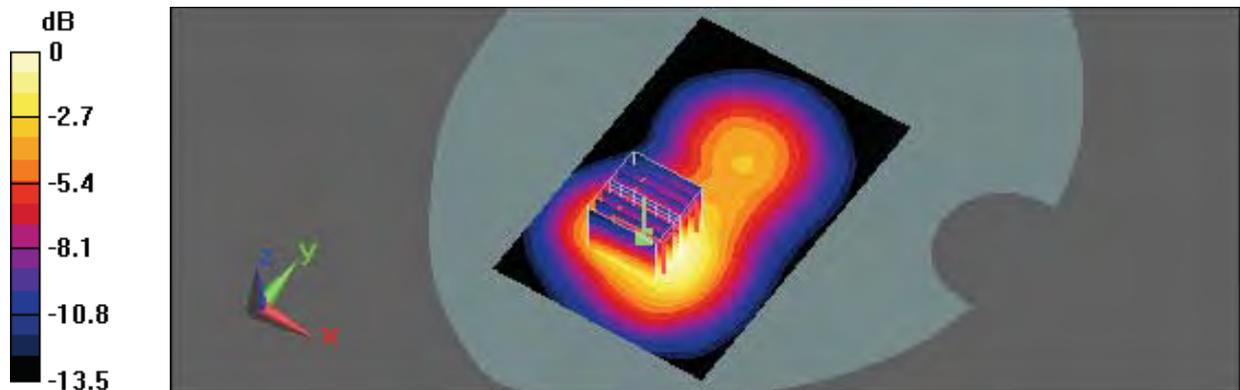
- Probe: ES3DV3 - SN3150 add; ConvF(4.81, 4.81, 4.81); Calibrated: 4/28/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 11/11/2008
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1150 and higher
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

Flat/Area Scan (61x91x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
 Maximum value of SAR (interpolated) = 0.502 mW/g

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

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=3\text{mm}$
 Reference Value = 9.86 V/m; Power Drift = 0.0057 dB
 Peak SAR (extrapolated) = 0.603 W/kg
SAR(1 g) = 0.406 mW/g; SAR(10 g) = 0.240 mW/g
 Maximum value of SAR (measured) = 0.496 mW/g



0 dB = 0.496mW/g



Appendix C - Calibration

All of the instruments Calibration information are listed below.

- Dipole _ D835V2 SN:4d063 Calibration No.D835V2-4d063 _May09
- Dipole _ D1900V2 SN:5d027 Calibration No.D1900V-5d027_Apr09
- Probe _ ES3DV3 SN:3150 Calibration No.ES3-3150_Apr09
- DAE _ DAE4 SN:779 Calibration No.DAE4-779_ Nov08



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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 (Auden)**

Certificate No: **D835V2-4d063_May09**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d063**

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

Calibration date: **May 25, 2009**

Condition of the calibrated item **In Tolerance**

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

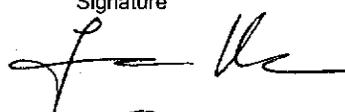
All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV2	SN: 3025	30-Apr-09 (No. ES3-3025_Apr09)	Apr-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Signature



Issued: May 25, 2009

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



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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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



Test Conditions

System configuration, as far as not given on page 1.

DASY Version	DASY5	V5.0
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	40.8 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature during test	(21.6 ± 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.38 mW / g
SAR normalized	normalized to 1W	9.52 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	9.56 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (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 ¹	normalized to 1W	6.26 mW / g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"



parameters

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	53.8 ± 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 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.55 mW / g
SAR normalized	normalized to 1W	10.2 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	9.84 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.68 mW / g
SAR normalized	normalized to 1W	6.72 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	6.55 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"



Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.9 Ω - 3.0 j Ω
Return Loss	- 29.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7 Ω - 4.3 j Ω
Return Loss	- 26.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.392 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	November 27, 2006

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: HSL 900 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 40.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASYS, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

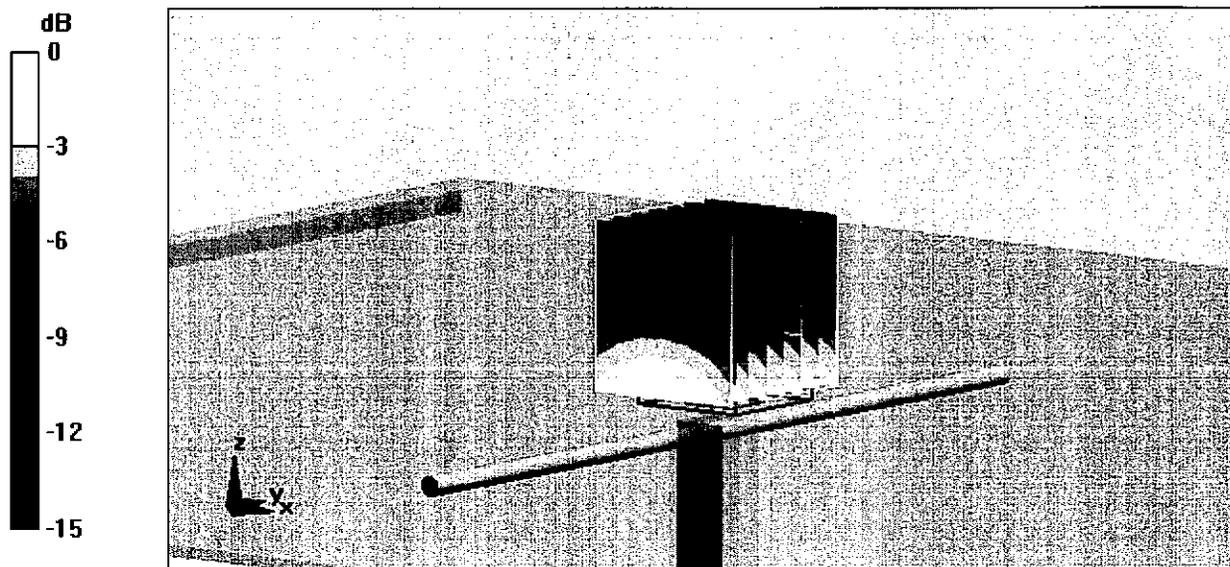
Pin=250mW; dip=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 57 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 3.54 W/kg

SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.56 mW/g

Maximum value of SAR (measured) = 2.77 mW/g



0 dB = 2.77mW/g

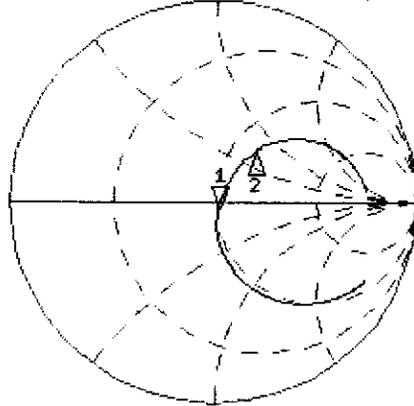


Measurement Plot for Head TSL

25 May 2009 08:37:14

CH1 S11 1 U FS 1: 51.889 Ω -2.9746 Ω 64.077 pF 835.000 000 MHz

*
Del
Cor



CH1 Markers
2: 53.775 Ω
32.887 Ω
900.000 MHz

Avg
16

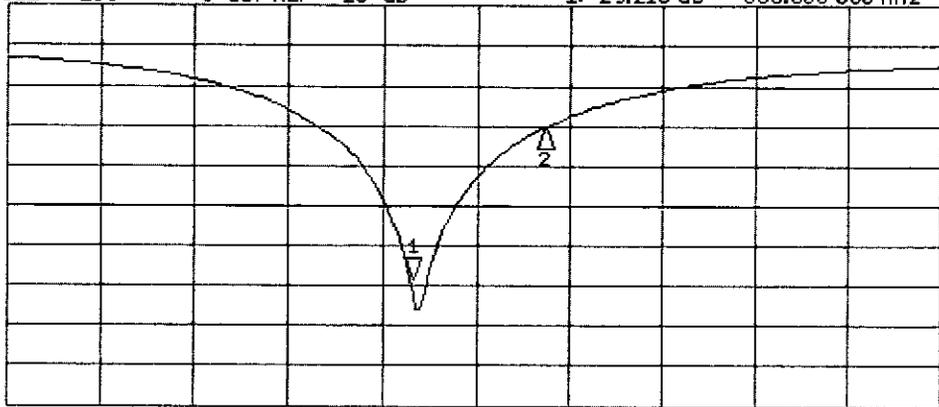
↑

CH2 S11 LOG 5 dB/REF -20 dB 1: -29.218 dB 835.000 000 MHz

Cor

Avg
16

↑



CH2 Markers
2: -10.428 dB
900.000 MHz

START 635.000 000 MHz

STOP 1 100.000 000 MHz

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: $f = 835 \text{ MHz}$; $\sigma = 1.01 \text{ mho/m}$; $\epsilon_r = 53.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(5.79, 5.79, 5.79); Calibrated: 30.04.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASYS, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

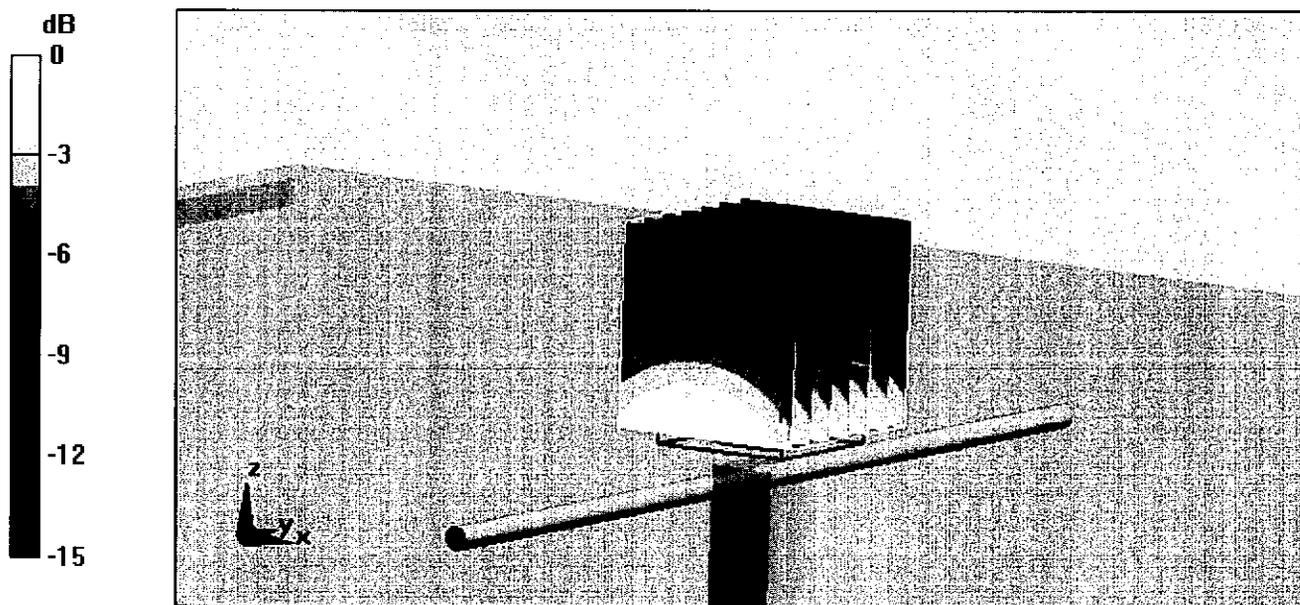
Pin = 250mW, d = 15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.6 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 3.74 W/kg

SAR(1 g) = 2.55 mW/g; SAR(10 g) = 1.68 mW/g

Maximum value of SAR (measured) = 2.94 mW/g



0 dB = 2.94mW/g

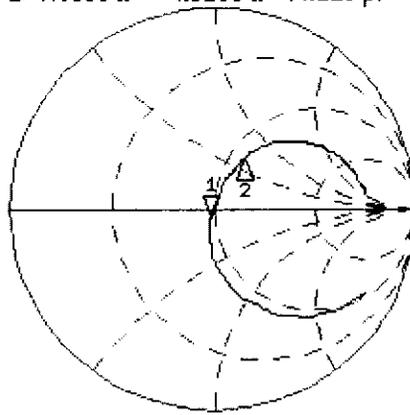


Measurement Plot for Body TSL

25 May 2009 12:27:46

CH1 S11 1 U FS 1: 47.689 Ω -4.3203 Ω 44.118 pF 835.000 000 MHz

*
Del
Cor



CH1 Markers
2: 57.635 Ω
31.402 Ω
900.000 MHz

Avg
16

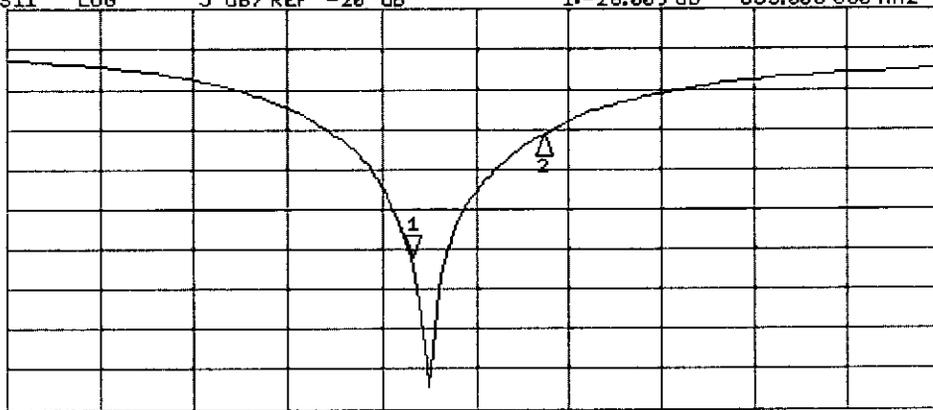
↑

CH2 S11 LOG 5 dB/REF -20 dB 1:-26.009 dB 835.000 000 MHz

Cor

Avg
16

↑



CH2 Markers
2:-10.904 dB
900.000 MHz

START 635.000 000 MHz

STOP 1 100.000 000 MHz



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Accreditation No.: **SCS 108**

Client **SGS (Auden)**

Certificate No: **D1900V2-5d027-Apr09**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d027**

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

Calibration date: **April 27, 2009**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by: **Jeton Kastrati** **Jeton Kastrati** **Jeton Kastrati**
Name Function Signature
Laboratory Technician

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

Issued: April 28, 2009

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- 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.



Test Conditions

System configuration, as far as not given on page 1.

DASY Version	DASY5	V5.0
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	38.6 \pm 6 %	1.47 mho/m \pm 6 %
Head TSL temperature during test	(21.6 \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	10.5 mW / g
SAR normalized	normalized to 1W	42.0 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	40.5 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	5.38 mW / g
SAR normalized	normalized to 1W	21.5 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	21.1 mW / g \pm 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	1.56 mho/m ± 6 %
Body TSL temperature during test	(21.3 ± 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 ²	normalized to 1W	42.1 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.58 mW / g
SAR normalized	normalized to 1W	22.3 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	22.3 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"



Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 5.6 j Ω
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 Ω + 6.4 j Ω
Return Loss	- 22.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 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	December 17, 2002

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: HSL U10 BB

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.47 \text{ mho/m}$; $\epsilon_r = 38.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.9, 4.9, 4.9); Calibrated: 28.04.2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASYS, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

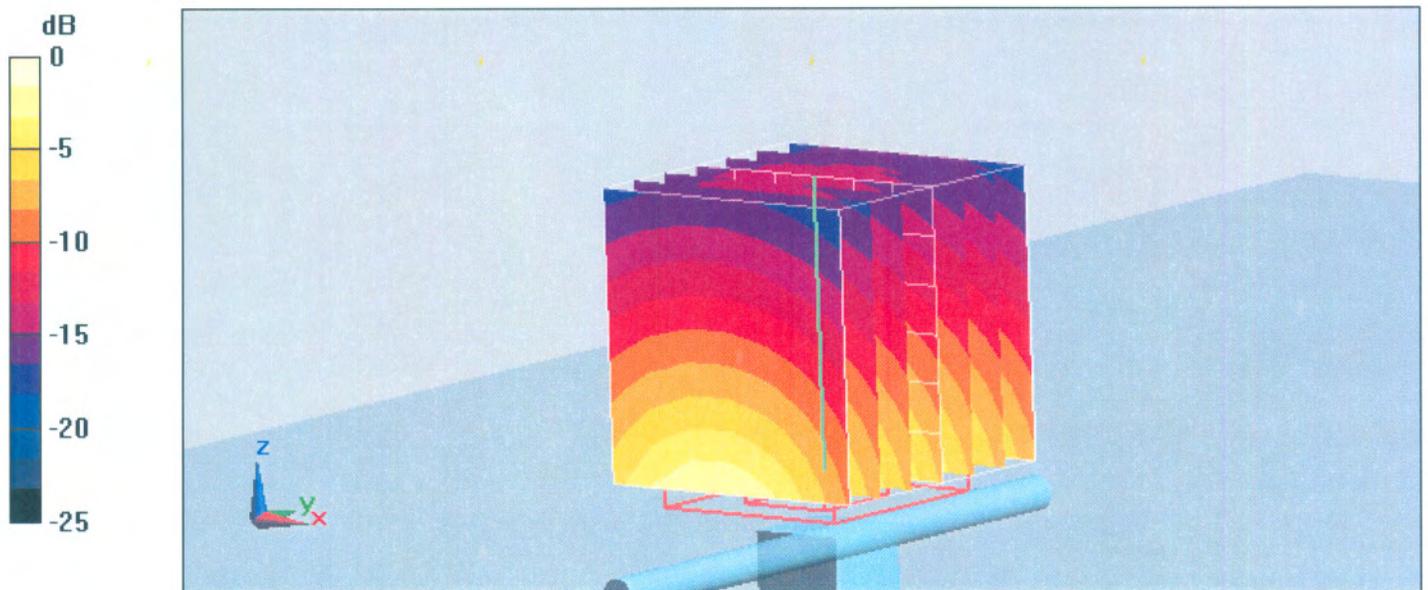
Pin = 250 mW; dip = 10 mm /Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 97.1 V/m; Power Drift = 0.044 dB

Peak SAR (extrapolated) = 19.7 W/kg

SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.38 mW/g

Maximum value of SAR (measured) = 13 mW/g



0 dB = 13mW/g

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 U10 BB

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.56 \text{ mho/m}$; $\epsilon_r = 55$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.5, 4.5, 4.5); Calibrated: 28.04.2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASYS, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

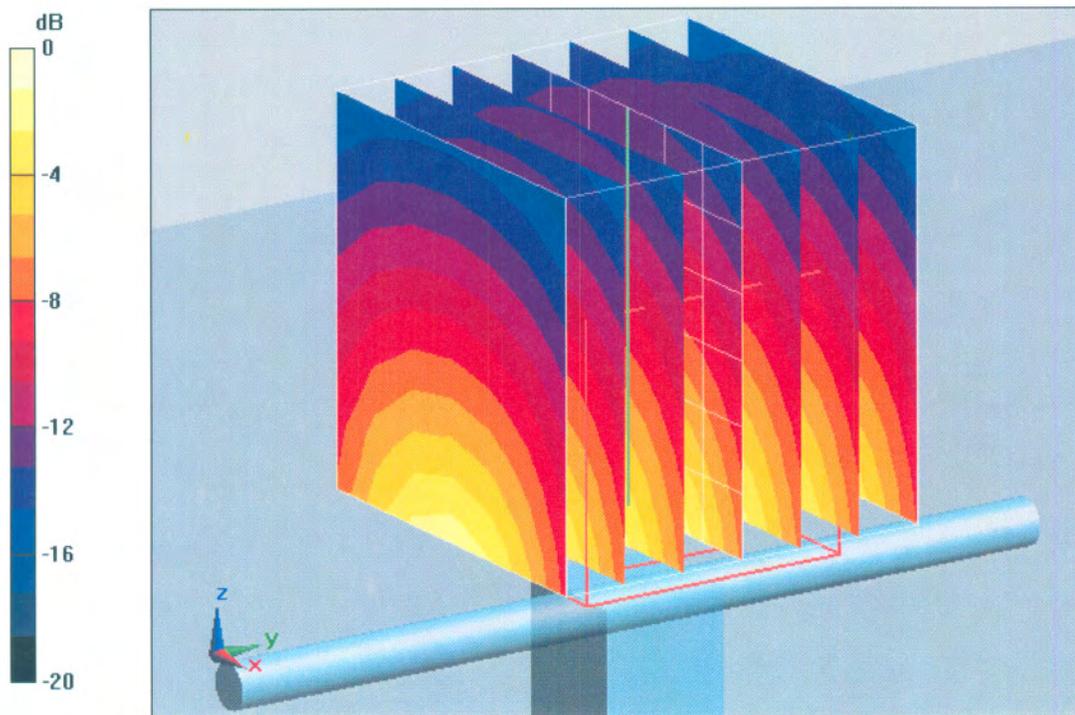
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Reference Value = 96 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 18.5 W/kg

SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.58 mW/g

Maximum value of SAR (measured) = 13.4 mW/g



0 dB = 13.4mW/g

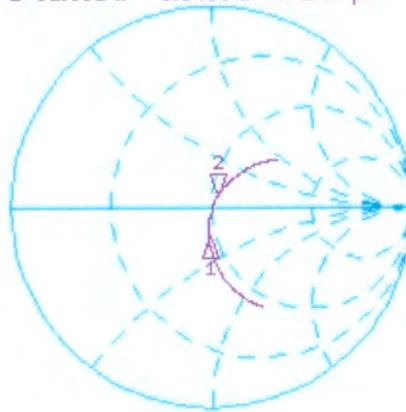


e Measurement Plot for Head TSL

27 Apr 2009 08:53:23

CH1 S11 1 U FS 2: 52.381 Ω 5.6406 Ω 472.49 μH 1 900.000 000 MHz

*
Del
Cor



CH1 Markers
1: 46.279 Ω
-14.666 Ω
1.80000 GHz

Avg
16

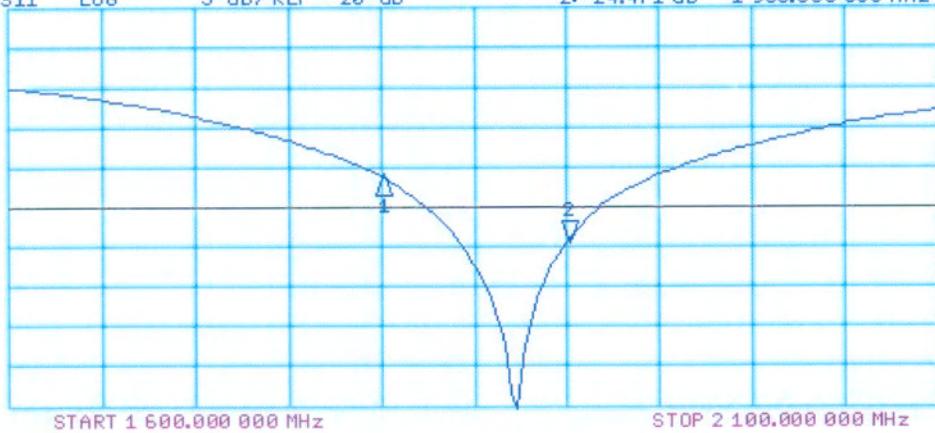
↑

CH2 S11 LOG 5 dB/REF -20 dB 2: -24.471 dB 1 900.000 000 MHz

Cor

Avg
16

↑



CH2 Markers
1: -16.174 dB
1.80000 GHz

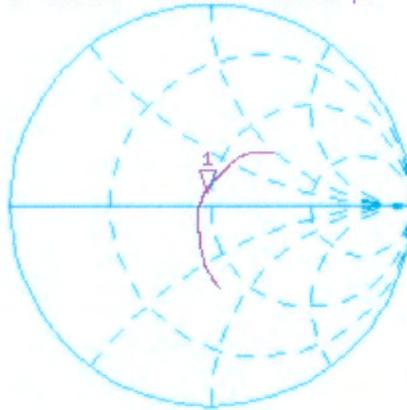


e Measurement Plot for Body TSL

21 Apr 2009 11:36:43

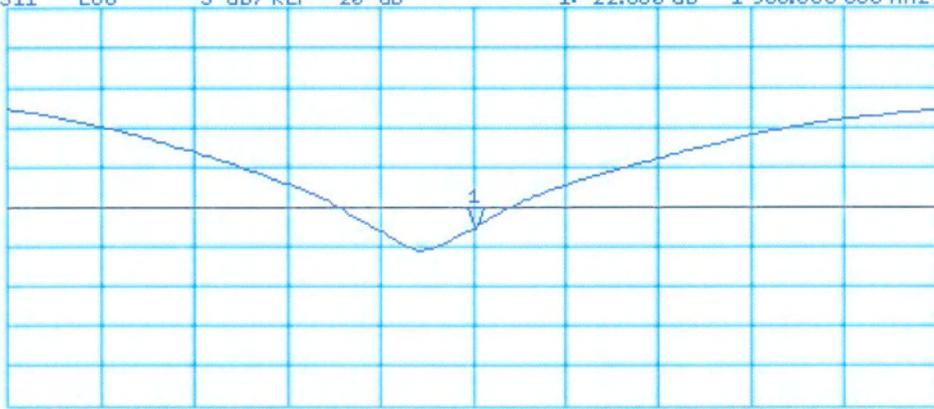
CH1 S11 1 U FS 1: 46.881 Ω 6.4121 Ω 537.12 μH 1 900.000 000 MHz

*
De1
CA
Avg
16



CH2 S11 LOG 5 dB/REF -20 dB 1:-22.680 dB 1 900.000 000 MHz

CA
Avg
16



CENTER 1 900.000 000 MHz

SPAN 400.000 000 MHz



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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **DAE4-779_Nov08**

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: **November 11, 2008**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	30-Sep-08 (No: 7673)	Sep-09
Keithley Multimeter Type 2001	SN: 0810278	30-Sep-08 (No: 7670)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

	Name	Function	Signature
Calibrated by:	Daniel Hess	Technician	

Approved by:	Fin Bornholt	R&D Director	
--------------	--------------	--------------	--

Issued: November 11, 2008

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Accreditation No.: **SCS 108**

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.



e Measurement

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	404.449 \pm 0.1% (k=2)	403.679 \pm 0.1% (k=2)	403.906 \pm 0.1% (k=2)
Low Range	3.97989 \pm 0.7% (k=2)	3.96584 \pm 0.7% (k=2)	3.96834 \pm 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	88 $^{\circ}$ \pm 1 $^{\circ}$
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1. DC Voltage Linearity

High Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	200000	200000.2	0.00
Channel X + Input	20000	20004.76	0.02
Channel X - Input	20000	-20000.46	0.00
Channel Y + Input	200000	199999.9	0.00
Channel Y + Input	20000	20004.23	0.02
Channel Y - Input	20000	-20000.37	0.00
Channel Z + Input	200000	200000.1	0.00
Channel Z + Input	20000	20003.22	0.02
Channel Z - Input	20000	-20000.98	0.00

Low Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	2000	1999.9	0.00
Channel X + Input	200	199.15	-0.43
Channel X - Input	200	-200.23	0.11
Channel Y + Input	2000	2000	0.00
Channel Y + Input	200	198.78	-0.61
Channel Y - Input	200	-199.84	-0.08
Channel Z + Input	2000	2000.1	0.00
Channel Z + Input	200	199.55	-0.22
Channel Z - Input	200	-201.30	0.65

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	-4.34	-5.11
	- 200	5.57	5.20
Channel Y	200	13.81	13.35
	- 200	-14.32	-13.88
Channel Z	200	2.61	2.32
	- 200	-4.14	-4.46

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	-	2.09	0.14
Channel Y	200	-0.49	-	2.40
Channel Z	200	-1.47	0.22	-



Inverter Values with inputs shorted

Measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15617	15330
Channel Y	15810	15565
Channel Z	16216	15563

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	-0.13	-2.92	1.64	0.57
Channel Y	-0.83	-2.41	0.83	0.63
Channel Z	-1.03	-2.84	-0.06	0.42

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.1999	202.2
Channel Y	0.1999	201.5
Channel Z	0.2000	201.5

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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Accreditation No.: **SCS 108**

Client **ATL (Auden)**

Certificate No: **ES3-3150_Apr09**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3150**

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

Calibration date: **April 28, 2009 (Additional Conversion Factors)**

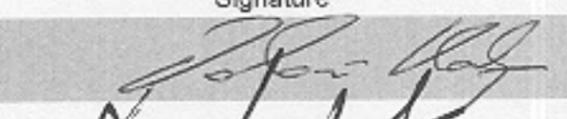
Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 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	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Test Report No.:
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Rev.00

Issued: April 29, 2009

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters:** Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy):** in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset:** The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.



Probe ES3DV3

SN:3150

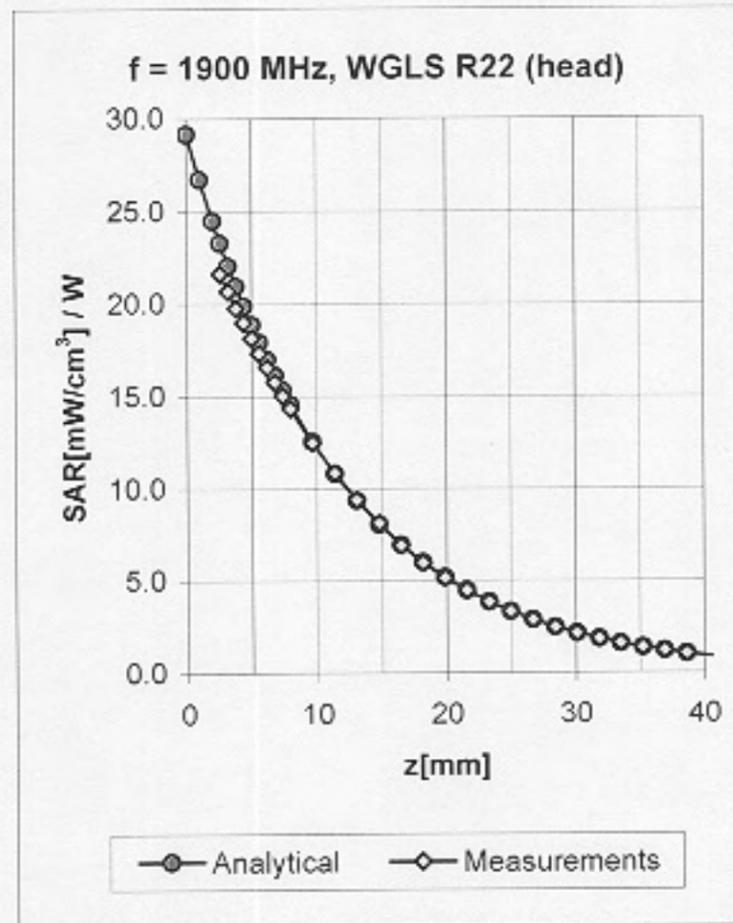
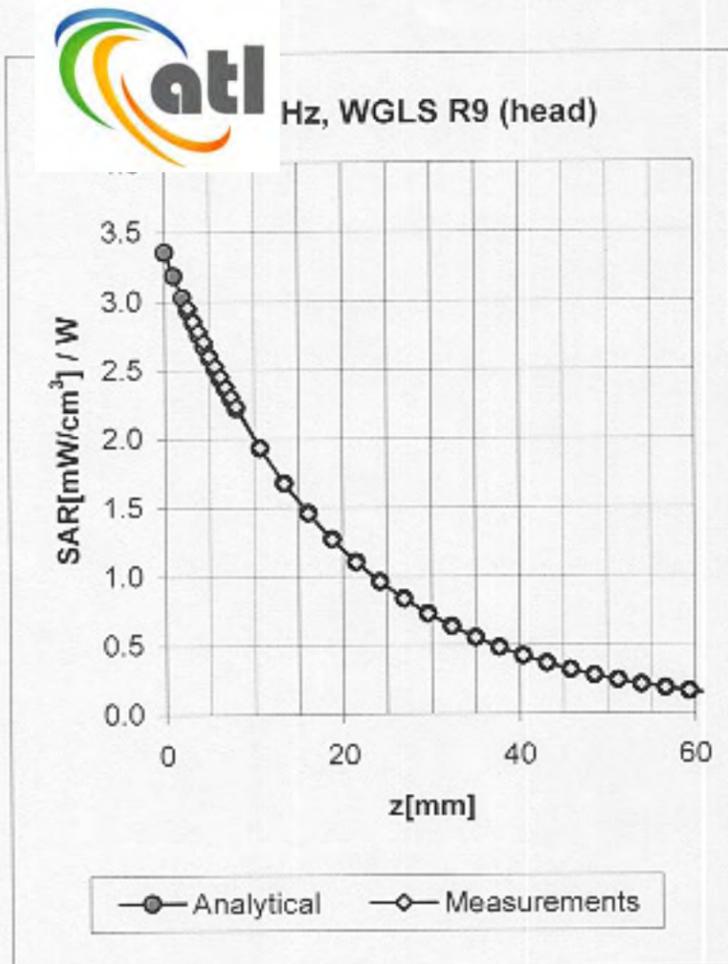
Additional Conversion Factors

Manufactured:	June 12, 2007
Last calibrated:	January 20, 2009
Recalibrated:	April 28, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.59	1.41	6.05 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.38	2.11	5.12 ± 11.0% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.99	1.13	6.02 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.41	2.15	4.81 ± 11.0% (k=2)

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^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.