



FCC SAR Compliance Test Report

Project Name: UMTS Mobile Phone

Model : HUAWEI U2800/U2800-8

FCC ID : OISU2800-8

Report No. : SYBH (Z-SAR) 035062011-2

	APPROVED	CHECKED	PREPARED
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DATE	2011-07-16	2011-07-16	2011-07-16

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Reliability Laboratory of Huawei Technologies Co., Ltd.

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※ ※ **Modified History** ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev. 1.0	Initial Test Report Release	2011-07-16	Miwenping

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HUAWEI U2800-8 are as below Table 1.

Band	Position	Test Mode	Measured MAX SAR _{1g} (W/kg)	MAX Conducted Power (dBm)	Turn-up Power (dBm)	Extrapolated Result (W/kg)
Band V	Head	RMC	1.12	23.52	23.80	1.20
	Body	RMC	0.82	23.48	23.80	0.88

Table 1: Summary of test result

The device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits of 1.6 W/Kg as averaged over any 1 g tissue according to the FCC rule §2.1093, the ANSI/IEEE C 95.1:1999, the NCRP Report Number 86 for uncontrolled environment, according to the Health Canada's Safety Code 6 and the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003 and FCC OET Bulletin 65 Supplement.

1.2 RF exposure limits

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

Table 2: RF exposure limits

The limit applied in this test report is shown in **bold** letters

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 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.

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

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.

1.3 EUT Description

Device Information:			
DUT Name:	UMTS Mobile Phone		
Type Identification:	HUAWEI U2800/U2800-8		
FCC ID :	QISU2800-8		
SN No:	020YQH9M0C000040		
Device Type :	portable device		
Exposure Category:	uncontrolled environment / general population		
Hardware Version :	Ver.A		
Software Version :	U2800CAGB101		
Antenna Type :	Integrated antenna		
Battery Options :	Huawei Technologies Co., Ltd. Rechargeable Li-ion Battery Model: HB5A2 Rated capacity:1000 mAh Nominal Voltage:  3.7 V Charging Voltage:  4.2 V S/N:GAGA11XC4008883		
Others Accessories	Headset		
Device Operating Configurations:			
Supporting Mode(s)	WCDMA 850, (Tested)		
Test Modulation	WCDMA(QPSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WCDMA Band V	826.4 ~ 846.6	871.4 ~ 891.6
Power Class :	3, tested with power control all up bits(WCDMA Band V)		
Test Channels (low-mid-high) :	4132-4182-4233(WCDMA Band V)		

Table 3: Device information and operating configuration

1.3.1 General Description

UMTS Mobile Phone HUAWEI U2800/U2800-8 is subscriber equipment in the WCDMA system. The UMTS frequency band is Band V, Band V test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, UMTS protocol processing.

1.4 Test specification(s)

IEEE Std C95.1 – 1999	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
IEEE 1528-2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
OET Bulletin No. 65, Supplement C– 2001	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
Canada's Safety Code 6	Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz (99-EHD-237)
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 4 of March 2010)
KDB941225 D01	SAR test for 3G devices v02 ,Published on Nov 13 2009

1.5 Testing laboratory

Test Site	Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Section K3,Bantian, Longgang District, Shenzhen, P.R.China
Telephone	+86-755-28785513
Fax	+86-755-36834474
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310

1.6 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Huawei Base, Bantian, Longgang District, Shenzhen, P.R.China

1.7 Application details

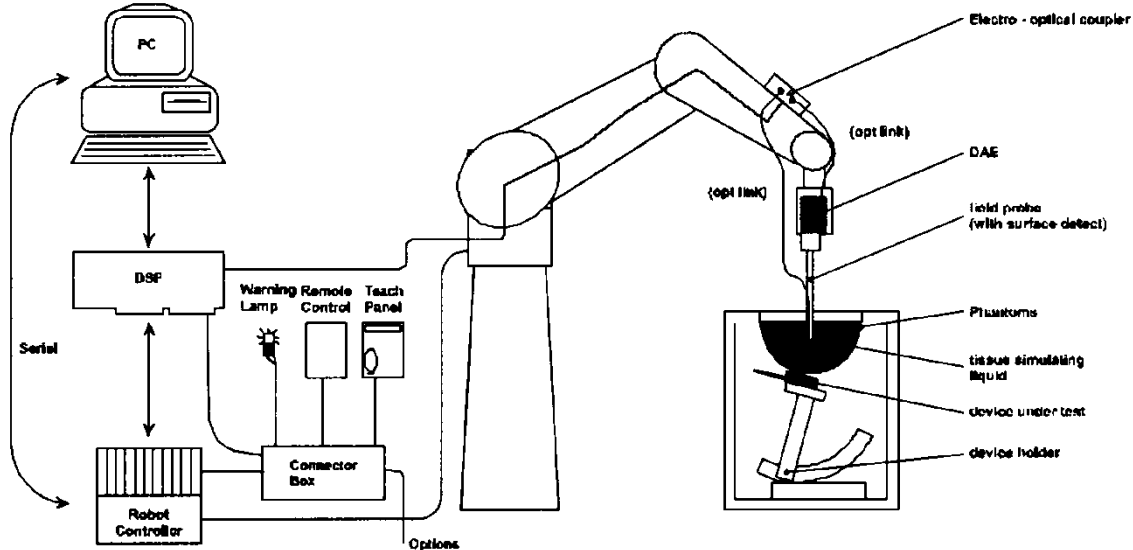
Start Date of test	2011-07-14
End Date of test	2011-07-15

1.8 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

2 SAR Measurement System

2.1 SAR Measurement Set-up



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

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
- The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows XP.
- DASY5 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.

2.2 Test environment

The DASY4 measurement system is placed at the head end of a room with dimensions: $5 \times 2.5 \times 3 \text{ m}^3$, the SAM phantom is placed in a distance of 75 cm from the side walls and 1.1m from the rear wall. Above the test system a $1.5 \times 1.5 \text{ m}^2$ array of pyramid absorbers is installed to reduce reflections from the ceiling.

Picture 1 of the photo documentation shows a complete view of the test environment.

The system allows the measurement of SAR values larger than 0.005 mW/g.

2.3 Data Acquisition Electronics description

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

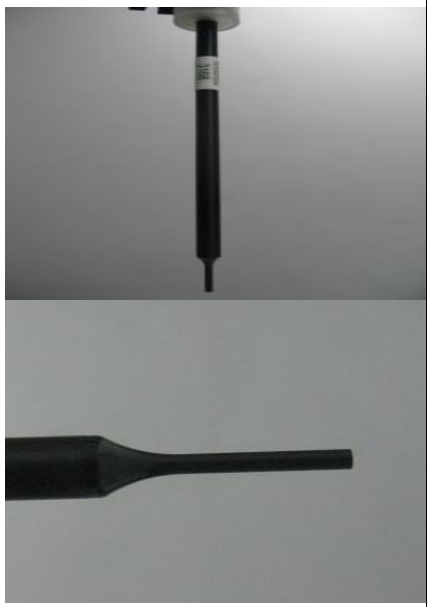
DAE4

Input Impedance	200MOhm	
The Inputs	symmetrical and floating	
Common mode rejection	above 80 dB	

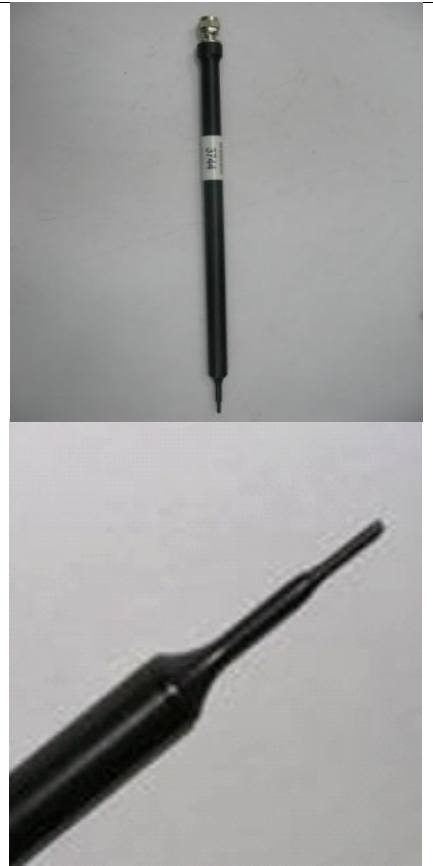
2.4 Probe description

These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (± 2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones	

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)	
Calibration	In air from 10 MHz to 2.5 GHz In head tissue simulating liquid (HSL) at 900 (800-1000) MHz and 1.8 GHz (1700-1910 MHz) (accuracy $\pm 11\%$; $k=2$) Calibration for other liquids and frequencies upon request	
Frequency	10 MHz to 3 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 3 GHz)	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)	
Dynamic range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB	
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces (EX3DV4 only)	
Dimensions	Overall length: 337 mm Tip length: 9 mm Body diameter: 10 mm Tip diameter: 2.5 mm Distance from probe tip to dipole centers: 1.0 mm	
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms (EX3DV4)	

2.5 Phantom description

SAM Twin Phantom

Shell Thickness	2mm +/- 0.2 mm; The ear region: 6mm	
Filling Volume	Approximately 30 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Left hand Right hand Flat phantom	

The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to cover the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible. Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.

ELI4 Phantom

Shell Thickness	2mm +/- 0.2 mm	
Filling Volume	Approximately 30 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Flat phantom	

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.

2.6 Device holder description

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used.



Larger DUT's (e.g. notebooks) 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.

2.7 Test Equipment List

This table gives a complete overview of the SAR measurement equipment

Devices used during the test described are marked ☒

	Manufacturer	Device	Type	Serial number	Date of last calibration)*
☒	SPEAG	Dosimetric E-Field Probe	ES3DV3	3254	2011-03-11
☐	SPEAG	Dosimetric E-Field Probe	EX3DV4	3736	2010-11-16
☒	SPEAG	900 MHz Validation Dipole	D900V2	1d112	2011-03-09
☐	SPEAG	Data acquisition electronics	DAE4	852	2010-12-24
☒	SPEAG	Data acquisition electronics	DAE4	1236	2010-10-26
☒	SPEAG	Software	DASY 5	N/A	N/A
☒	SPEAG	Twin Phantom	SAM1	TP-1475	N/A
☒	SPEAG	Twin Phantom	SAM2	TP-1474	N/A
☐	SPEAG	Twin Phantom	SAM3	TP-1597	N/A
☐	SPEAG	Twin Phantom	SAM4	TP-1620	N/A
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1038	N/A
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1111	N/A
☐	R & S	Universal Radio Communication Tester	CMU 200	111397	2010-08-11
☒	R & S	Universal Radio Communication Tester	CMU 200	113989	2011-06-02
☒	Agilent)*	Network Analyser	E5071B	MY42404956	2011-02-22
☒	Agilent	Dielectric Probe Kit	85070E	2484	N/A
☒	Agilent	Signal Generator	N5181A	MY47420989	2011-02-22
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA0746001	N/A
☒	Agilent	Power Meter	E4417A	MY45101339	2011-02-22
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2011-02-22

Note: a) The calibration interval of validation dipoles is 3 years.

b) 900 MHz probe/dipole calibration is valid +/-100 MHz and fully covers the 850 MHz band.

c) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

3 SAR Measurement Procedure

3.1 Scanning procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The „reference“ and „drift“ measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT's output power and should vary max. +/- 5 %.
- The „surface check“ measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)
- The „area scan“ measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension. If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation. Results of this coarse scan are shown in annex 2.
- A „7x7x7 zoom scan“ measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse“ scan. This is a fine 7x7 grid where the robot additionally moves the probe in 7 steps along the z-axis away from the bottom of the Phantom. Grid spacing for the cube measurement is 5 mm in x and y-direction and 5 mm in z-direction. DASY5 is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in annex 2. Test results relevant for the specified standard (see chapter 1.6.) are shown in table form in chapter 2.5.
- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth. A z-axis scan of the measurement with maximum SAR value is shown in annex 2.

3.2 Spatial Peak SAR Evaluation

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of $7 \times 7 \times 7$ points. The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points ($20 \times 20 \times 20$) are interpolated to calculate the average.

Advanced Extrapolation

DASY5 uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

3.3 Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all 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 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 incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation by SEMCAD

The SEMCAD software 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	Norm _i , a ₀ , a ₁ , a ₂
	- Conversion factor	ConvF _i
	- Diode compression point	Dcpi
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 DASY5 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:

$$V_i = U_i + U_i^2 \cdot cf/dcp_i$$

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:
$$E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$$

H-field probes: $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2)/f$

with V_i = compensated signal of channel i (i = x, y, z)
 $Norm_i$ = sensor sensitivity of channel i (i = x, y, z)
[mV/(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):

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$SAR = (E_{tot}^2 \cdot \sigma) / (\rho \cdot 1000)$$

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/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm²
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in A/m

4 System Verification Procedure

4.1 Tissue Verification

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

The following materials are used for producing the tissue-equivalent materials.

Ingredients (% of weight)	Head Tissue					
Frequency Band (MHz)	450	835	900	1800	1950	2450
Water	38.56	41.45	40.92	52.64	55.242	62.7
Salt (NaCl)	3.95	1.45	1.48	0.36	0.306	0.5
Sugar	56.32	56.0	56.5	0.0	0.0	0.0
HEC	0.98	1.0	1.0	0.0	0.0	0.0
Bactericide	0.19	0.1	0.1	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	47.0	44.542	36.8
Ingredients (% of weight)	Body Tissue					
Frequency Band (MHz)	450	835	900	1800	1950	2450
Water	51.16	52.4	56.0	69.91	69.91	73.2
Salt (NaCl)	1.49	1.40	0.76	0.13	0.13	0.04
Sugar	46.78	45.0	41.76	0.0	0.0	0.0
HEC	0.52	1.0	1.21	0.0	0.0	0.0
Bactericide	0.05	0.1	0.27	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	29.96	29.96	26.7

Table 4: Tissue Dielectric Properties

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16M Ω + resistivity
HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100(ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

Used Target Frequency	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
	ϵ_r (+/-5%)	σ (S/m) (+/-5%)	ϵ_r	σ (S/m)		
835MHz Head	41.5 (39.43~43.58)	0.90 (0.86~0.95)	42.43	0.925	20.8°C	July,15,2011
900MHz Head	41.5 (39.43~43.58)	0.97 (0.92~1.02)	41.67	0.987	20.8°C	July,15,2011
835MHz Body	55.2 (52.44~57.96)	0.97 (0.92~1.02)	52.70	0.956	20.8°C	July,14,2011
900MHz Body	55.0 (52.25~57.75)	1.05 (0.99~1.10)	52.00	1.020	20.8°C	July,14,2011
ϵ_r = Relative permittivity, σ = Conductivity						

Table 5: Measured Tissue Parameter

The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

4.2 System Check

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system validation is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows validation results for all frequency bands and tissue liquids used during the tests (Graphic Plot(s) see Appendix A).

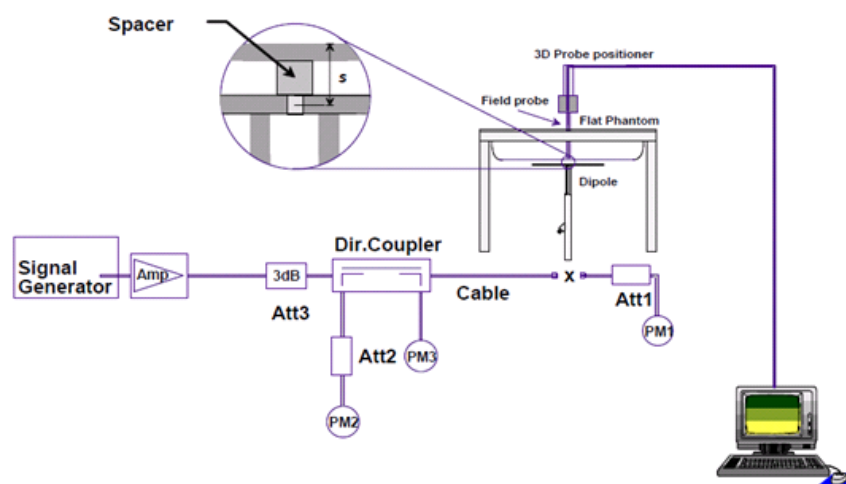
System Check	Target SAR (250 mW) (+/- 10%)		Measured SAR(250mW)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D900V2 Head	2.75 (2.61~2.89)	1.76 (1.67~1.85)	2.63	1.72	20.8°C	July,15,2011
D900V2 Body	2.84 (2.70 ~2.98)	1.83 (1.73~1.92)	2.90	1.87	20.8°C	July,14,2011

Table 6: System Check Results

4.3 Validation Procedure

The validation is performed by using a validation dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250 mW. To adjust this power a power meter is used. The power sensor is connected to the cable before the validation to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the validation to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

Validation results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system.



5 Measurement Uncertainty Evaluation

5.1 Measurement uncertainty evaluation for SAR test

The overall combined measurement uncertainty of the measurement system is $\pm 10.7\%$ ($K=1$).

The expanded uncertainty ($k=2$) is assessed to be $\pm 21.4\%$

This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	$\pm 5.9\%$	Normal	1	1	1	$\pm 5.9\%$	$\pm 5.9\%$	∞
Axial isotropy	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 1.9\%$	$\pm 1.9\%$	∞
Hemispherical isotropy	$\pm 9.6\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 3.9\%$	$\pm 3.9\%$	∞
Spatial resolution	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Boundary effects	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe linearity	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
System detection limits	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Readout electronics	$\pm 0.3\%$	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Response time	$\pm 0.8\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.5\%$	$\pm 0.5\%$	∞
Integration time	$\pm 2.6\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5\%$	$\pm 1.5\%$	∞
RF ambient conditions	$\pm 3.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Probe positioner	$\pm 0.4\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.2\%$	$\pm 0.2\%$	∞
Probe positioning	$\pm 2.9\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Max. SAR evaluation	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Test Sample Related								
Device positioning	$\pm 2.9\%$	Normal	1	1	1	$\pm 2.9\%$	$\pm 2.9\%$	145
Device holder uncertainty	$\pm 3.6\%$	Normal	1	1	1	$\pm 3.6\%$	$\pm 3.6\%$	5
Power drift	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9\%$	$\pm 2.9\%$	∞
Phantom and Set-up								
Phantom uncertainty	$\pm 4.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Liquid conductivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (meas.)	$\pm 2.5\%$	Normal	1	0.64	0.43	$\pm 1.6\%$	$\pm 1.1\%$	∞
Liquid permittivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.6	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (meas.)	$\pm 2.5\%$	Normal	1	0.6	0.49	$\pm 1.5\%$	$\pm 1.2\%$	∞
Combined Uncertainty						$\pm 10.9\%$	$\pm 10.7\%$	387
Expanded Std. Uncertainty						$\pm 21.9\%$	$\pm 21.4\%$	

Table 7: Measurement uncertainties

5.2 Measurement uncertainty evaluation for system validation

The overall combined measurement uncertainty of the measurement system is $\pm 9.2\%$ ($K=1$).

The expanded uncertainty ($k=2$) is assessed to be $\pm 18.4\%$

This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	$\pm 5.9\%$	Normal	1	1	1	$\pm 5.9\%$	$\pm 5.9\%$	∞
Axial isotropy	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
Hemispherical isotropy	$\pm 9.6\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 0.0\%$	$\pm 0.0\%$	∞
Boundary effects	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe linearity	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
System detection limits	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Readout electronics	$\pm 0.3\%$	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Response time	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Integration time	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
RF ambient conditions	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe positioner	$\pm 0.4\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.2\%$	$\pm 0.2\%$	∞
Probe positioning	$\pm 2.9\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Max. SAR evaluation	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Dipole								
Deviation of experimental dipole	$\pm 5.5\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 3.2\%$	$\pm 3.2\%$	∞
Dipole axis to liquid distance	$\pm 2.0\%$	Rectangular	1	1	1	$\pm 1.2\%$	$\pm 1.2\%$	∞
Power drift	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
Phantom and Set-up								
Phantom uncertainty	$\pm 4.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Liquid conductivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (meas.)	$\pm 2.5\%$	Normal	1	0.64	0.43	$\pm 1.6\%$	$\pm 1.1\%$	∞
Liquid permittivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.6	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (meas.)	$\pm 2.5\%$	Normal	1	0.6	0.49	$\pm 1.5\%$	$\pm 1.2\%$	∞
Combined Uncertainty						$\pm 9.5\%$	$\pm 9.2\%$	
Expanded Std. Uncertainty						$\pm 18.9\%$	$\pm 18.4\%$	

Table 8: Measurement uncertainties

6 SAR Test Configuration

6.1 WCDMA Test Configuration

1) RMC

As the SAR body tests for WCDMA Band V, we established the radio link through call processing. The maximum output power were verified on high, middle and low channels for each test band according to 3GPP TS 34.121 with the following configuration:

- 1) 12.2kbps RMC, 64,144,384 kbps RMC with TPC set to 'all 1'.
- 2) Test loop Mode 1.

For the output power, the configurations for the DPCCH and DPDCH₁ are as followed (EUT do not support the DPDCH_{2-n})

	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	Spreading Factor	Spreading Code Number	Bits/Slot
DPCCH	15	15	256	0	10
DPDCH ₁	15	15	256	64	10
	30	30	128	32	20
	60	60	64	16	40
	120	120	32	8	80
	240	240	16	4	160
	480	480	8	2	320
	960	960	4	1	640
DPDCH _n	960	960	4	1, 2, 3	640

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all "1s". SAR for other spreading codes and multiple DPDCH_n, when supported by the EUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCH_n configuration, are less than ¼ dB higher than those measured in 12.2 kbps RMC.

7 SAR Measurement Results

7.1 Conducted power measurements

For the measurements a Rohde & Schwarz Radio Communication Tester CMU 200 was used.

The output power was measured using an integrated RF connector and attached RF cable.

SAR drift measured at same position in liquid before and after each SAR test as below 7.2.1 chapter.

7.1.1 after each SAR testConducted power measurements WCDMA FDD V (850 MHz)

UMTS850 (Band V)		Conducted Power (dBm)		
		4132CH	4183CH	4233CH
WCDMA	12.2kbps RMC	23.37	23.48	23.52
	64kbps RMC	23.29	23.62	23.45
	144kbps RMC	23.33	23.58	23.51
	384kbps RMC	23.34	23.64	23.49

Table 9: Test results conducted power measurement WCDMA 850

7.2 SAR measurement Result

7.2.1 SAR measurement Result of WCDMA Band V

Test Position of Head	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Left Hand Touched	RMC	4182/836.4	0.985	0.687	0.020	1.60	21.6°C
Left Hand Tilted 15°	RMC	4182/836.5	0.556	0.400	-0.005	1.60	21.6°C
Right Hand Touched	RMC	4182/836.6	1.100	0.767	0.014	1.60	21.6°C
Right Hand Tilted 15°	RMC	4182/836.7	0.410	0.292	0.169	1.60	21.6°C
Left Hand Touched	RMC	4233/846.6	1.030	0.710	-0.007	1.60	21.6°C
Left Hand Touched	RMC	4132/826.4	0.926	0.643	0.067	1.60	21.6°C
Right Hand Touched	RMC	4233/846.6	1.120	0.773	-0.086	1.60	21.6°C
Right Hand Touched	RMC	4132/826.4	1.000	0.702	0.037	1.60	21.6°C

Table 10: Test results head SAR UMTS FDD V 850 MHz

Test Position of Body with 15mm	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Towards Phantom	RMC	4182/836.4	0.674	0.483	-0.034	1.60	21.6°C
Towards Ground	RMC	4182/836.4	0.806	0.573	0.035	1.60	21.6°C
Towards Ground	RMC	4233/846.6	0.765	0.539	-0.020	1.60	21.6°C
Towards Ground	RMC	4132/826.4	0.820	0.583	0.082	1.60	21.6°C
Towards Ground with Headset	RMC	4132/826.4	0.455	0.321	0.170	1.60	21.6°C

Table 11: Test results body SAR UMTS FDD V 850 MHz

Note: 1) The value with bold colour is the maximum SAR value of each test band.

2) Upper and lower frequencies were measured at the worst position.

3) The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8 W/kg), testing at the high and low channels is optional.

4) Tests in body position were performed with 15 mm air gap between DUT and SAM to simulate the use of a non-metallic belt-clip or holster.

5) The addition body test was performed at worst case.

Appendix A. System Check Plots

(Pls See Appendix A.)

Appendix B. SAR Measurement Plots

(Pls See Appendix B.)

Appendix C. Calibration Certificate

(Pls See Appendix C.)

Appendix D. Photo documentation

(Pls See Appendix D.)

END



Appendix A. System Check Plots

SystemPerformanceCheck-D900-ES-Head

SystemPerformanceCheck-D900-ES-Body

Date/Time: 7/15/2011 3:56:59, Date/Time: 7/15/2011 4:04:57

Test Laboratory: HUAWEI SAR Lab

SystemPerformanceCheck-D900-ES-Head

DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN:1d112

Communication System: CW; Frequency: 900 MHz

Medium parameters used: $f = 900$ MHz; $\sigma = 0.987$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/d=15mm, Pin=250mW/Area Scan (6x11x1): Measurement grid:

dx=15mm, dy=15mm

Maximum value of SAR (measured) = 2.6 mW/g

Configuration/d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm,

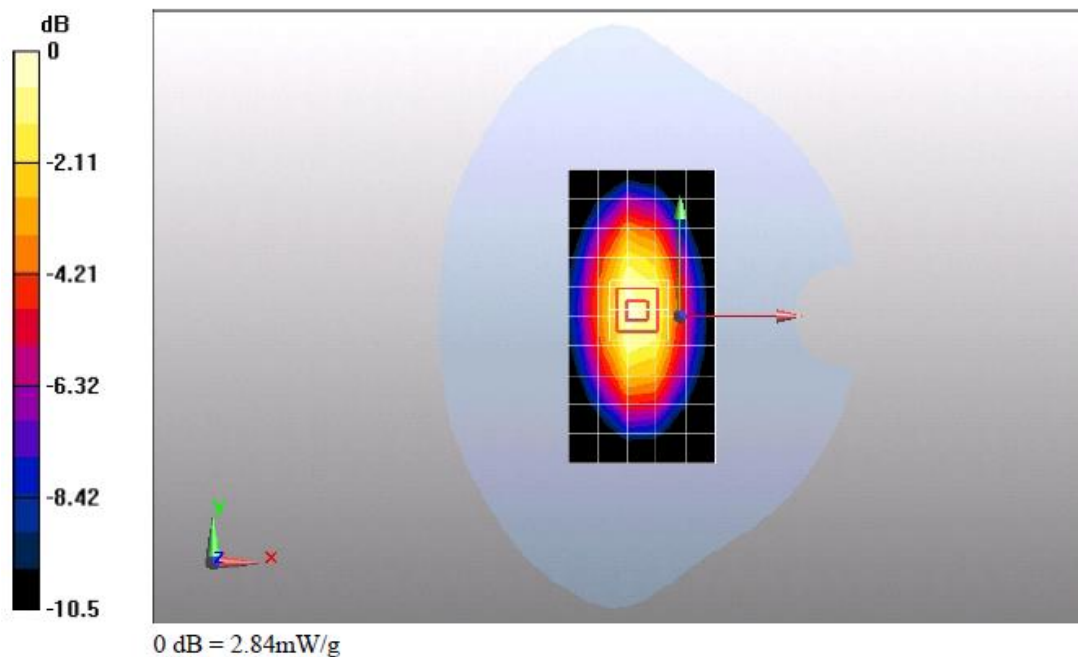
dy=5mm, dz=5mm

Reference Value = 52.9 V/m; Power Drift = 0.056 dB

Peak SAR (extrapolated) = 3.89 W/kg

SAR(1 g) = 2.63 mW/g; SAR(10 g) = 1.72 mW/g

Maximum value of SAR (measured) = 2.84 mW/g



Date/Time: 7/14/2011 22:54:29, Date/Time: 7/14/2011 23:02:25

Test Laboratory: HUAWEI SAR Lab

SystemPerformanceCheck-D900-ES-Body

DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN:1d112

Communication System: CW; Frequency: 900 MHz

Medium parameters used: $f = 900$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.03, 6.03, 6.03); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM2; Type: SAM; Serial: TP-1474
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/d=15mm, Pin=250mW/Area Scan (6x11x1): Measurement grid:

dx=15mm, dy=15mm

Maximum value of SAR (measured) = 2.96 mW/g

Configuration/d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm,

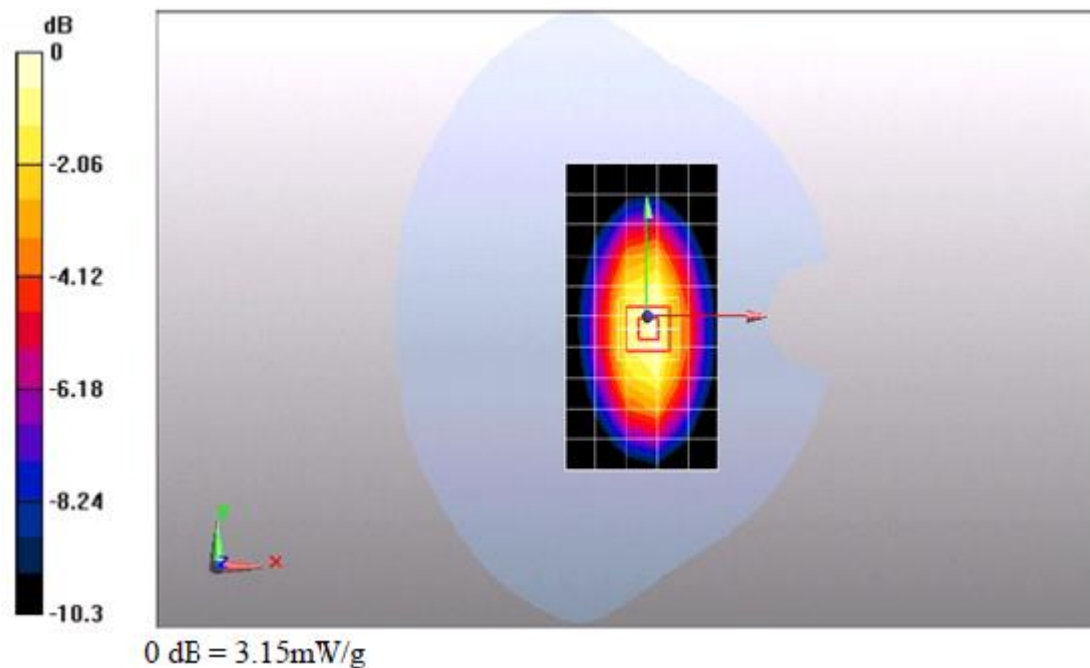
dy=5mm, dz=5mm

Reference Value = 52.4 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 4.39 W/kg

SAR(1 g) = 2.9 mW/g; SAR(10 g) = 1.87 mW/g

Maximum value of SAR (measured) = 3.15 mW/g





Appendix B. SAR Measurement Plots

WCDMA 850 MHz head

WCDMA 850 MHz body

Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4182CH Left hand touch cheek

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 836.4 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.926$ mho/m; $\epsilon_r = 42.4$; $\rho = 1000$ kg/m³

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.03 mW/g

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

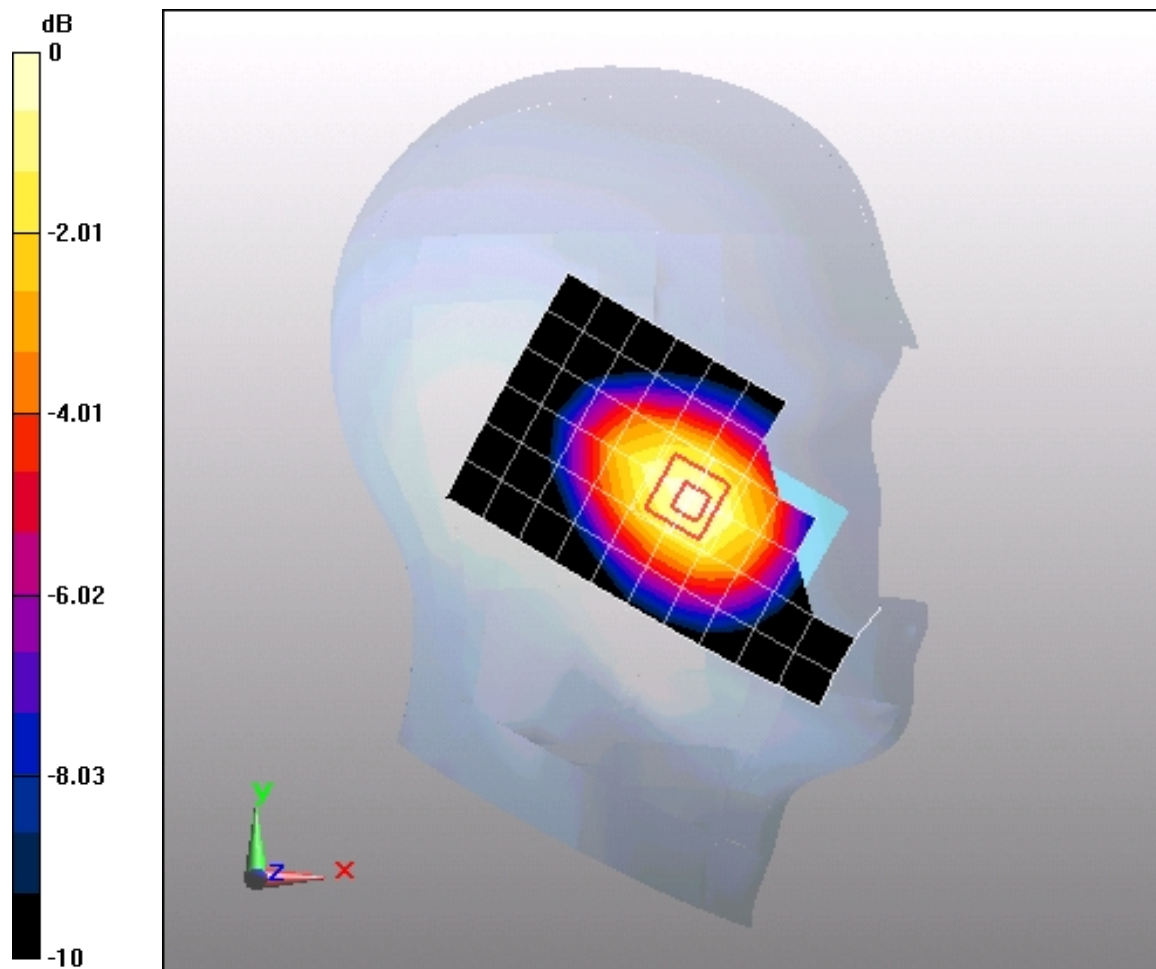
Reference Value = 12.9 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 1.34 W/kg

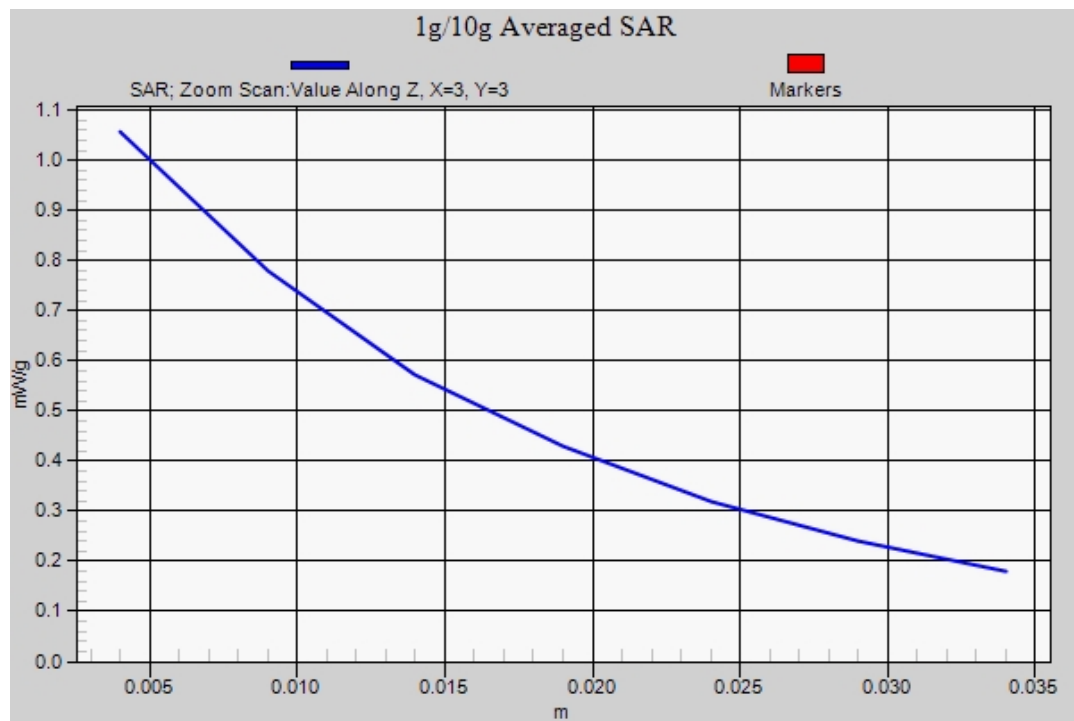
SAR(1 g) = 0.985 mW/g; SAR(10 g) = 0.687 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.06 mW/g



0 dB = 1.06mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4182CH Left hand tilt 15 degree

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 836.4 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.926$ mho/m; $\epsilon_r = 42.4$; $\rho = 1000$ kg/m³

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.586 mW/g

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

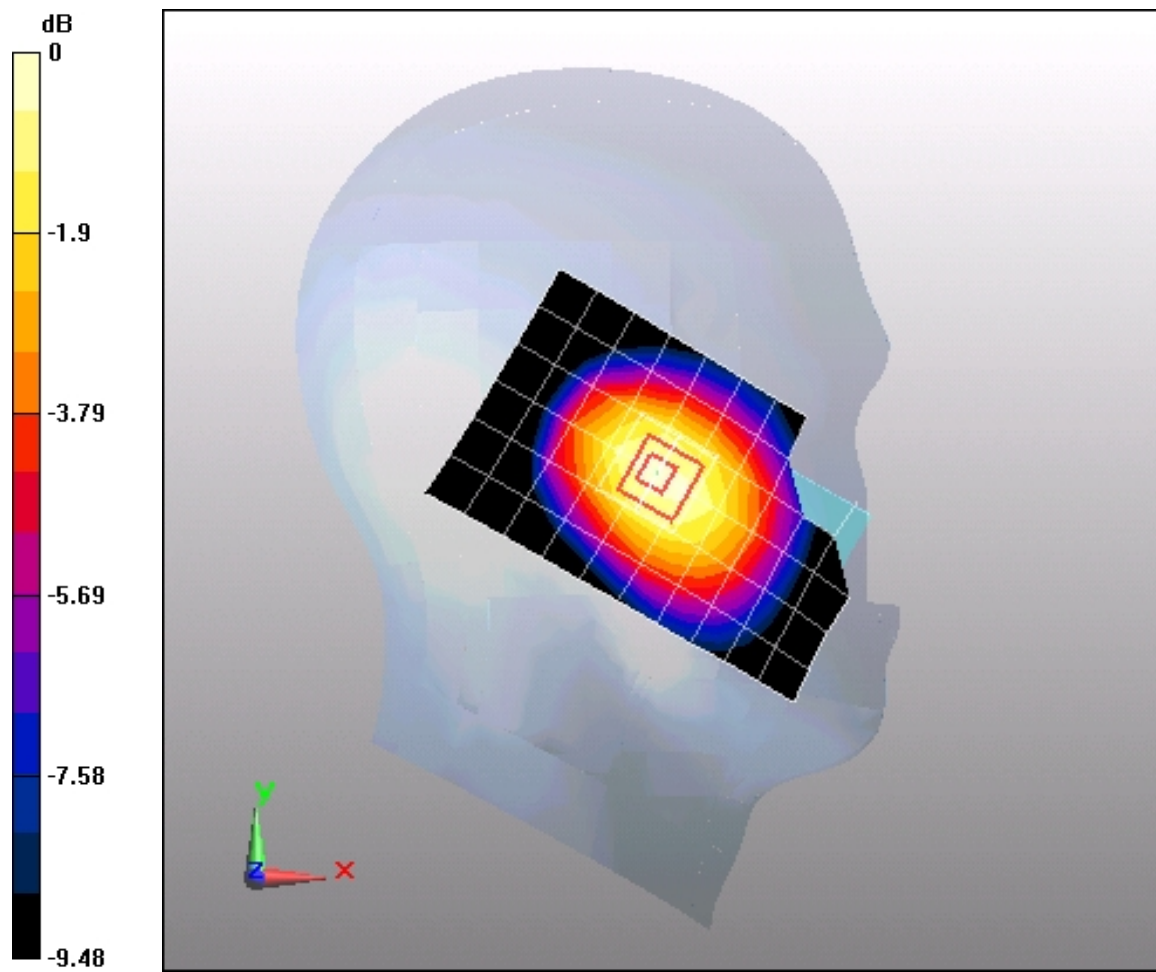
Reference Value = 16.5 V/m; Power Drift = -0.00471 dB

Peak SAR (extrapolated) = 0.731 W/kg

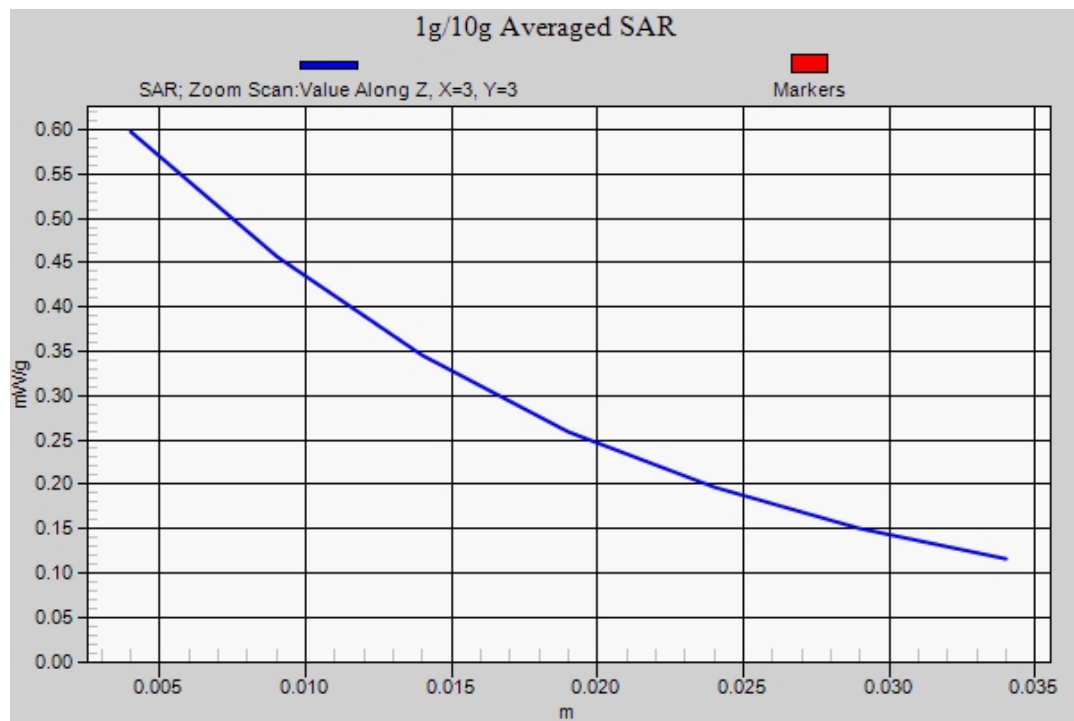
SAR(1 g) = 0.556 mW/g; SAR(10 g) = 0.400 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.597 mW/g



0 dB = 0.597mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4182CH Right hand touch cheek

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 836.4 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.926$ mho/m; $\epsilon_r = 42.4$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.06 mW/g

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

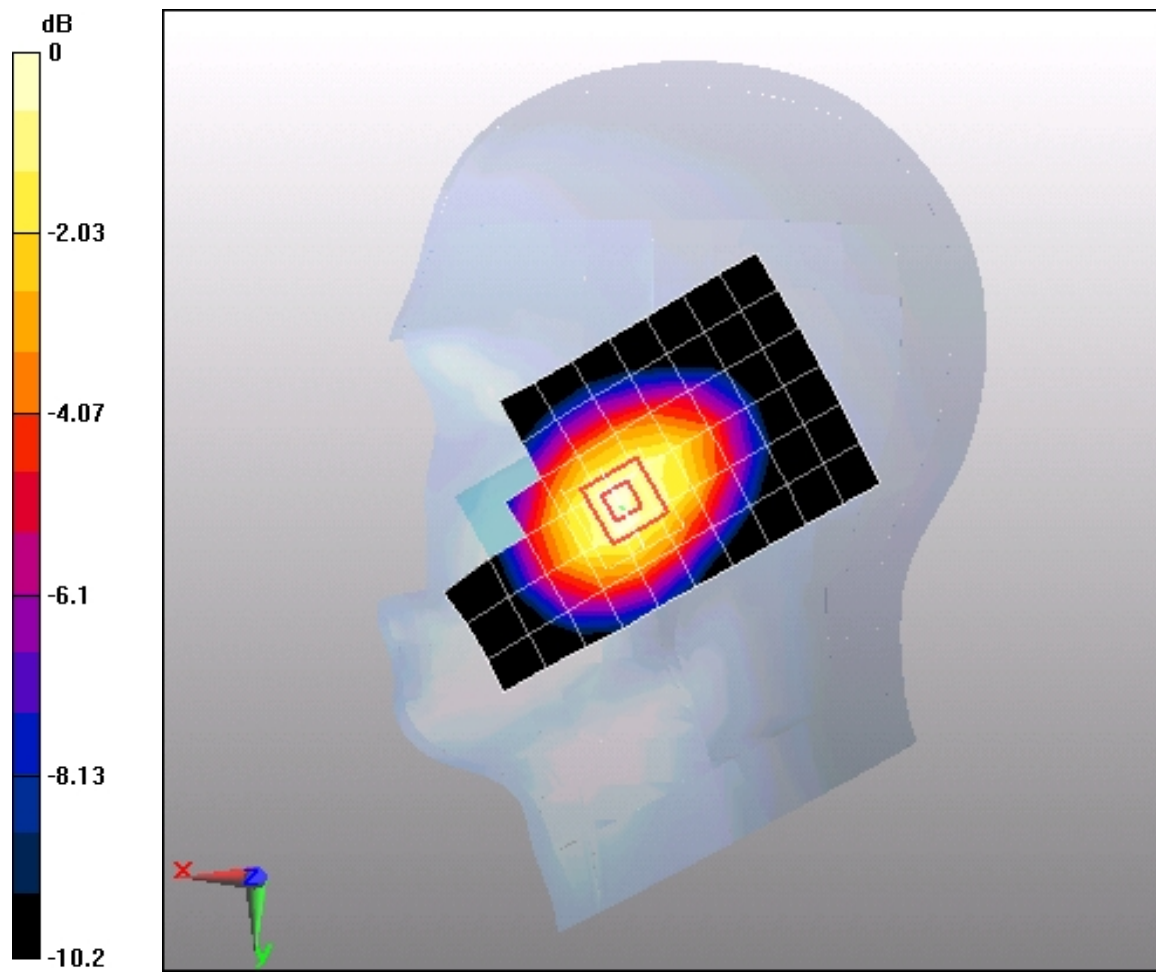
Reference Value = 15.1 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 1.48 W/kg

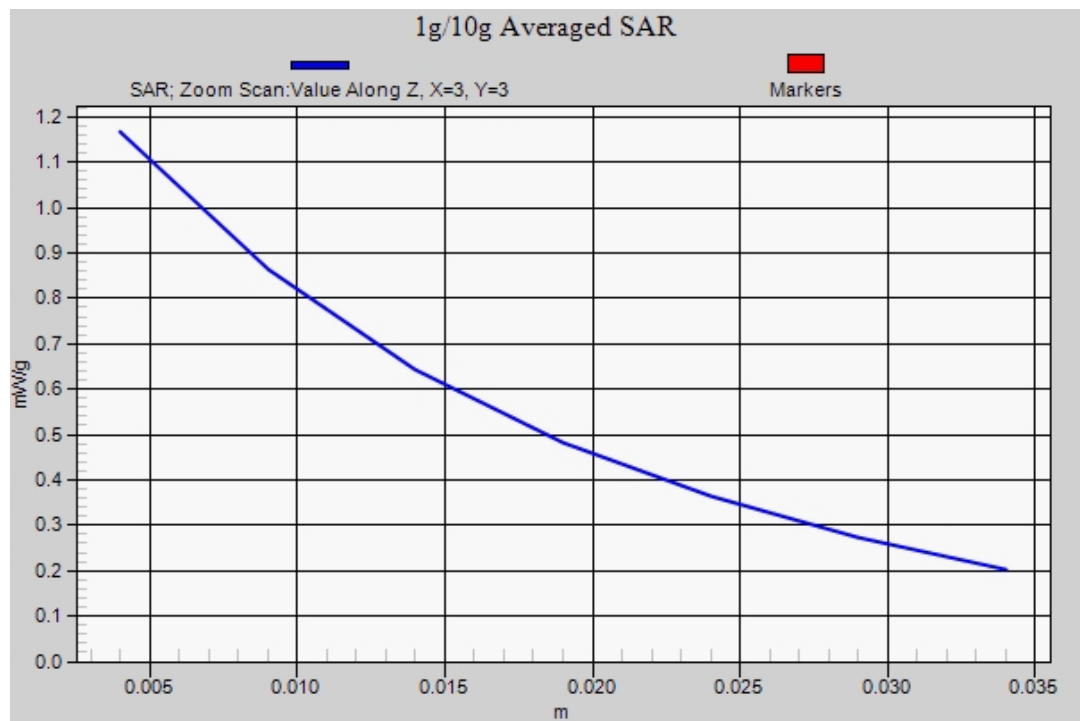
SAR(1 g) = 1.1 mW/g; SAR(10 g) = 0.767 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.17 mW/g



0 dB = 1.17mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4182CH Right hand tilt 15 degree

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 836.4 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.926$ mho/m; $\epsilon_r = 42.4$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASYS, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.425 mW/g

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

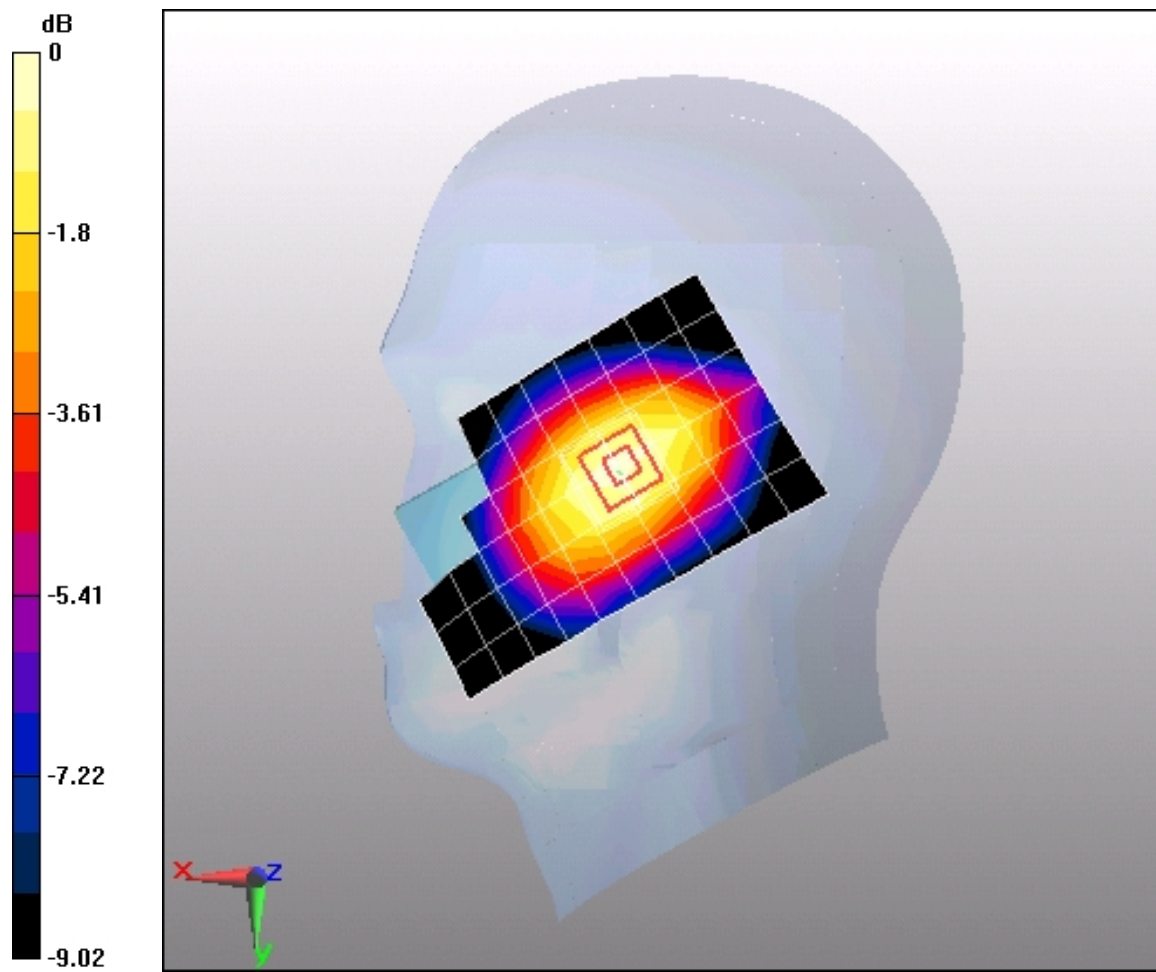
Reference Value = 18.7 V/m; Power Drift = 0.169 dB

Peak SAR (extrapolated) = 0.552 W/kg

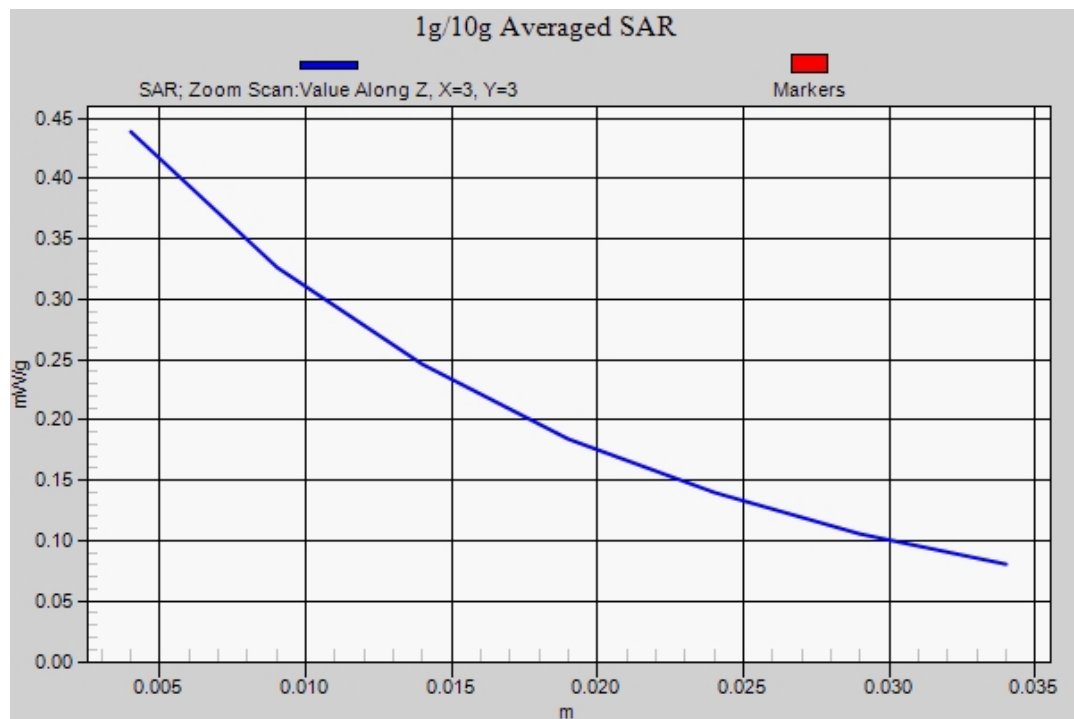
SAR(1 g) = 0.410 mW/g; SAR(10 g) = 0.292 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.439 mW/g



0 dB = 0.439mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4233CH Left hand touch cheek

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 846.6 MHz

Medium parameters used: $f = 847$ MHz; $\sigma = 0.937$ mho/m; $\epsilon_r = 42.3$; $\rho = 1000$ kg/m³

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.08 mW/g

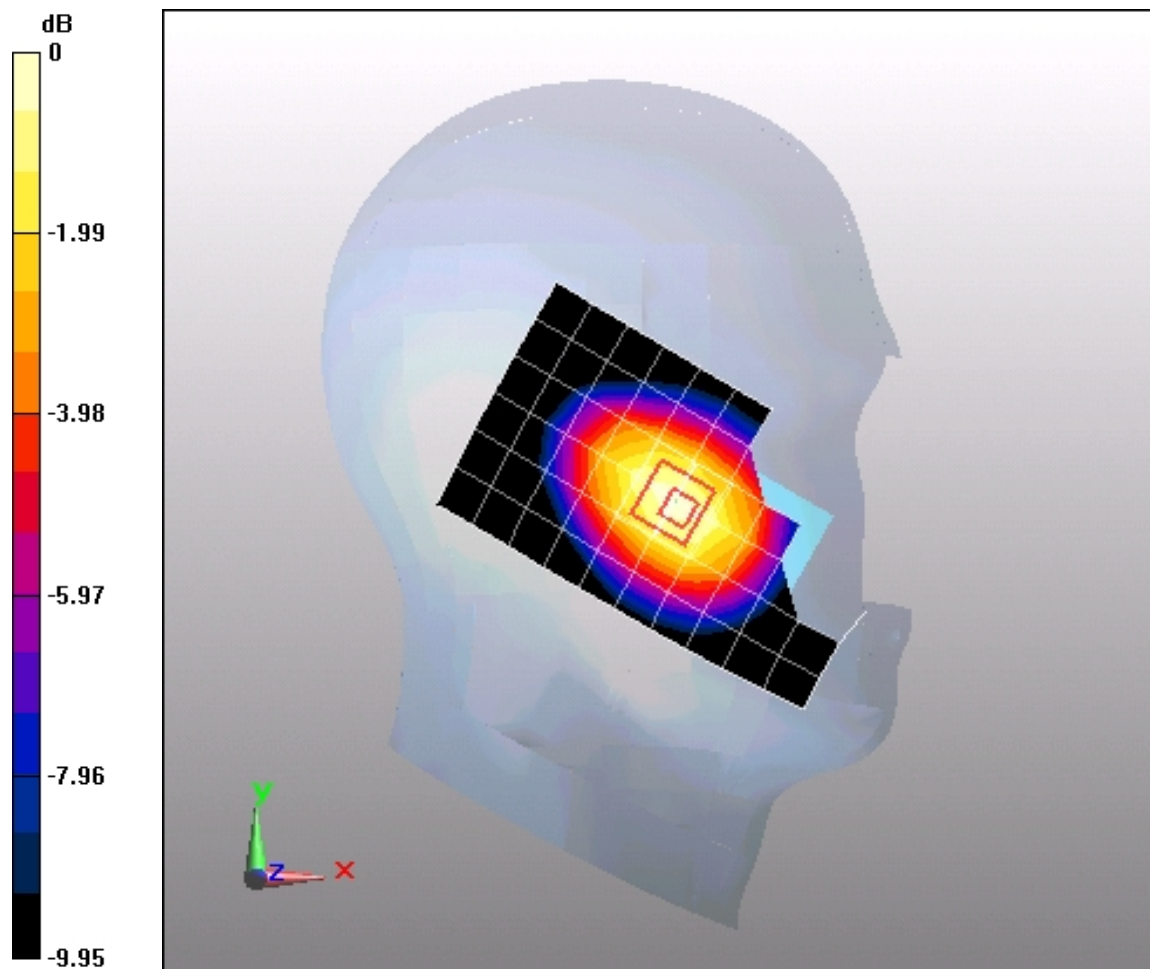
Configuration/Head/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.1 V/m; Power Drift = -0.00714 dB

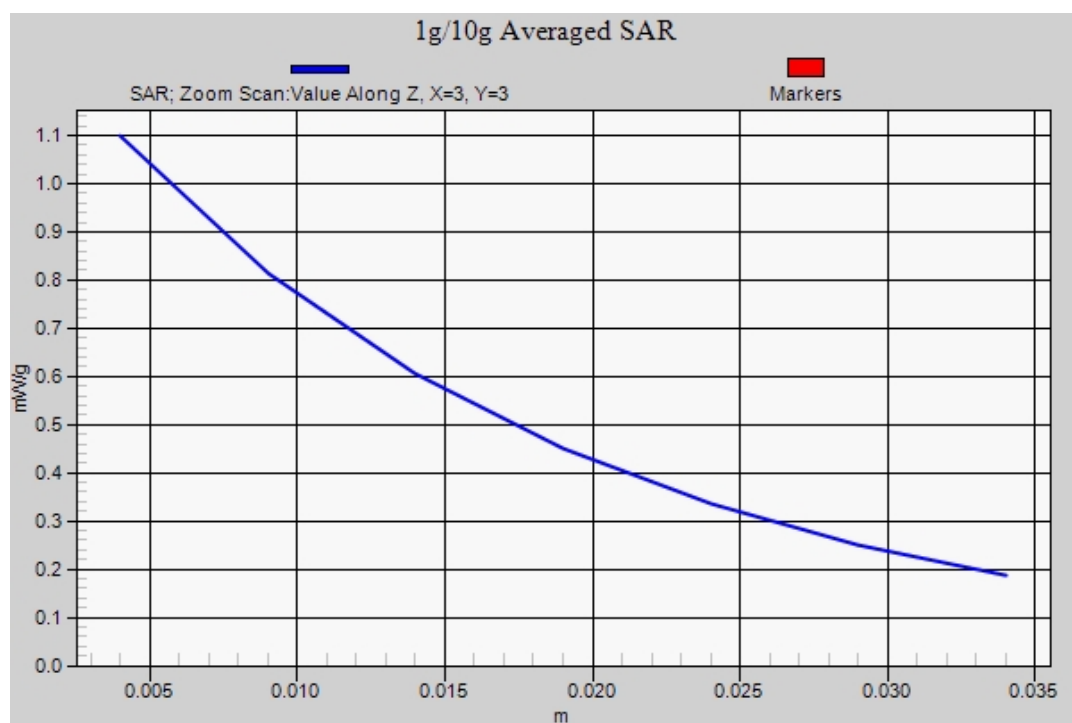
Peak SAR (extrapolated) = 1.42 W/kg

SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.710 mW/g

Maximum value of SAR (measured) = 1.1 mW/g



0 dB = 1.1mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4132CH Left hand touch cheek

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 826.4 MHz

Medium parameters used (interpolated): $f = 826.4$ MHz; $\sigma = 0.915$ mho/m; $\epsilon_r = 42.5$; $\rho = 1000$ kg/m³

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.942 mW/g

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

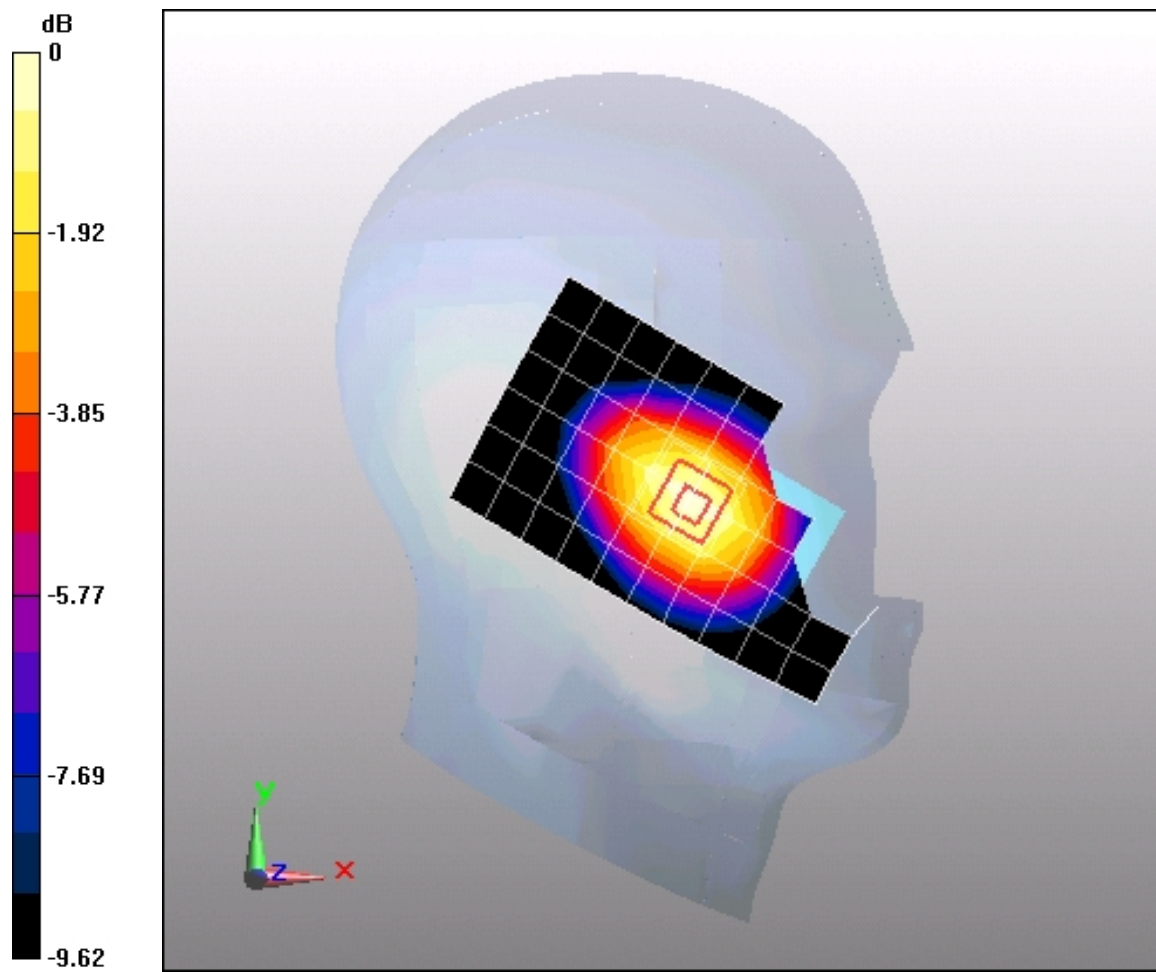
Reference Value = 11.8 V/m; Power Drift = 0.067 dB

Peak SAR (extrapolated) = 1.26 W/kg

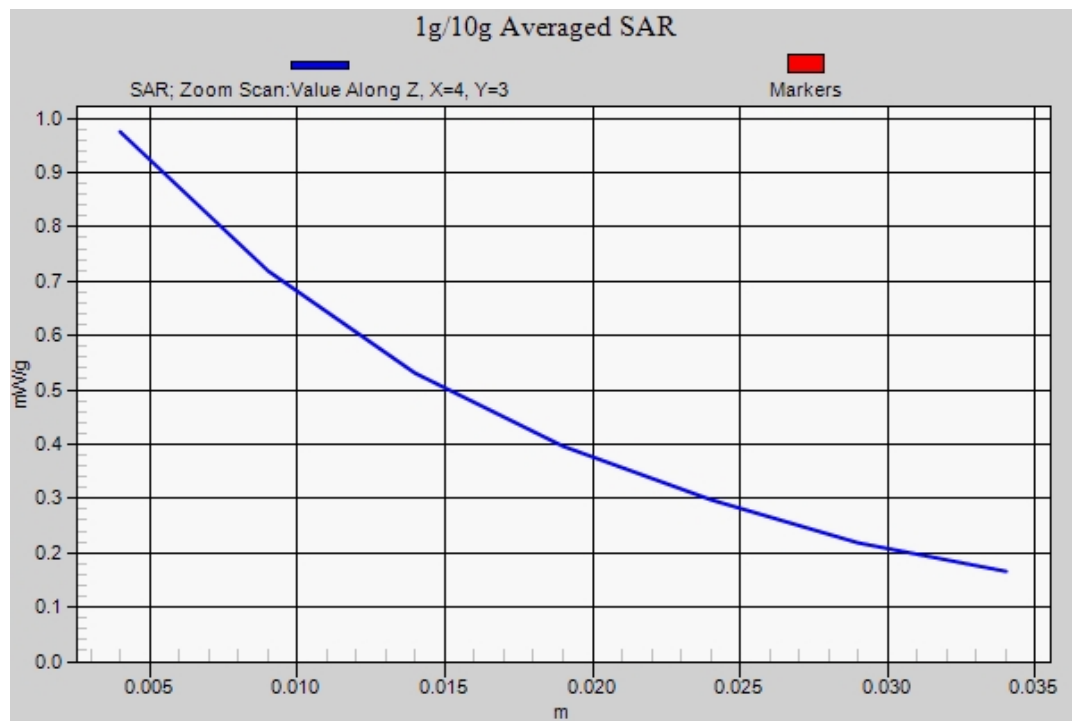
SAR(1 g) = 0.926 mW/g; SAR(10 g) = 0.643 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.975 mW/g



0 dB = 0.975mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4233CH Right hand touch cheek

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 846.6 MHz

Medium parameters used: $f = 847$ MHz; $\sigma = 0.937$ mho/m; $\epsilon_r = 42.3$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.11 mW/g

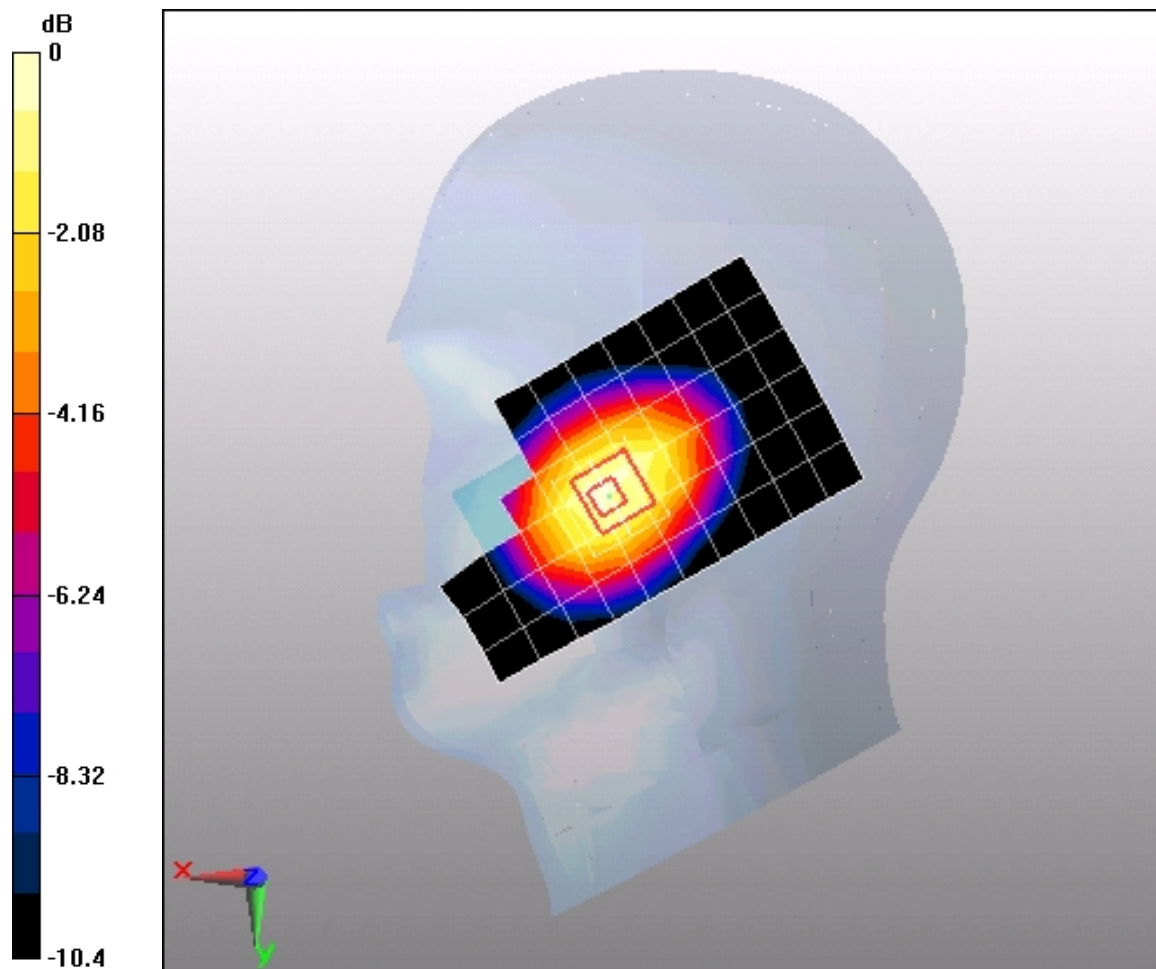
Configuration/Head/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.6 V/m; Power Drift = -0.086 dB

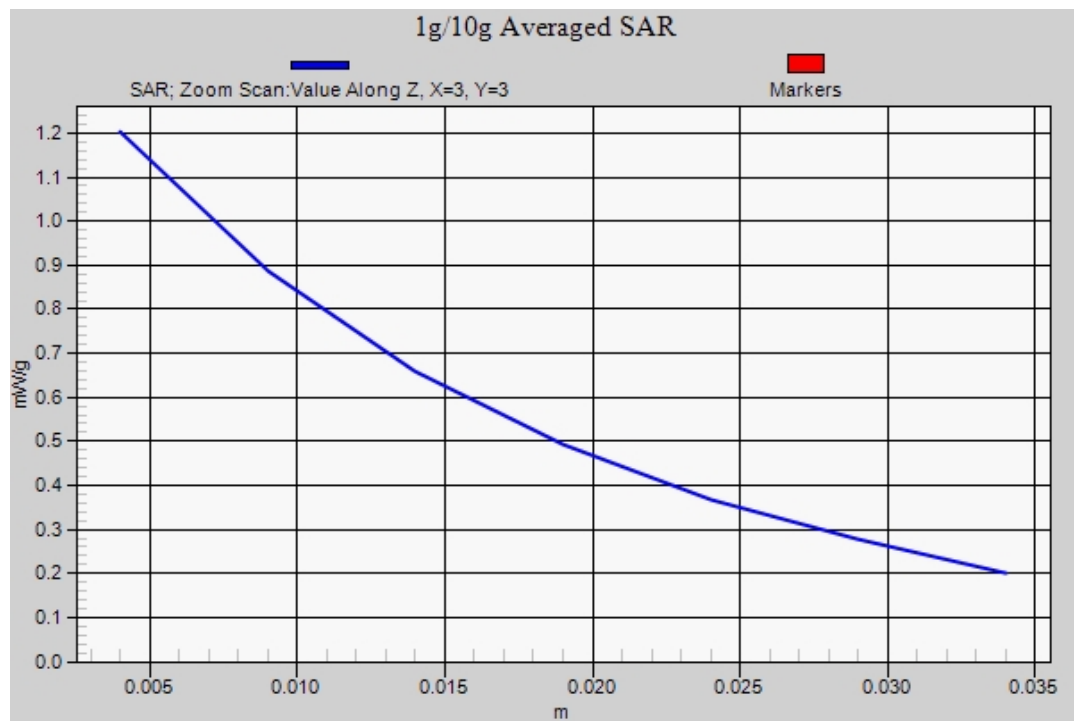
Peak SAR (extrapolated) = 1.53 W/kg

SAR(1 g) = 1.12 mW/g; SAR(10 g) = 0.773 mW/g

Maximum value of SAR (measured) = 1.2 mW/g



0 dB = 1.2mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4132CH Right hand touch cheek

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 826.4 MHz

Medium parameters used (interpolated): $f = 826.4$ MHz; $\sigma = 0.915$ mho/m; $\epsilon_r = 42.5$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.01, 6.01, 6.01); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM1; Type: SAM; Serial: TP-1475
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.990 mW/g

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

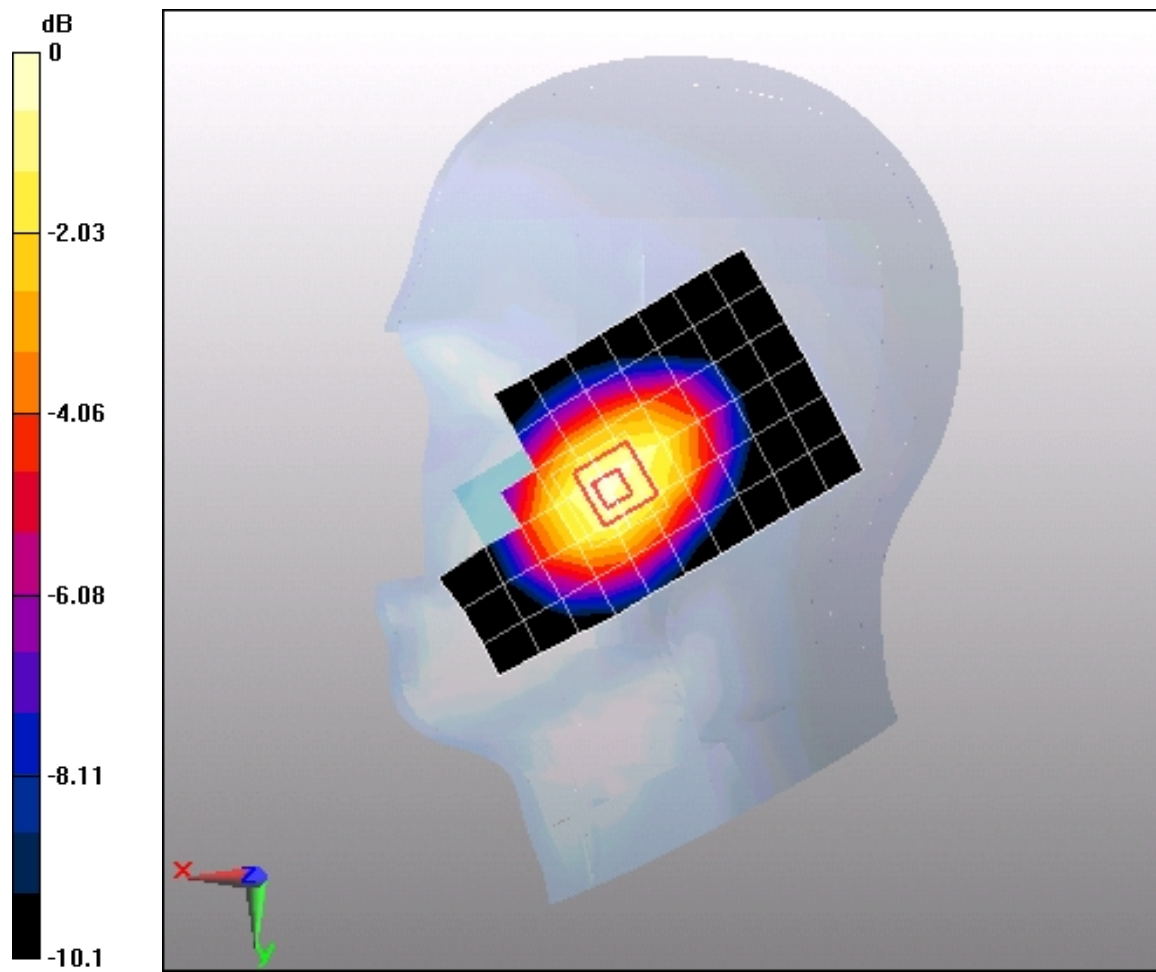
Reference Value = 13.4 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 1.35 W/kg

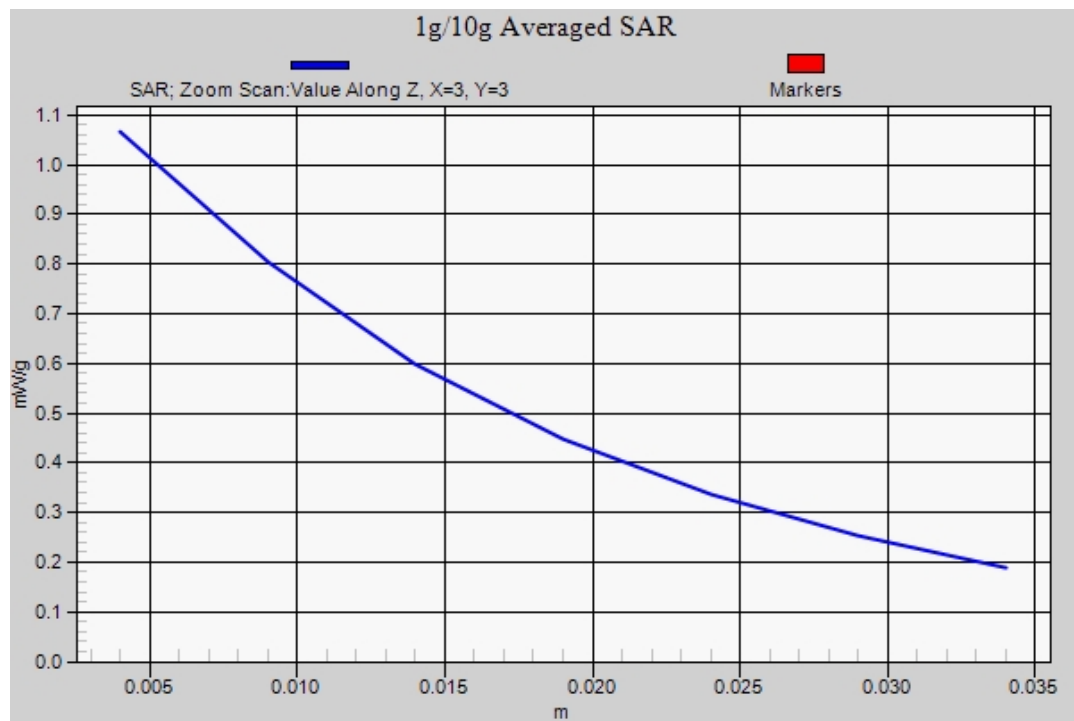
SAR(1 g) = 1 mW/g; SAR(10 g) = 0.702 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.07 mW/g



0 dB = 1.07mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4182CH Towards phantom 15mm

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD(WCDMA); Frequency: 836.4 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.958$ mho/m; $\epsilon_r = 52.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.03, 6.03, 6.03); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM2; Type: SAM; Serial: TP-1474
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.690 mW/g

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

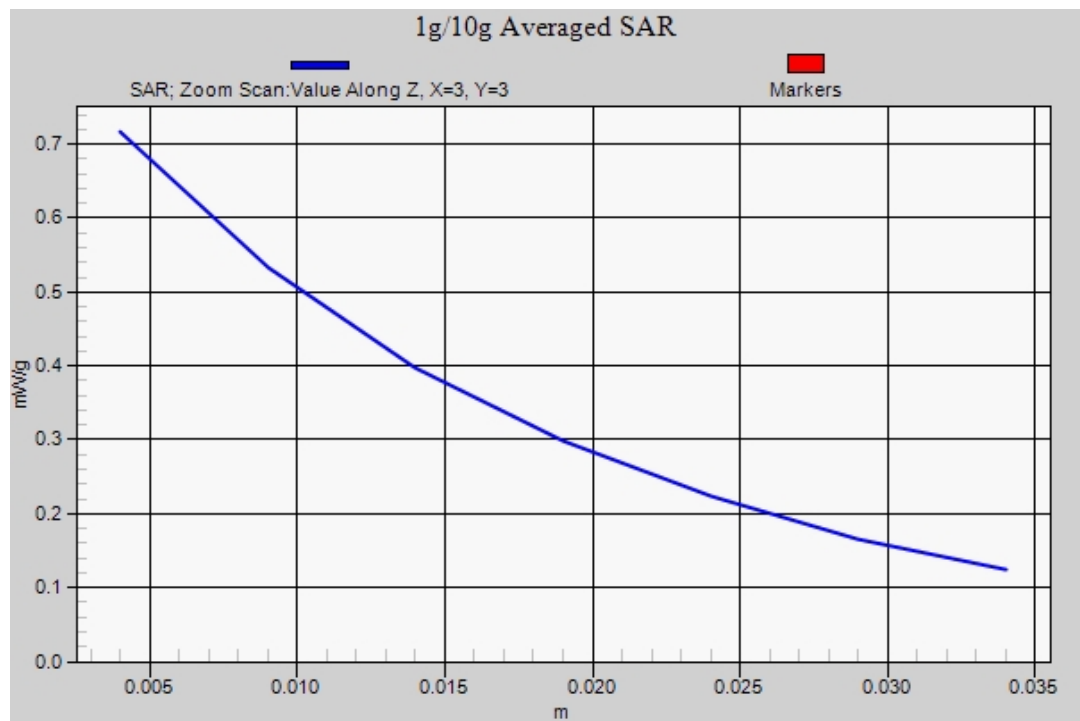
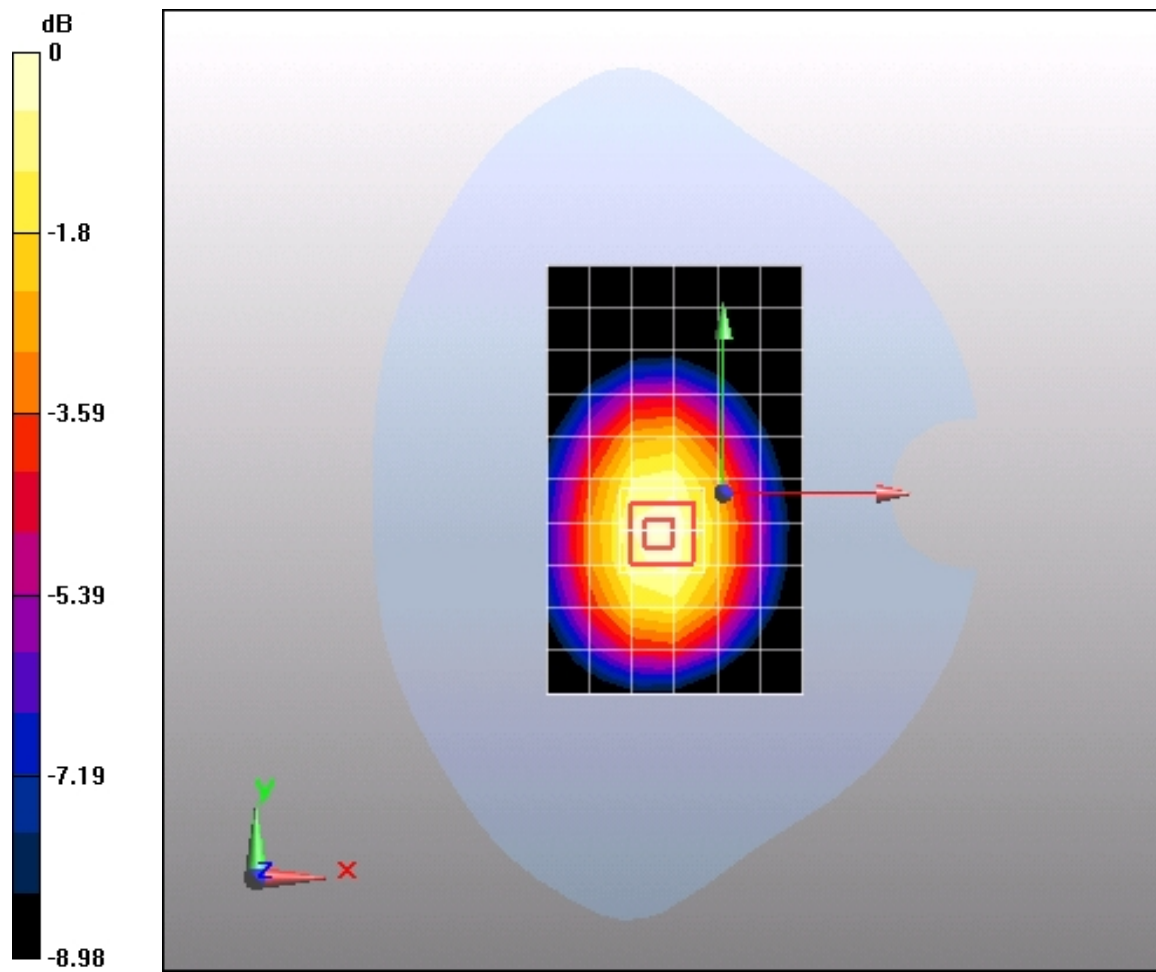
Reference Value = 26 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.908 W/kg

SAR(1 g) = 0.674 mW/g; SAR(10 g) = 0.483 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.716 mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4182CH Towards ground 15mm

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD(WCDMA); Frequency: 836.4 MHz

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.958$ mho/m; $\epsilon_r = 52.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.03, 6.03, 6.03); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM2; Type: SAM; Serial: TP-1474
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.815 mW/g

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

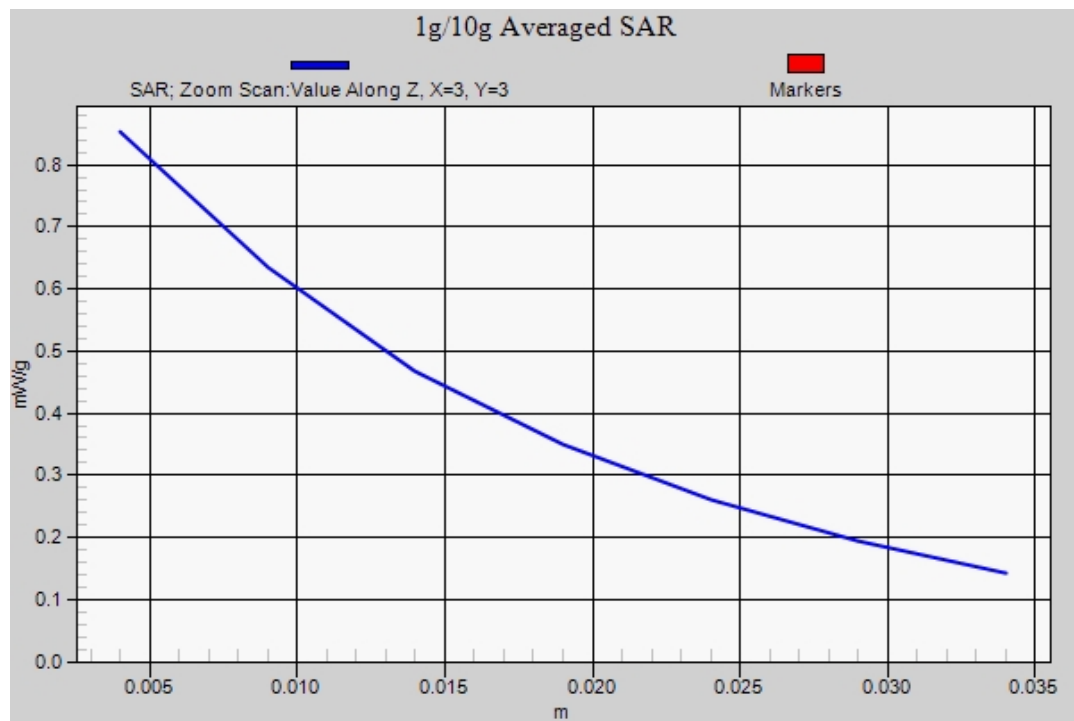
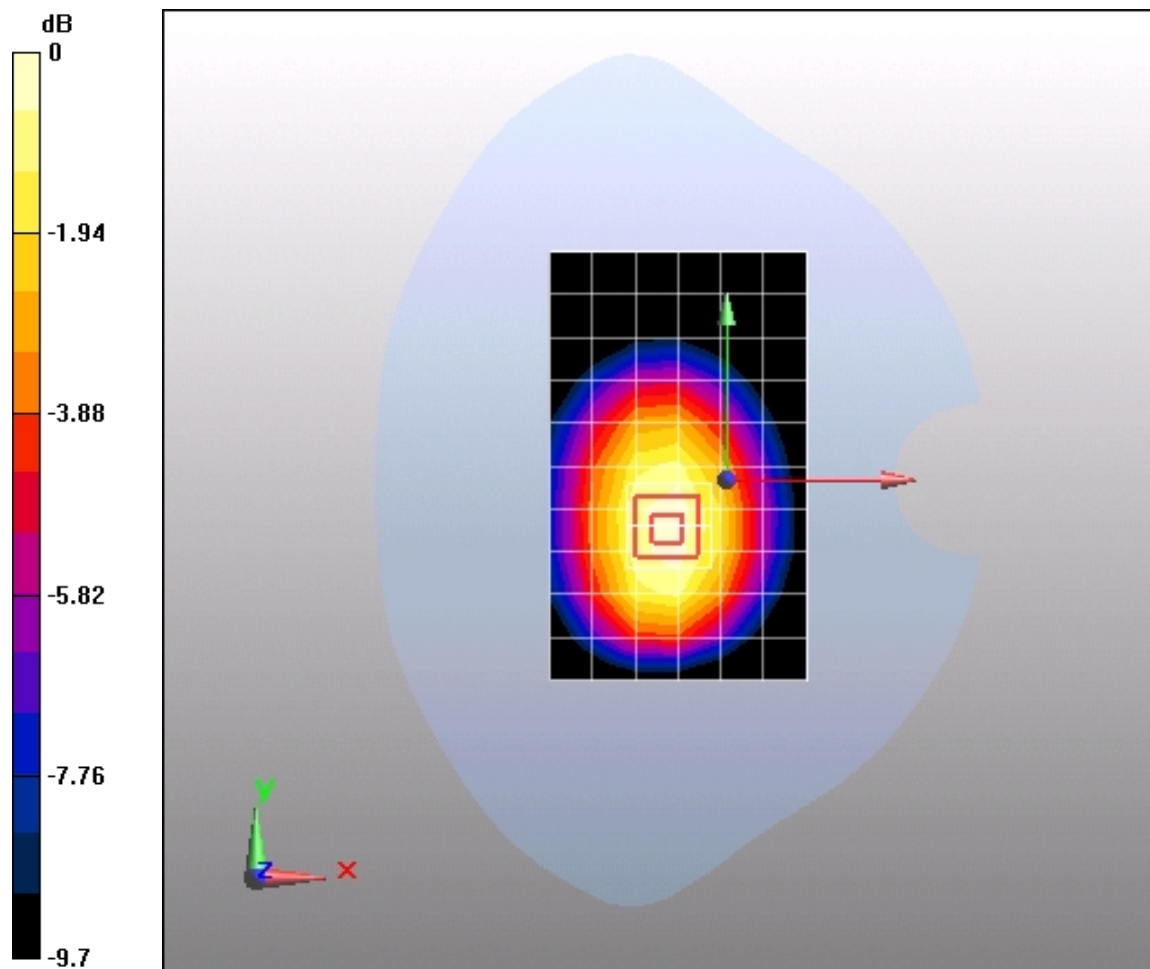
Reference Value = 27.9 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 1.09 W/kg

SAR(1 g) = 0.806 mW/g; SAR(10 g) = 0.573 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.853 mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4233CH Towards ground 15mm

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 846.6 MHz

Medium parameters used: $f = 847$ MHz; $\sigma = 0.969$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.03, 6.03, 6.03); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM2; Type: SAM; Serial: TP-1474
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.778 mW/g

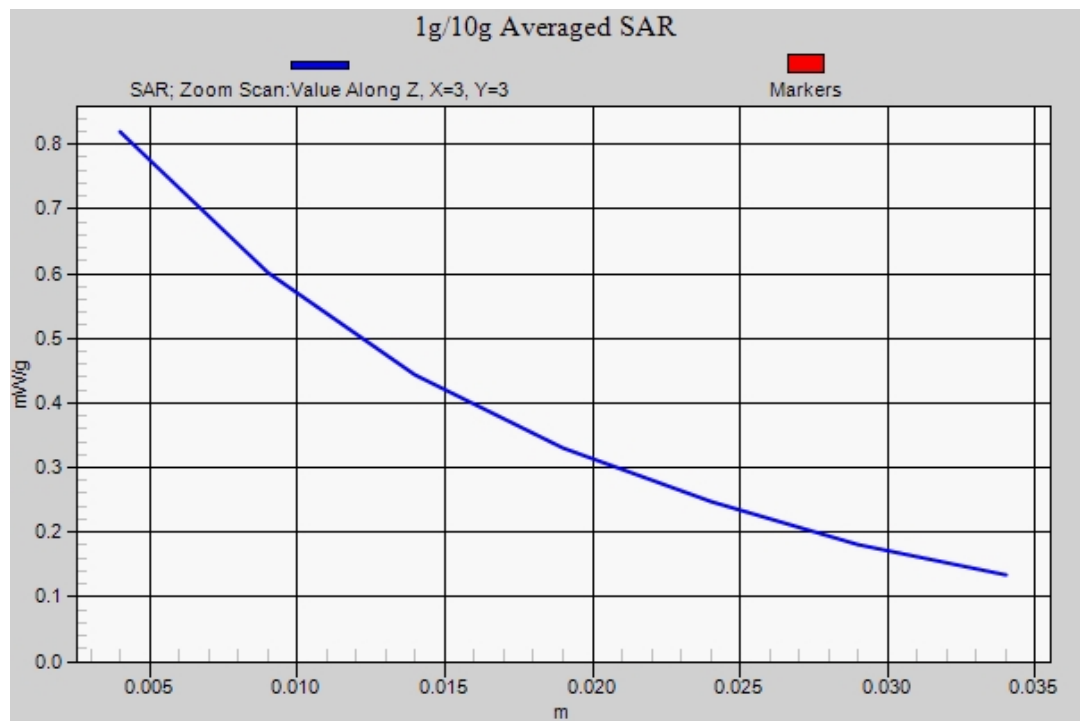
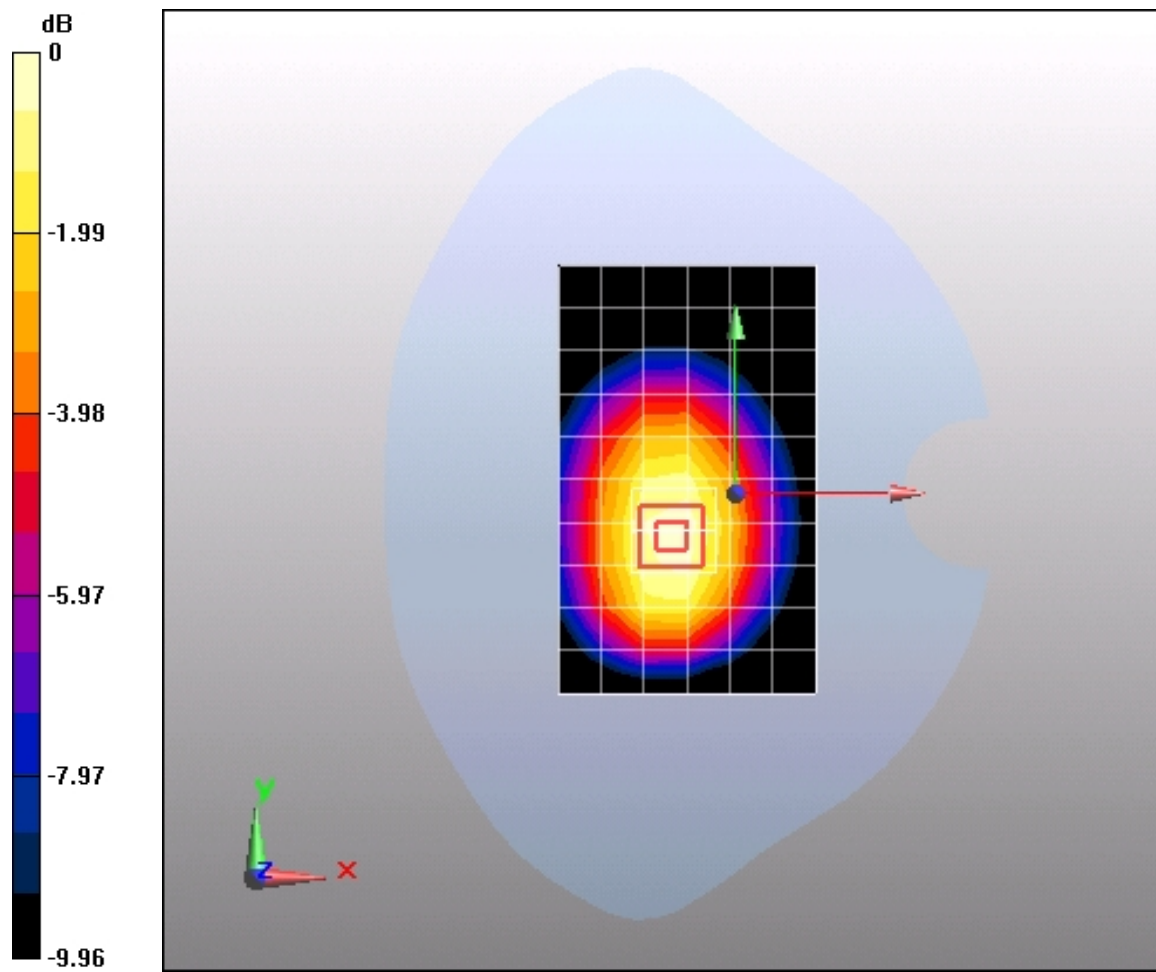
Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 27.2 V/m; Power Drift = -0.020 dB

Peak SAR (extrapolated) = 1.04 W/kg

SAR(1 g) = 0.765 mW/g; SAR(10 g) = 0.539 mW/g

Maximum value of SAR (measured) = 0.819 mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4132CH Towards ground 15mm

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 826.4 MHz

Medium parameters used (interpolated): $f = 826.4$ MHz; $\sigma = 0.947$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.03, 6.03, 6.03); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM2; Type: SAM; Serial: TP-1474
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.838 mW/g

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

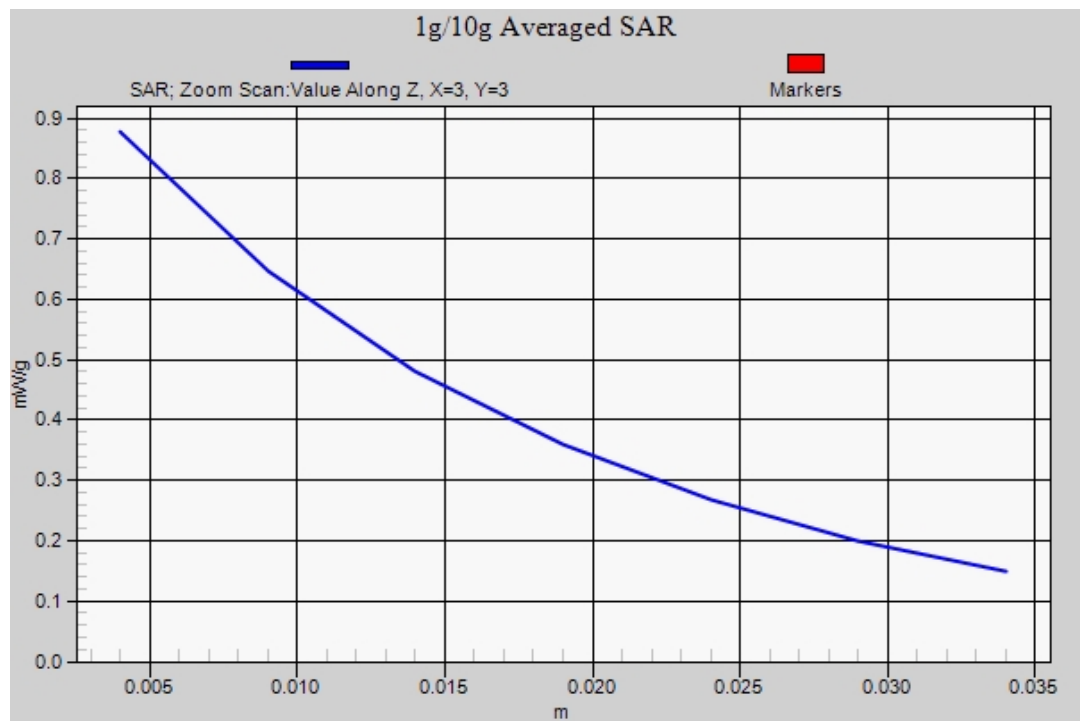
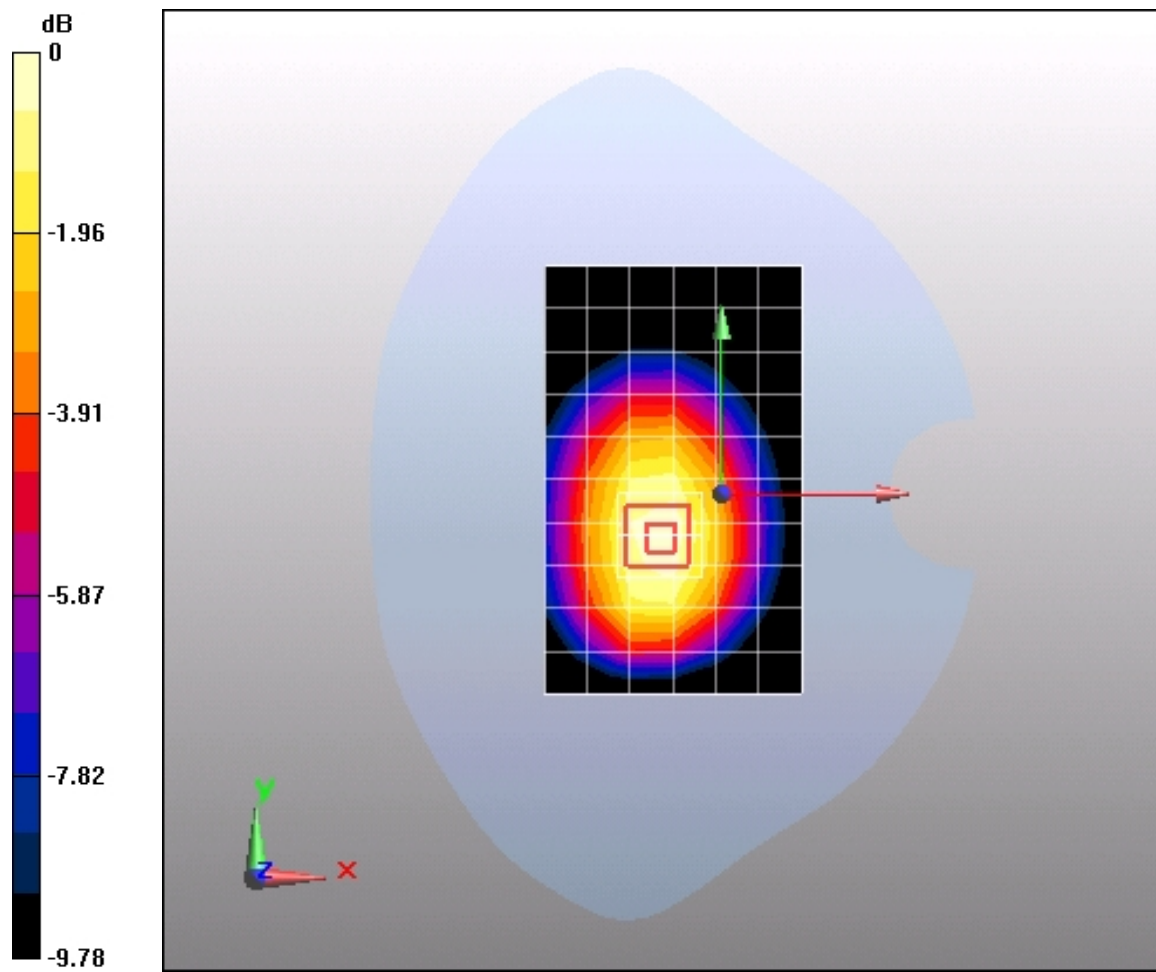
Reference Value = 28.3 V/m; Power Drift = 0.082 dB

Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.820 mW/g; SAR(10 g) = 0.583 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.877 mW/g



Test Laboratory: HUAWEI SAR Lab

U2800-8 WCDMA850 4132CH Towards ground 15mm with Headset

DUT: U2800-8; Type: Handset; Serial: 020YQH9M0C000040

Communication System: HW -UMTS-FDD; Frequency: 826.4 MHz

Medium parameters used (interpolated): $f = 826.4$ MHz; $\sigma = 0.947$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3254; ConvF(6.03, 6.03, 6.03); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1236; Calibrated: 10/26/2010
- Phantom: SAM2; Type: SAM; Serial: TP-1474
- Measurement SW: DASYS, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.450 mW/g

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

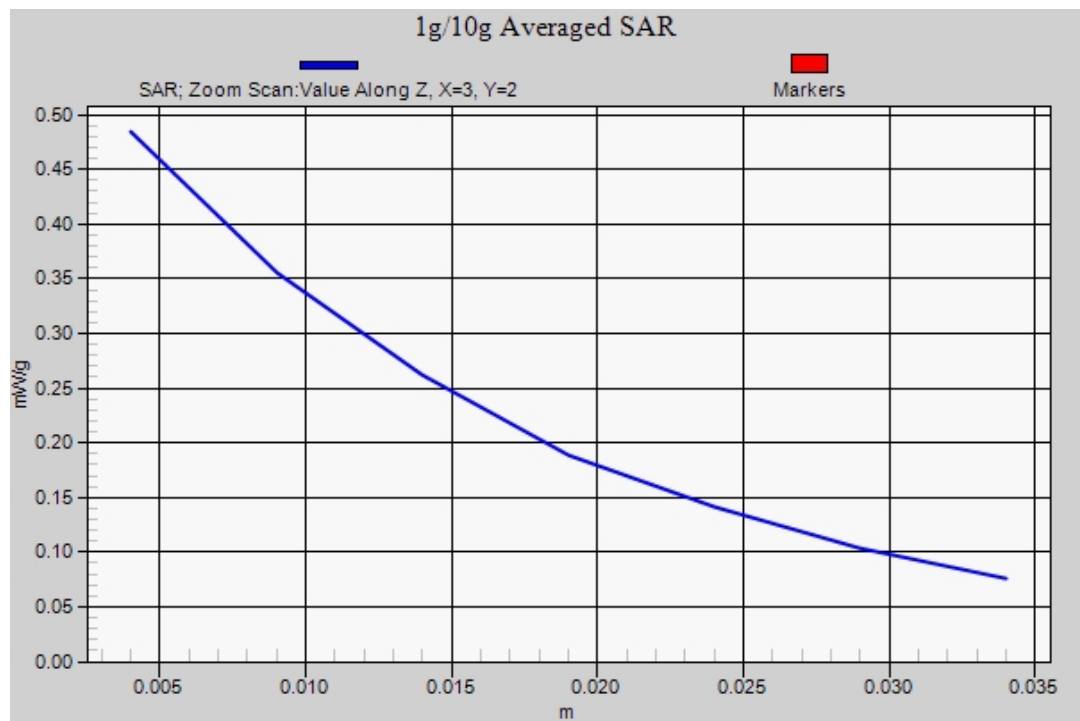
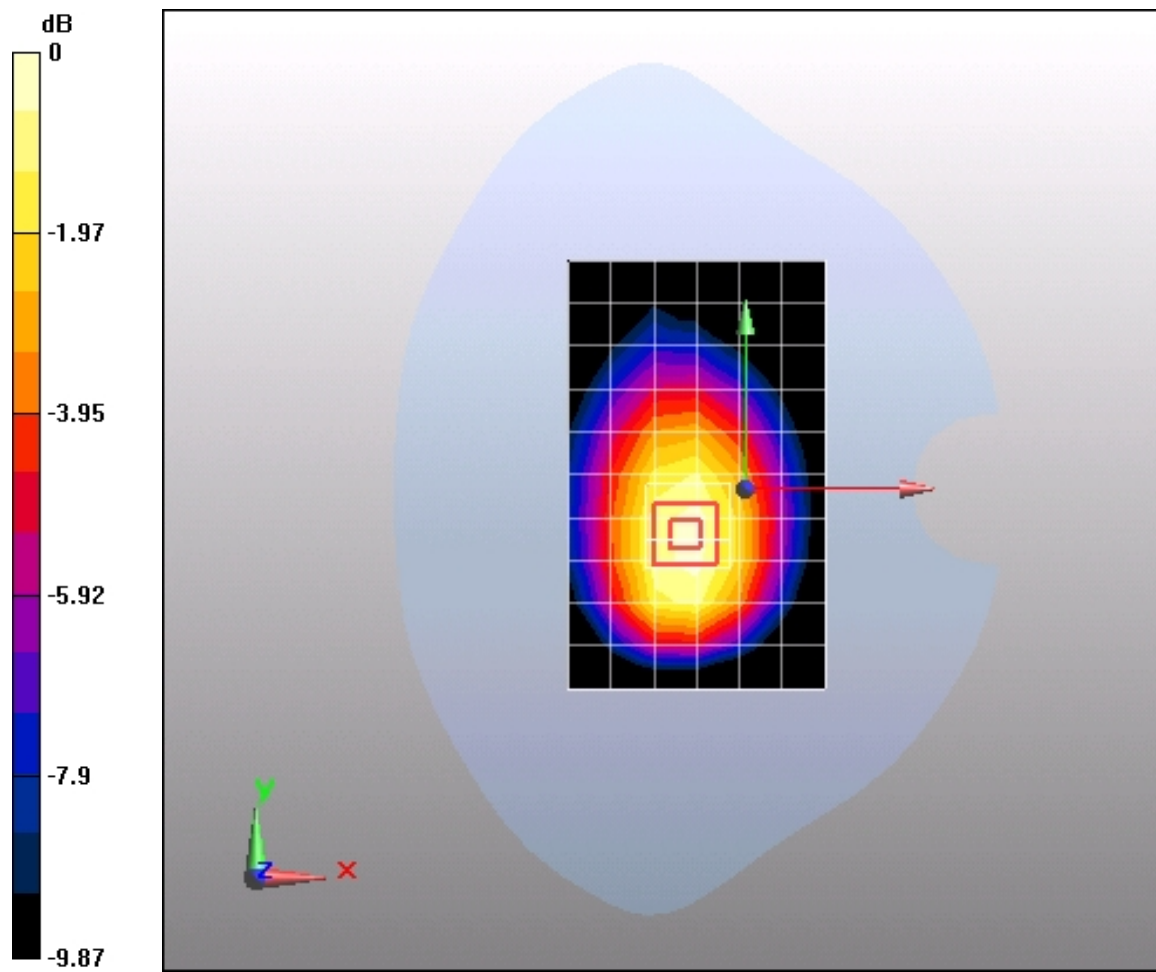
Reference Value = 20.6 V/m; Power Drift = 0.170 dB

Peak SAR (extrapolated) = 0.621 W/kg

SAR(1 g) = 0.455 mW/g; SAR(10 g) = 0.321 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.484 mW/g





Appendix C. Calibration Certificate

Calibration report "D900V2-SN1d112"

Calibration report "DAE4-SN1236"

Calibration report "Probe ES3DV3-SN3254"



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

Accreditation No.: SCS 108

Client **Huawei Shenzhen (Auden)**

Certificate No: **D900V2-1d112_Mar11**

CALIBRATION CERTIFICATE

Object **D900V2 - SN: 1d112**

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

Calibration date: **March 9, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: March 10, 2011

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

Measurement Conditions

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

DASY Version	DASY5	V52.6
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	900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.2 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.2 $\pm$ 6 %	0.94 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.75 mW / g
SAR normalized	normalized to 1W	11.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	11.2 mW /g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.76 mW / g
SAR normalized	normalized to 1W	7.04 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	7.13 mW /g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.7 ± 6 %	1.05 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	2.84 mW / g
SAR normalized	normalized to 1W	11.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	11.3 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.83 mW / g
SAR normalized	normalized to 1W	7.32 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	7.30 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.3 Ω - 6.0 j Ω
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 Ω - 8.3 j Ω
Return Loss	- 20.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.411 ns
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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	February 22, 2010

DASY5 Validation Report for Head TSL

Date/Time: 09.03.2011 15:53:14

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d112

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.95 \text{ mho/m}$; $\epsilon_r = 40.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.88, 5.88, 5.88); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Head/d=15mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

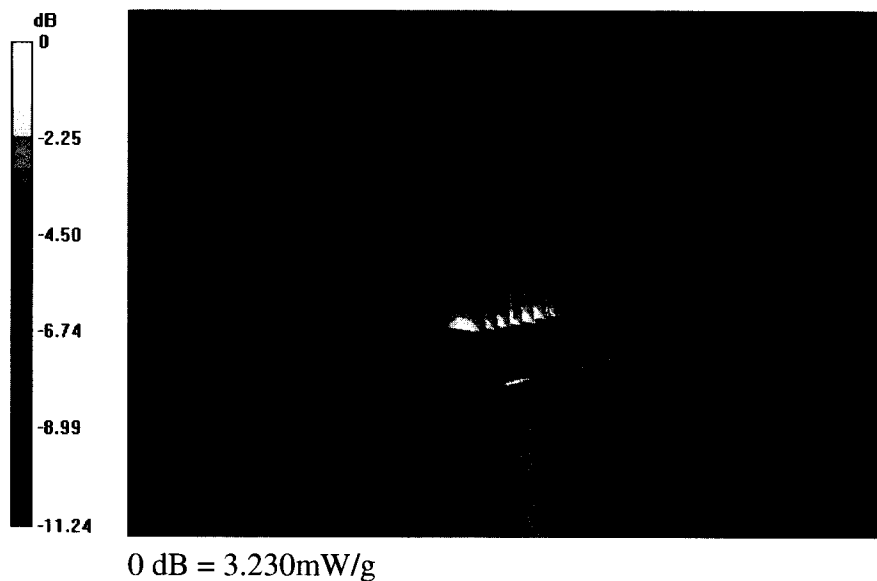
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 60.051 V/m; Power Drift = -0.0029 dB

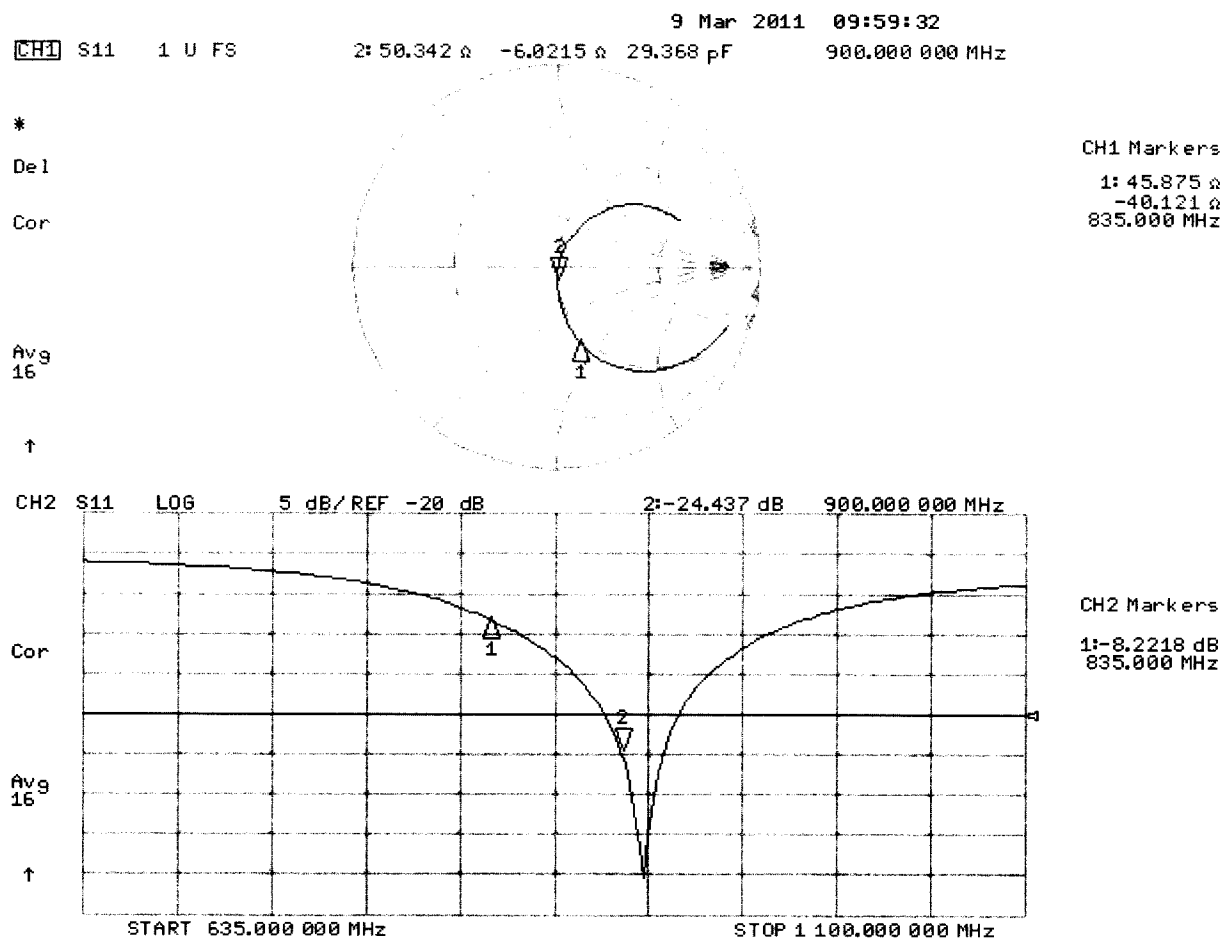
Peak SAR (extrapolated) = 4.164 W/kg

SAR(1 g) = 2.75 mW/g; SAR(10 g) = 1.76 mW/g

Maximum value of SAR (measured) = 3.230 mW/g



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 09.03.2011 11:47:22

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d112

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: M900

Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 1.05 \text{ mho/m}$; $\epsilon_r = 53.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.81, 5.81, 5.81); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Body/d=15mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

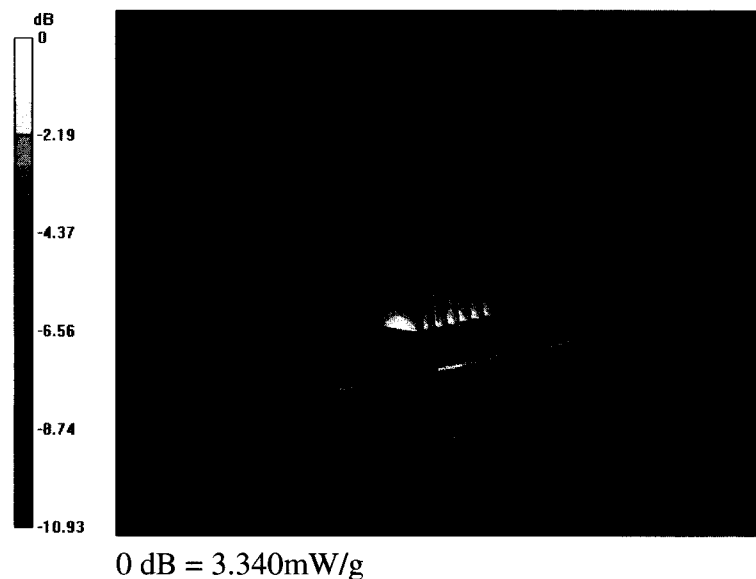
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 58.188 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 4.264 W/kg

SAR(1 g) = 2.84 mW/g; SAR(10 g) = 1.83 mW/g

Maximum value of SAR (measured) = 3.341 mW/g

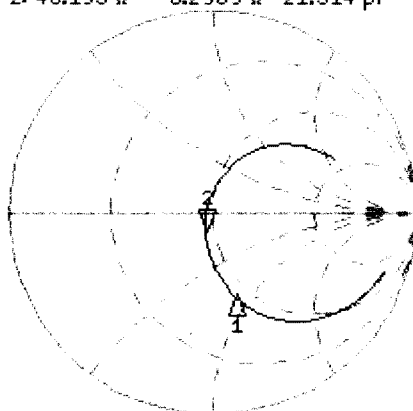


Impedance Measurement Plot for Body TSL

9 Mar 2011 10:31:18
 CH1 S11 1 U FS 2: 46.195 Ω -8.2969 Ω 21.314 pF 900.000 000 MHz

*
 Del
 Cor

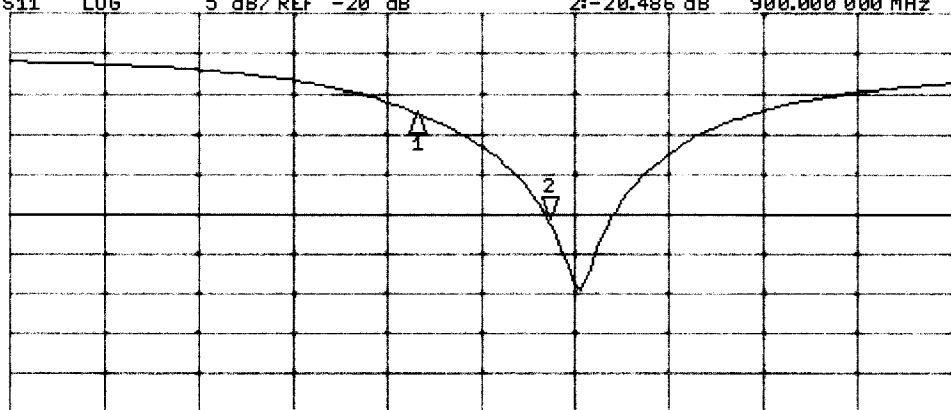
Avg
 16
 ↑



CH1 Markers
 1: 42.566 Ω
 -43.305 Ω
 835.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 2: -20.486 dB 900.000 000 MHz

Cor
 Avg
 16
 ↑



CH2 Markers
 1: -7.3323 dB
 835.000 MHz

START 635.000 000 MHz STOP 1 100.000 000 MHz

Calibration Report "DAE4-SN1236"

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Accreditation No.: SCS 108

Client Huawei SH (Auden)

Certificate No: DAE4-1236_Oct10

CALIBRATION CERTIFICATE

Object DAE4 - SD 000 D04 BJ - SN: 1236

Calibration procedure(s) QA CAL-06.v22
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: October 26, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0610278	28-Sep-10 (No: 10076)	Sep-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 008 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

Calibrated by:	Name Eric Hainfeld	Function Technician	Signature
Approved by:	Fin Bornholt	R&D Director	

Issued: October 26, 2010

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	404.985 $\pm$ 0.1% (k=2)	404.913 $\pm$ 0.1% (k=2)	405.914 $\pm$ 0.1% (k=2)
Low Range	3.98821 $\pm$ 0.7% (k=2)	3.96798 $\pm$ 0.7% (k=2)	4.00517 $\pm$ 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	136.0 $^{\circ}$ $\pm$ 1 $^{\circ}$
---	-------------------------------------

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199987.8	-5.07	-0.00
Channel X	+ Input	19999.45	-0.25	-0.00
Channel X	- Input	-19998.46	1.54	-0.01
Channel Y	+ Input	199997.8	-3.16	-0.00
Channel Y	+ Input	19996.97	-2.53	-0.01
Channel Y	- Input	-20000.89	-1.19	0.01
Channel Z	+ Input	200011.7	1.18	0.00
Channel Z	+ Input	19996.30	-3.10	-0.02
Channel Z	- Input	-20000.89	-1.19	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.1	0.05	0.00
Channel X	+ Input	200.81	0.71	0.35
Channel X	- Input	-199.97	-0.07	0.04
Channel Y	+ Input	2000.5	0.57	0.03
Channel Y	+ Input	199.61	-0.29	-0.15
Channel Y	- Input	-201.03	-1.03	0.52
Channel Z	+ Input	2001.1	1.19	0.06
Channel Z	+ Input	199.04	-0.86	-0.43
Channel Z	- Input	-200.59	-0.59	0.30

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	16.27	14.67
	- 200	-14.51	-15.98
Channel Y	200	-15.41	-15.97
	- 200	14.99	14.94
Channel Z	200	-14.10	-14.71
	- 200	12.74	12.83

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	-	2.01	1.24
Channel Y	200	-0.12	-	2.79
Channel Z	200	1.72	-0.74	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15748	17238
Channel Y	16003	17264
Channel Z	16296	16350

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	-0.08	-2.17	2.32	0.78
Channel Y	-0.81	-3.36	2.26	0.79
Channel Z	-0.94	-2.13	0.38	0.54

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <251A

7. Input Resistance (Typical values for information)

	Zeroing (k Ω m)	Measuring (M Ω m)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

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

9. Power Consumption (Typical values for information)

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

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Accreditation No.: SCS 108

Client Huawei Shenzhen (Auden)

Certificate No: ES3-3254_Mar11

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3254

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

Calibration date: March 11, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: March 16, 2011

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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
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- 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 affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 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:3254

Manufactured: June 29, 2009
Calibrated: March 11, 2011

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3254

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	1.31	1.35	1.34	± 10.1 %
DCP (mV) ^B	100.5	100.7	101.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	117.3	±2.2 %
			Y	0.00	0.00	1.00	115.3	
			Z	0.00	0.00	1.00	116.3	

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

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).
^B Numerical linearization parameter: uncertainty not required.
^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3254

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	6.01	6.01	6.01	1.00	1.00	± 12.0 %
900	41.5	0.97	5.92	5.92	5.92	1.00	1.13	± 12.0 %
1750	40.1	1.37	5.10	5.10	5.10	1.00	1.07	± 12.0 %
1900	40.0	1.40	4.96	4.96	4.96	0.91	1.15	± 12.0 %
2000	40.0	1.40	4.91	4.91	4.91	0.91	1.13	± 12.0 %
2600	39.0	1.96	4.25	4.25	4.25	0.82	1.24	± 12.0 %

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

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

DASY/EASY - Parameters of Probe: ES3DV3- SN:3254

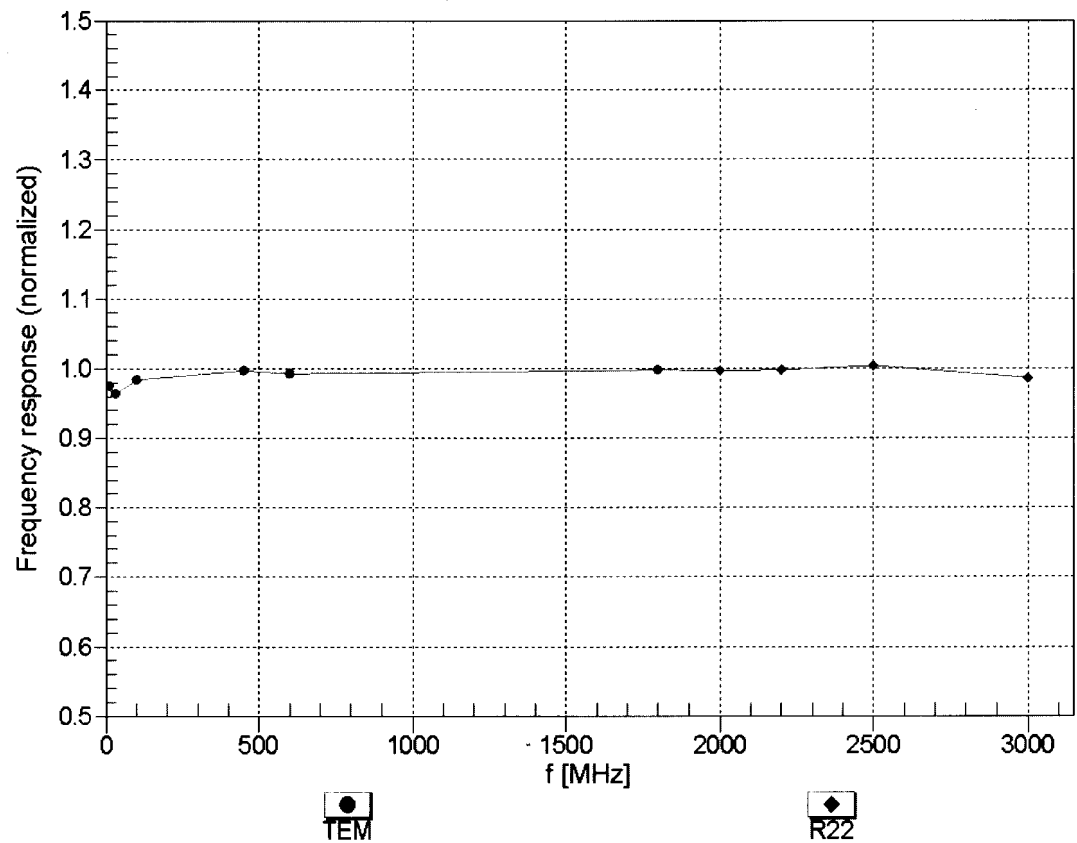
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.03	6.03	6.03	1.00	1.00	± 12.0 %
900	55.0	1.05	5.93	5.93	5.93	1.00	1.00	± 12.0 %
1750	53.4	1.49	4.91	4.91	4.91	0.99	1.23	± 12.0 %
1900	53.3	1.52	4.73	4.73	4.73	0.89	1.25	± 12.0 %
2000	53.3	1.52	4.71	4.71	4.71	0.81	1.34	± 12.0 %
2600	52.5	2.16	4.13	4.13	4.13	1.00	1.11	± 12.0 %

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

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

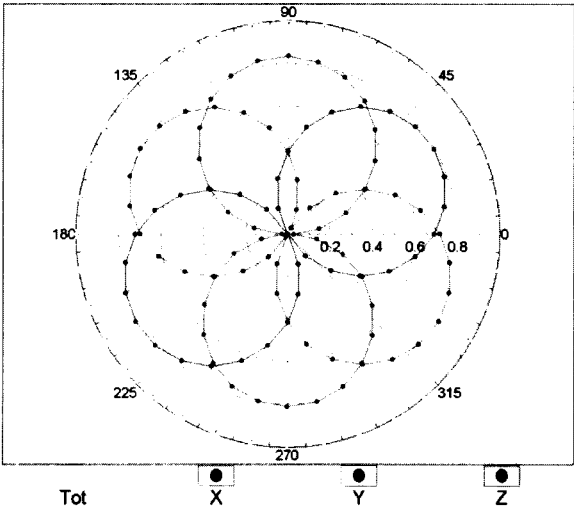
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



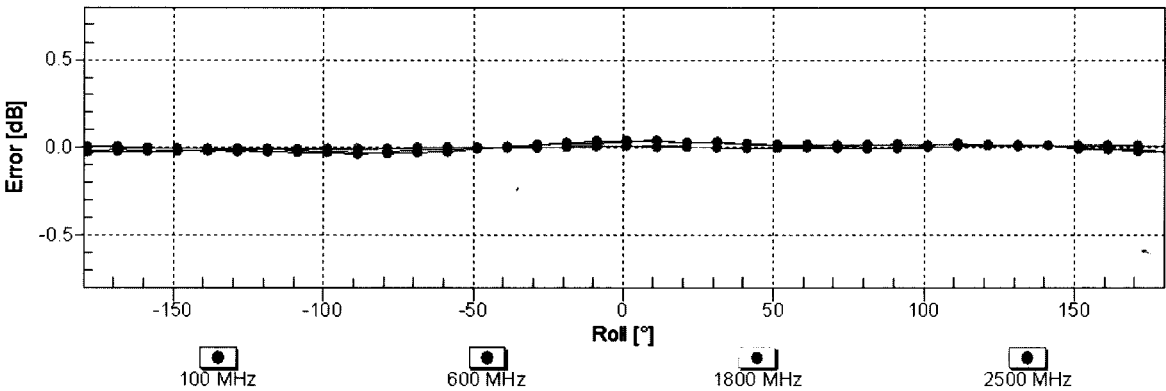
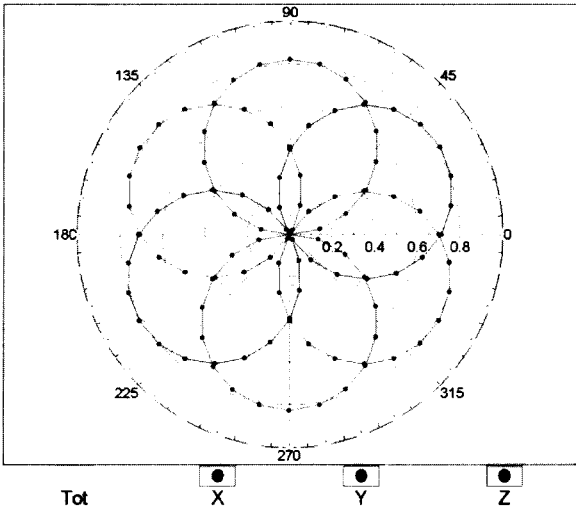
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz,TEM

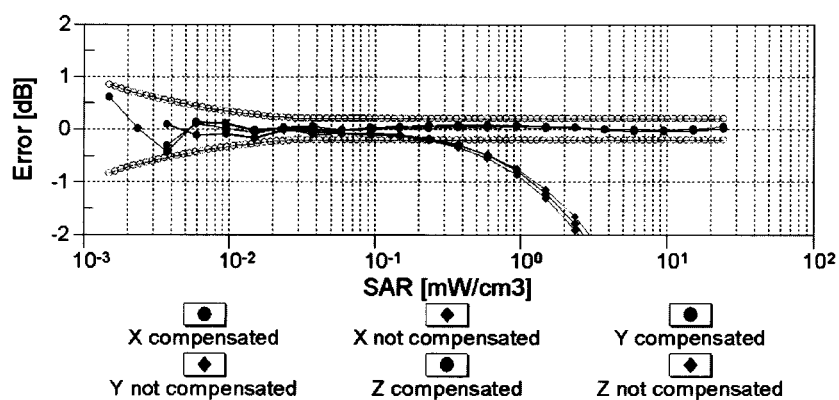
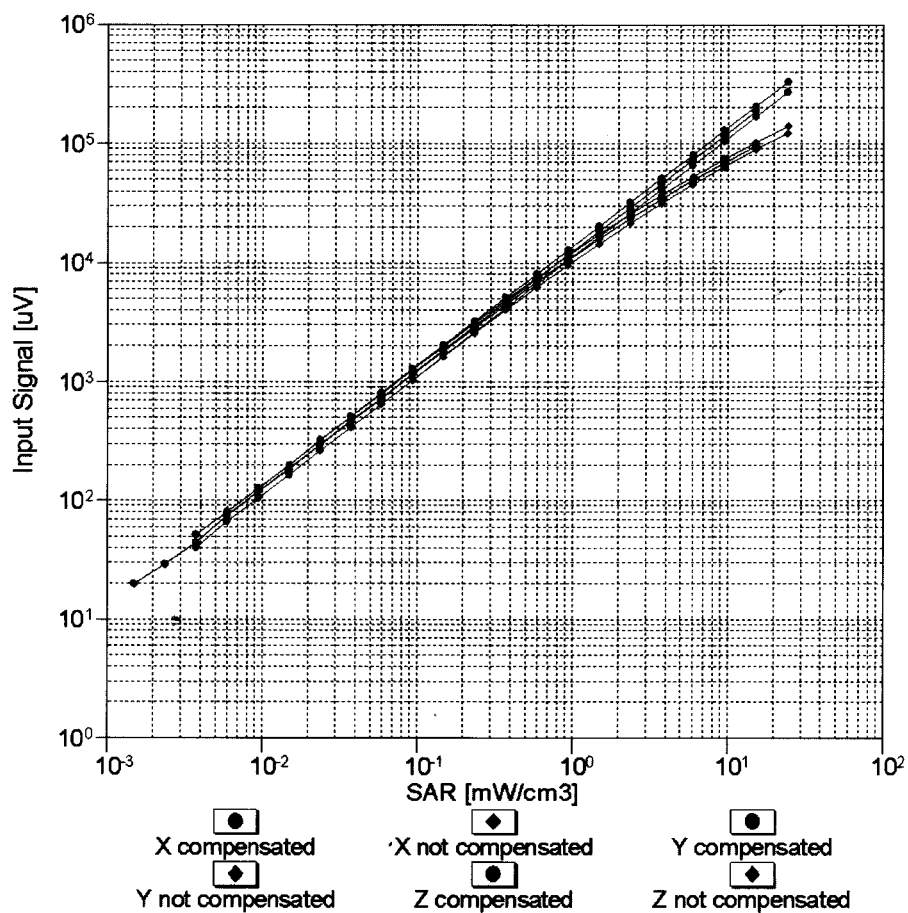


f=1800 MHz,R22



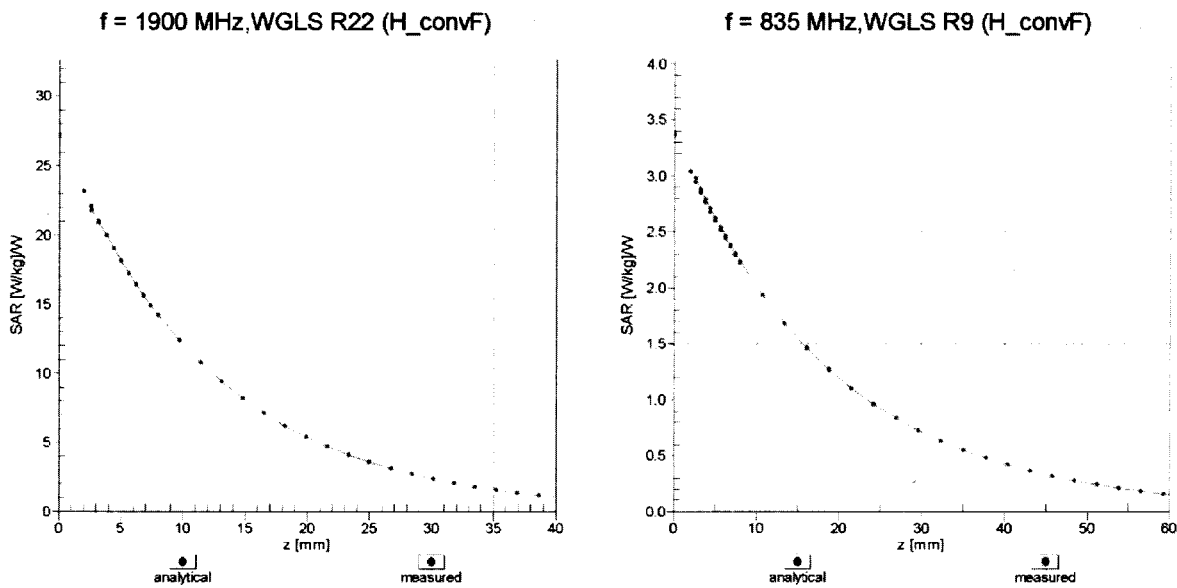
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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



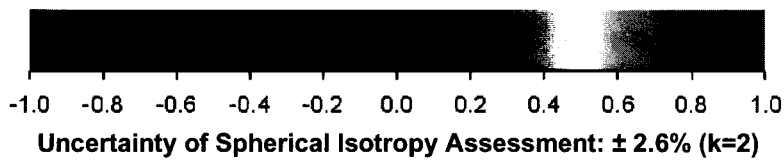
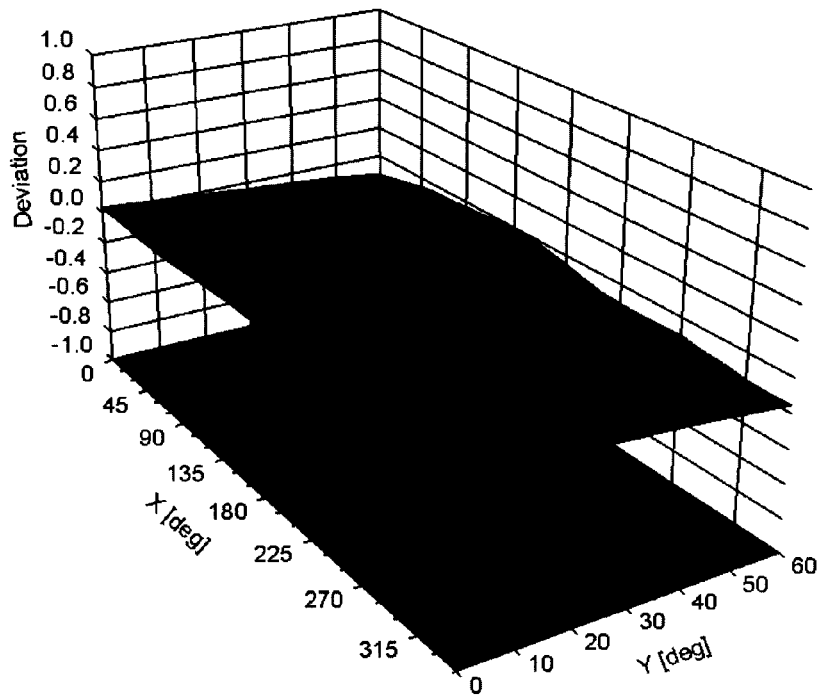
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3254

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm



Appendix D. Photo documentation

Test Facility

Test Positions

Liquid depth

Test Facility

Photo 1: Measurement System DASY 5



Test Positions

Photo 2: Front View



Photo 3: Rear View



Photo 4: Left Hand Touched



Photo 5: Left Hand Tilted 15°

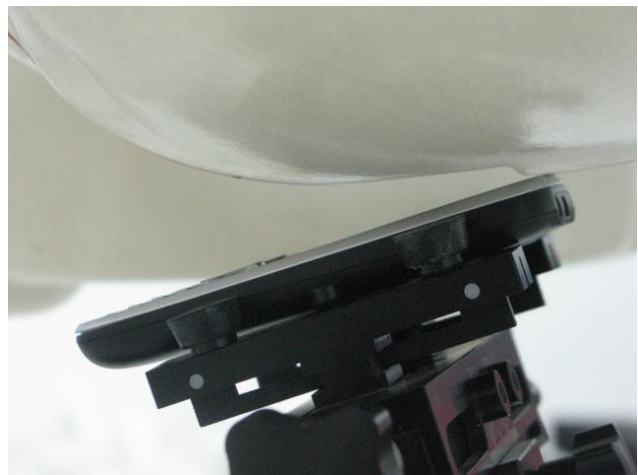


Photo 6: Right Hand Touched

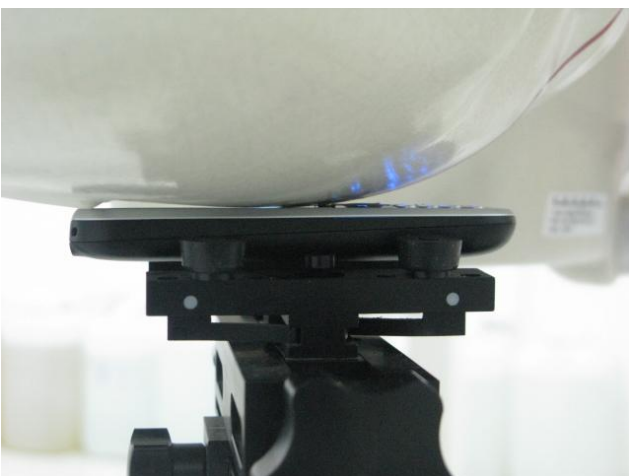


Photo 7: Right Hand Tilted 15°



Photo 8: Towards Phantom (15mm)



Photo 9: Towards Ground (15mm)



Liquid depth

Photo 10: HSL835MHz depth (15.00cm)

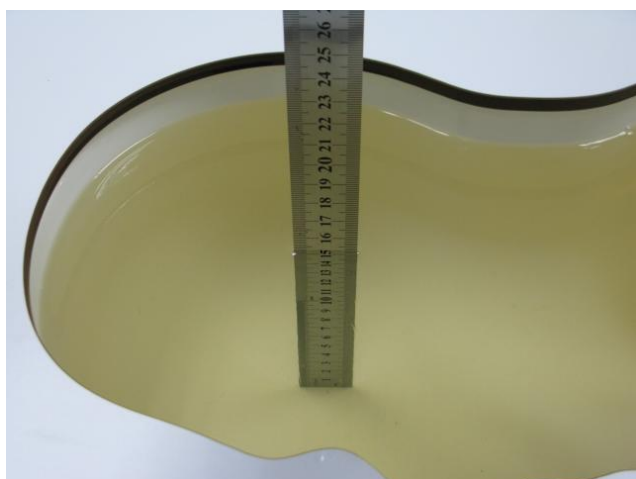


Photo 11: MSL835MHz depth (15.00cm)

