



No. DAT-P-114/01-01



No. L0442

TEST REPORT

No. 2006E00813

FCCID	QISE220
Test name	Electromagnetic Field (Specific Absorption Rate)
Product	HSDPA USB MODEM
Model	E220
Client	HUAWEI Technologies Co., Ltd.
Type of test	Non Type approval

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Product name	HSDPA USB MODEM	Sample Model	E220
Client	HUAWEI Technologies Co., Ltd.	Type of test	Non Type Approval
Factory	HUAWEI Technologies Co., Ltd.	Sampling arrival date	May 29 th , 2006
Manufacturer	HUAWEI Technologies Co., Ltd.		
Sampling/ Sending sample	Sending sample	Sample sent by	Fan Yong
Sampling location	/	Sampling person	/
Sample quantity	1	Sample matrix	/
Series number of the Sample	/		
Manufacture date	/	Manufacture location	China, Shenzhen
Test basis	<p>EN 50360-2001: Product standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones.</p> <p>EN 50361-2001: Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones.</p> <p>ANSI C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.</p> <p>IEEE 1528-2003: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques.</p> <p>IEC 62209-2 (Draft): Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30MHz to 6GHz Handheld and Body-Mounted Devices used in close proximity to the Body.</p> <p>OET Bulletin 65 (Edition 97-01) and Supplement C(Edition 01-01): Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits.</p>		
Test conclusion	<p>Localized Specific Absorption Rate (SAR) of this portable wireless equipment has been measured in all cases requested by the relevant standards cited in Clause 5.2 of this test report. Maximum localized SAR is below exposure limits specified in the relevant standards cited in Clause 5.1 of this test report.</p> <p>General Judgment:</p> <p align="right">Pass (Stamp) Date of issue: June 5th, 2006</p>		
Note	The test results relate only to the items tested of the sample(s).		

Approved by Lu Minniu (Lu Minniu) Reviewed by Wang Hongbo (Wang Hongbo) Tested by Qi Dianyuan (Qi Dianyuan)

Deputy Director of the laboratory

1 COMPETENCE AND WARRANTIES

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Telecommunication Metrology Center of Ministry of Information Industry guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at **Telecommunication Metrology Center of Ministry of Information Industry** at the time of execution of the test.

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3 DESCRIPTION OF EUT

3.1 Addressing Information Related to EUT

Table 1: Applicant (The Client)

Name or Company	HUAWEI Technologies Co., Ltd.
Address/Post	Bantian, Longgang District, Shenzhen, Guangdong
City	Shenzhen
Postal Code	518129
Country	China
Telephone	0755-28780808
Fax	0755-28780808

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Table 2: Manufacturer

Name or Company	HUAWEI Technologies Co., Ltd.
Address/Post	Bantian, Longgang District, Shenzhen, Guangdong
City	Shenzhen
Postal Code	518129
Country	China
Telephone	0755-28780808
Fax	0755-28780808

3.2 Constituents of EUT

Table 3: Constituents of Samples

Description	Model	Serial Number	Manufacturer
HSDPA USB MODEM	E220	\	HUAWEI Technologies Co., Ltd.



Picture 1-a: Front side of the datacard



Picture 1-b: Back Side of the datacard

Picture 1: Constituents of the sample

3.3 General Description

Equipment Under Test (EUT) is an HSDPA USB modem with integrated antenna. SAR is tested PCS 1900MHz. The modem has GPRS function, and its GPRS class is 10.

The sample under test was selected by the Client.

Components list please refer to documents of the manufacturer.

4 OPERATIONAL CONDITIONS DURING TEST

4.1 Schematic Test Configuration

A communication link is set up with a System Simulator (SS) by air link, and a call is established. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 512, 661 and 810 respectively in the case of PCS 1900 MHz. The EUT is commanded to operate at maximum transmitting power.

Since the EUT only has the data transfer function, but does not have the speech transfer function, the tests in the band of PCS 1900MHz are only performed in the mode of GPRS and EGPRS.

The EUT shall use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the manufacturer. If a wireless link is used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the handset by at least 30 dB.

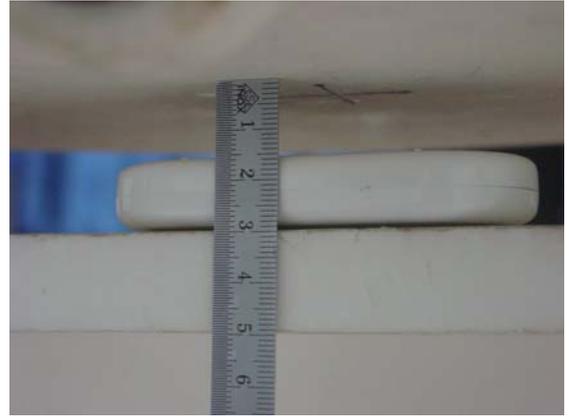
According to the "2 dB rule" specified in the OET Bulletin 65 (Edition 97-01) and Supplement C(Edition 01-01), "**If the SAR measured at the middle channel for each test configuration (left, right, Cheek/Touch, Tile/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s)**". Test channels have been set first to the middle and then to low and high if necessary.

For each channel, the EUT is tested at the following 5 test positions:

- Test Position 1: The front side of the EUT is directed to the bottom of the flat phantom. The separation distance is 1.5cm between the surface of the front side of the EUT and the bottom of the flat phantom. (Picture 2-a)
- Test Position 2: The back side of the EUT is directed to the bottom of the flat phantom. The separation distance is 1.5cm between the surface of the back side of the EUT and the bottom of the flat phantom. (Picture 2-b)
- Test Position 3: The right side of the EUT is directed to and tightly touched the bottom of the flat phantom. (Picture 2-c)
- Test Position 4: The left side of the EUT is directed to and tightly touched the bottom of the flat phantom. (Picture 2-d)
- Test Position 5: The bottom side of the EUT is directed to and tightly touched the bottom of the flat phantom. (Picture 2-e)



Picture 2-a: Test position 1



Picture 2-b: Test position 2



Picture 2-c: Test position 3



Picture 2-d: Test position 4



Picture 2-e: Test position 5

During the test, an IBM laptop is used as an assistant to help to setup communication, whose type is IBM X40 . (See Picture 3)



Picture 3-a: Close



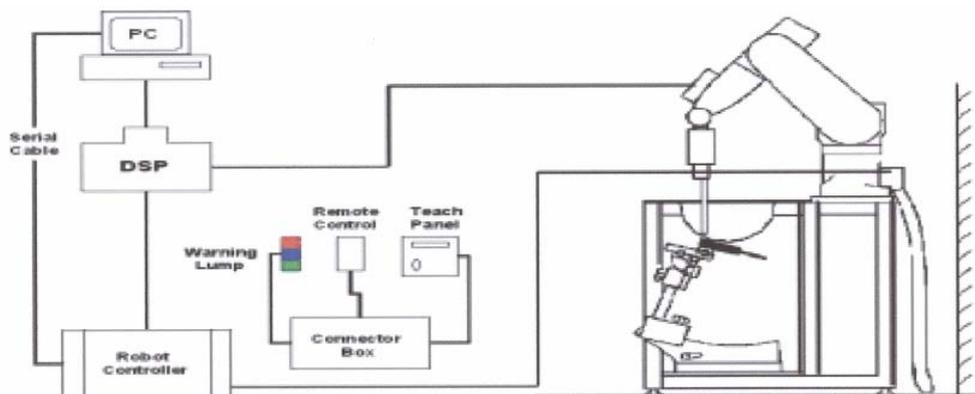
Picture 3-b: Open

Picture 3: IBM laptop as a test assistant

4.2 SAR Measurement Set-up

These measurements were performed with the automated near-field scanning system DASY4 Professional 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, teaches pendant (Joystick), and remote control, is used to drive the robot motors. The PC consists of the Micron Pentium III 800 MHz computer with Windows 2000 system and SAR Measurement Software DASY4 (version 4.7), A/D interface card, monitor, mouse, and keyboard. The Stäubli 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 coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.



Picture 4: SAR Lab Test Measurement Set-up

The DAE consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and

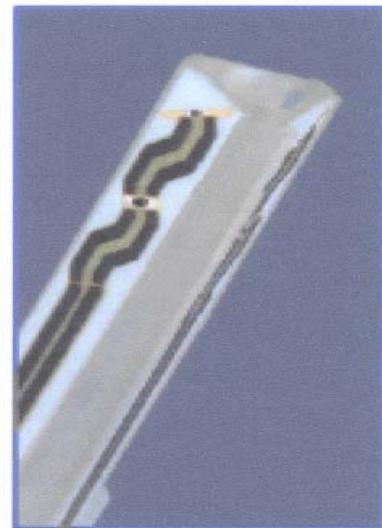
control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

4.3 Dasy4 E-field Probe System

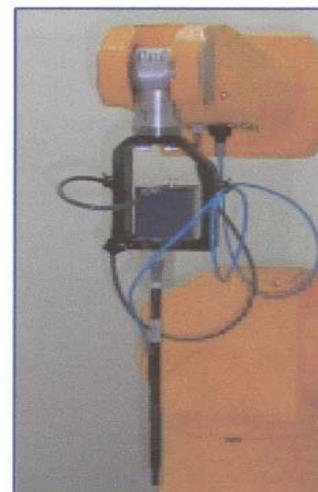
The SAR measurements were conducted with the dosimetric probe ET3DV6 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the standard procedure with an accuracy of better than $\pm 10\%$. The spherical isotropy was evaluated and found to be better than $\pm 0.25\text{dB}$.

ET3DV6 Probe Specification

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection System(ET3DV6 only) Built-in shielding against static charges PEEK enclosure material(resistant to organic solvents, e.q., glycol)
Calibration	In air from 10 MHz to 2.5 GHz In brain and muscle simulating tissue at frequencies of 450MHz, 900MHz and 1.8GHz (accuracy $\pm 8\%$) Calibration for other liquids and frequencies upon request
Frequency	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic Range	5 μ W/g to > 100mW/g; Linearity: $\pm 0.2\text{dB}$
Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surface(ET3DV6 only)
Dimensions	Overall length: 330mm Tip length: 16mm Body diameter: 12mm Tip diameter: 6.8mm Distance from probe tip to dipole centers: 2.7mm
Application	General dosimetry up to 3GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms



Picture 5: ET3DV6 E-field Probe



Picture 6: ET3DV6 E-field

4.4 E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy was evaluated and found to be better than $\pm 0.25\text{dB}$. The sensitivity parameters (NormX, NormY, 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 1 GHz, and in a wave guide above 1 GHz 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 (brain or muscle),

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).

Note: Please see Annex E to check the probe calibration certificate.



Picture 7: Device Holder

4.5 Other Test Equipment

4.5.1 Device Holder for Transmitters

In combination with the Generic Twin Phantom V3.0, 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 repeatably positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

4.5.2 Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. 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 the

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 in the robot.

Shell Thickness 2±0.1 mm
 Filling Volume Approx. 20 liters
 Dimensions 810 x 1000 x 500 mm (H x L x W)
 Available Special



Picture 8: Generic Twin Phantom

4.6 Equivalent Tissues

The liquid used for the frequency range of 800-2000 MHz consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table 4 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528.

Table 4. Composition of the Body Tissue Equivalent Matter

MIXTURE %	FREQUENCY 1900MHz		
Water	69.91		
Glycol monobutyl	29.96		
Salt	0.13		
Dielectric Parameters Target Value	f=1900MHz	ε=53.3	σ=1.52

4.7 System Specifications

4.7.1 Robotic System Specifications

Specifications

Positioner: Stäubli Unimation Corp. Robot Model: RX90L

Repeatability: ±0.02 mm

No. of Axis: 6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor: Pentium III

Clock Speed: 800 MHz

Operating System: Windows 2000

Data Converter

Features: Signal Amplifier, multiplexer, A/D converter, and control logic

Software: DASY4 software

Connecting Lines: Optical downlink for data and status info.

Optical uplink for commands and clock

5 CHARACTERISTICS OF THE TEST

5.1 Applicable Limit Regulations

EN 50360–2001: Product standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones.

It specifies the maximum exposure limit of **2.0 W/kg** as averaged over any 10 gram of tissue for portable devices being used within 20 mm of the user in the uncontrolled environment.

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

It specifies the maximum exposure limit of **1.6 W/kg** as averaged over any 1 gram of tissue for portable devices being used within 20 mm of the user in the uncontrolled environment.

5.2 Applicable Measurement Standards

EN 50361–2001: Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones.

IEEE 1528–2003: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques.

IEC 62209-2 (Draft): Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30MHz to 6GHz Handheld and Body-Mounted Devices used in close proximity to the body.

OET Bulletin 65 (Edition 97-01) and Supplement C (Edition 01-01): Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits.

They specify the measurement method for demonstration of compliance with the SAR limits for such equipments.

6 LABORATORY ENVIRONMENT

Table 5: The Ambient Conditions during EMF Test

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

7 CONDUCTED OUTPUT POWER MEASUREMENT

7.1 Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMU-200) to ensure the maximum power transmission and proper modulation. This result contains conducted output power and ERP for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

7.2 Conducted Power

7.2.1 Measurement Methods

The EUT was set up for the maximum output power. The channel power was measured with Agilent Spectrum Analyzer E4440A. These measurements were done at 3 channels, 512, 661 and 810 before SAR test and after SAR test in the GPRS and EGPRS modes

7.2.2 Measurement result

Table 6: Conducted Power Measurement Results

	Conducted Power		
	Channel 512 (1850.2MHz)	Channel 661 (1880MHz)	Channel 810 (1909.8MHz)
GPRS			
Before Test (dBm)	30.84	30.49	30.59
After Test (dBm)	30.76	30.52	30.54
EGPRS			
Before Test (dBm)	26.21	26.18	26.13
After Test (dBm)	26.17	26.23	26.09

7.2.3 Power Drift

To control the output power stability during the SAR test, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Table 9 and Table 10 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

8 TEST RESULTS

8.1 Dielectric Performance

Table 7: Dielectric Performance of Body Tissue Simulating Liquid

Measurement is made at temperature 22.5 °C and relative humidity 49%.			
Liquid temperature during the test: 21.4°C			
/	Frequency	Permittivity ϵ	Conductivity σ (S/m)
Target value	1900MHz	53.3	1.52
Measurement value (Average of 10 tests)	1900MHz	55.85	1.55

8.2 System Validation

Table 8: System Validation

Measurement is made at temperature 23.3 °C, relative humidity 47%, input power 250 mW. Liquid temperature during the test: 22.5°C							
Liquid parameters		Frequency		Permittivity ϵ		Conductivity σ (S/m)	
		1900 MHz		40.27		1.45	
Verification results	Frequency	Target value (W/kg)		Measurement value (W/kg)			
		10 g Average	1 g Average	10 g Average	1 g Average		
	1900 MHz	5.125	9.925	5.27	9.91		

Note: Target Values used are one fourth of those in IEEE Std 1528-2003 (feeding power is normalized to 1 Watt), i.e. 250 mW is used as feeding power to the validation dipole (SPEAG using).

8.3 Summary of Measurement Results (PCS 1900-GPRS)

Table 9: SAR Values (PCS 1900-GPRS)

Limit of SAR (W/kg)	10 g Average	1 g Average	Power Drift (dB)
	2.0	1.6	
Test Case	Measurement Result (W/kg)		
	10 g Average	1 g Average	
Flat Phantom, Test Position 1, Mid frequency (See Figure 1)	0.074	0.112	-0.111
Flat Phantom, Test Position 2, Mid frequency (See Figure 3)	0.048	0.075	0.057
Flat Phantom, Test Position 3, Mid frequency (See Figure 5)	0.298	0.588	-0.028
Flat Phantom, Test Position 4, Mid frequency (See Figure 7)	0.301	0.582	0.017
Flat Phantom, Test Position 5, Mid frequency (See Figure 9)	0.101	0.206	-0.200

8.4 Summary of Measurement Results (PCS 1900-EGPRS)

Table 10: SAR Values (PCS 1900-EGPRS)

Limit of SAR (W/kg)	10 g Average	1 g Average	Power Drift (dB)
	2.0	1.6	
Test Case	Measurement Result (W/kg)		
	10 g Average	1 g Average	
Flat Phantom, Test Position 1, Mid frequency (See Figure 11)	0.042	0.064	-0.200
Flat Phantom, Test Position 2, Mid frequency (See Figure 13)	0.028	0.044	-0.173
Flat Phantom, Test Position 3, Mid frequency (See Figure 15)	0.150	0.292	0.051
Flat Phantom, Test Position 4, Mid frequency (See Figure 17)	0.153	0.295	0.043
Flat Phantom, Test Position 5, Mid frequency (See Figure 19)	0.050	0.101	-0.034

8.5 Conclusion

Localized Specific Absorption Rate (SAR) of this portable wireless device has been measured in all cases requested by the relevant standards cited in Clause 5.2 of this report. Maximum localized SAR is below exposure limits specified in the relevant standards cited in Clause 5.1 of this test report.

9 Measurement Uncertainty

SN	a	Type	c	d	e = f(d,k)	f	h = c x f / e	k
	Uncertainty Component		Tol. (± %)	Prob. Dist.	Div.	c _i (1 g)	1 g u _i (±%)	v _i
1	System repetivity	A	0.5	N	1	1	0.5	9
Measurement System								
2	Probe Calibration	B	5	N	2	1	2.5	∞
3	Axial Isotropy	B	4.7	R	√3	(1-cp) ^{1/2}	4.3	∞
4	Hemispherical Isotropy	B	9.4	R	√3	√c _p		
5	Boundary Effect	B	0.4	R	√3	1	0.23	∞
6	Linearity	B	4.7	R	√3	1	2.7	∞
7	System Detection Limits	B	1.0	R	√3	1	0.6	∞
8	Readout Electronics	B	1.0	N	1	1	1.0	∞
9	RF Ambient Conditions	B	3.0	R	√3	1	1.73	∞
10	Probe Positioner Mechanical Tolerance	B	0.4	R	√3	1	0.2	∞

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11	Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	∞
12	Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	∞
Test sample Related								
13	Test Sample Positioning	A	4.9	N	1	1	4.9	N-1
14	Device Holder Uncertainty	A	6.1	N	1	1	6.1	N-1
15	Output Power Variation - SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.9	∞
Phantom and Tissue Parameters								
16	Phantom Uncertainty (shape and thickness tolerances)	B	1.0	R	$\sqrt{3}$	1	0.6	∞
17	Liquid Conductivity - deviation from target values	B	5.0	R	$\sqrt{3}$	0.64	1.7	∞
18	Liquid Conductivity - measurement uncertainty	B	5.0	N	1	0.64	1.7	M
19	Liquid Permittivity - deviation from target values	B	5.0	R	$\sqrt{3}$	0.6	1.7	∞
20	Liquid Permittivity - measurement uncertainty	B	5.0	N	1	0.6	1.7	M
Combined Standard Uncertainty					RSS		11.25	
Expanded Uncertainty (95% CONFIDENCE INTERVAL)					K=2		22.5	

10 MAIN TEST INSTRUMENTS

Table 11: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	HP 8753E	US38433212	August 29,2005	One year
02	Dielectric Probe Kit	Agilent 85070C	US99360113	No Calibration Requested	
03	Power meter	NRVD	101253	June 20, 2005	One year
04	Power sensor	NRV-Z5	100333		
05	Power sensor	NRV-Z6	100011	September 3, 2005	One year
06	Signal Generator	E4433B	US37230472	September 5, 2005	One Year
07	Amplifier	VTL5400	0505	No Calibration Requested	
08	BTS	CMU 200	105948	August 15, 2005	One year
09	E-field Probe	SPEAG ET3DV6	1736	November 25, 2005	One year
10	DAE	SPEAG DAE3	536	July 11, 2005	One year

11 TEST PERIOD

The test is performed from June 1st, 2006 to June 3rd, 2006.

12 TEST LOCATION

The test is performed at Radio Communication & Electromagnetic Compatibility Laboratory of Telecommunication Metrology Center of Ministry of Information Industry of The People's Republic of China

END OF REPORT BODY

ANNEX A: MEASUREMENT PROCESS

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the reference point was measured and was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of the phantom was measured at a distance of 3.9 mm from the inner surface of the shell. The area covered the entire dimension of the flat phantom and the horizontal grid spacing was 10 mm x 10 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point, a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7 x 7x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

a. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axis. This polynomial was then used to evaluate the points between the surface and the probe tip.

b. The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot"-condition (in x ~ y and z-directions). The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation is repeated.

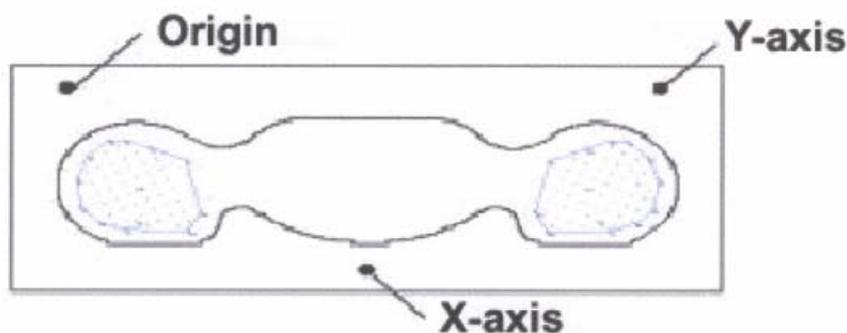


Figure A: SAR Measurement Points in Area Scan

ANNEX B: TEST LAYOUT



Picture B1: Specific Absorption Rate Test Layout



Picture B2 Liquid depth in the Flat Phantom (PCS 1900MHz)

ANNEX C: GRAPH RESULTS

1900 GPRS Test Position 1

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 1/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.124 mW/g

Test Position 1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm

Reference Value = 8.91 V/m; Power Drift = -0.111 dB

Peak SAR (extrapolated) = 0.186 W/kg

SAR(1 g) = 0.112 mW/g; SAR(10 g) = 0.074 mW/g

Maximum value of SAR (measured) = 0.118 mW/g

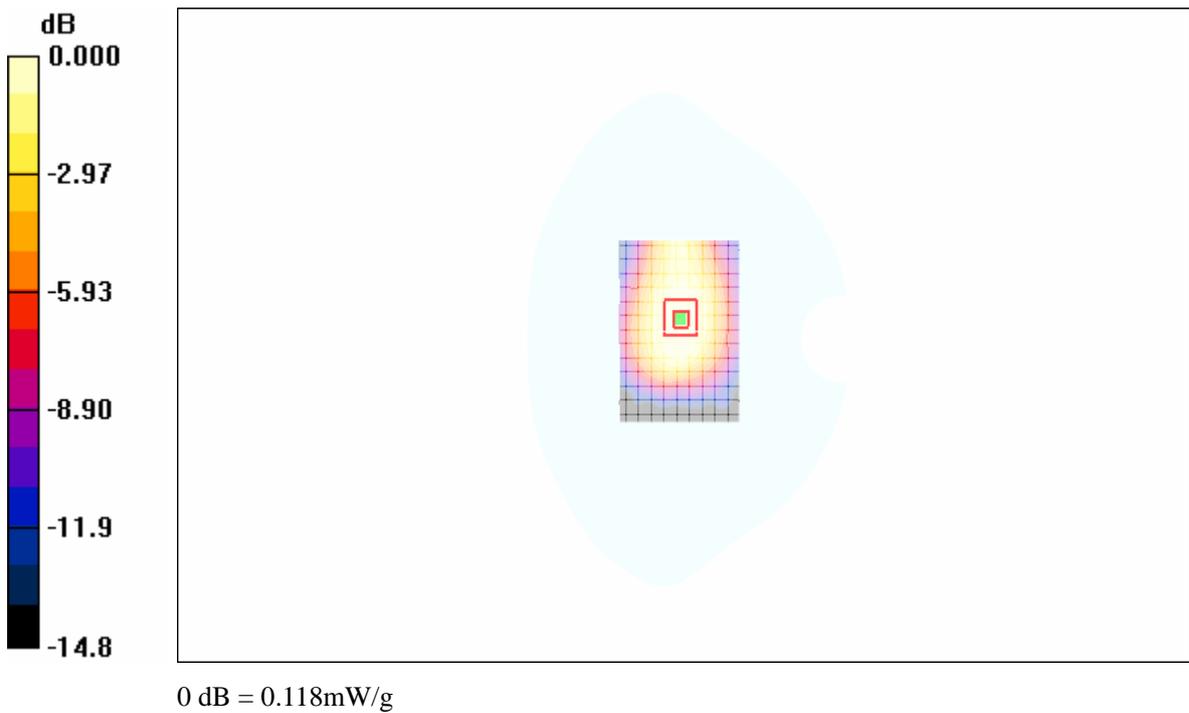


Fig. 1 PCS 1900 GPRS CH661 Test Position 1

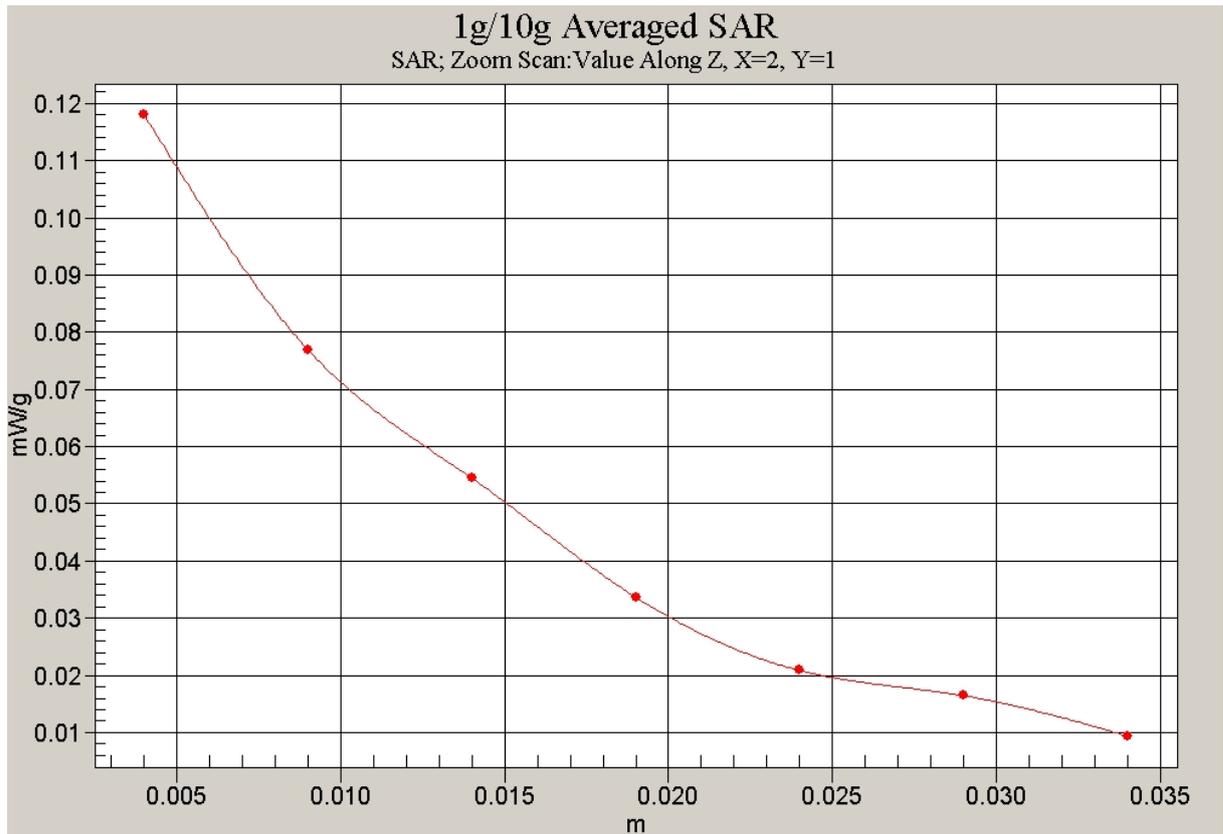


Fig.2 Z-Scan at power reference point (PCS 1900 GPRS CH661 Test Position 1)

1900 GPRS Test Position 2

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 2/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.080 mW/g

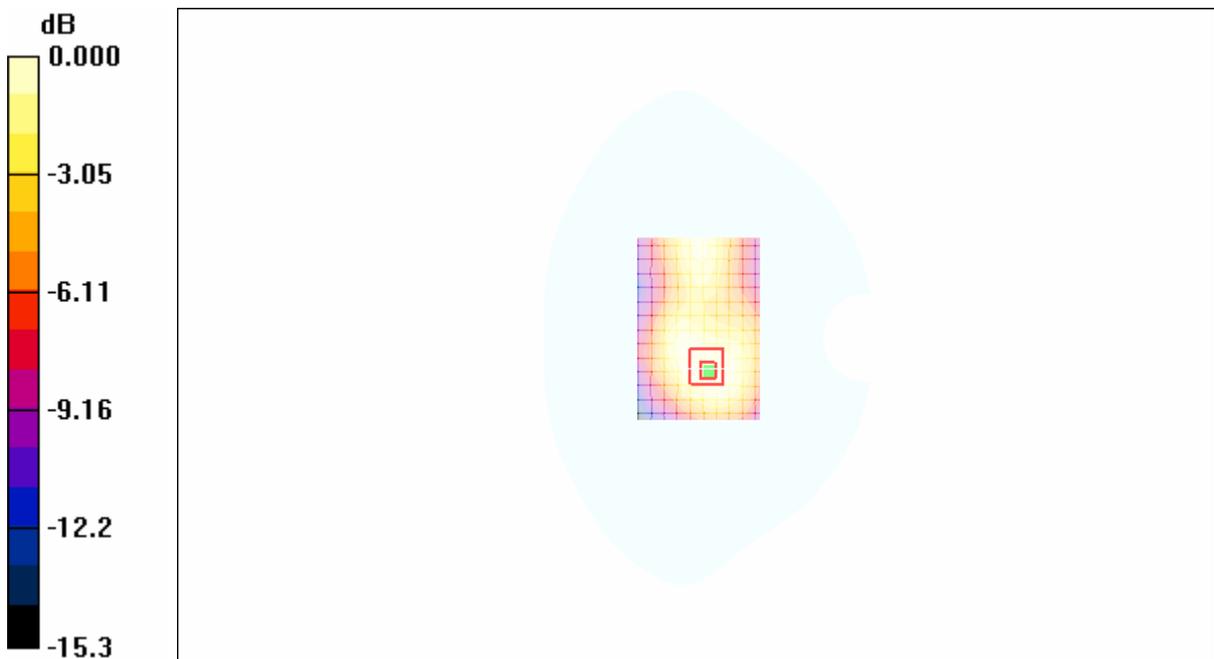
Test Position 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.09 V/m; Power Drift = 0.057 dB

Peak SAR (extrapolated) = 0.126 W/kg

SAR(1 g) = 0.075 mW/g; SAR(10 g) = 0.048 mW/g

Maximum value of SAR (measured) = 0.079 mW/g



0 dB = 0.079mW/g

Fig.3 PCS 1900 GPRS CH661 Test Position 2

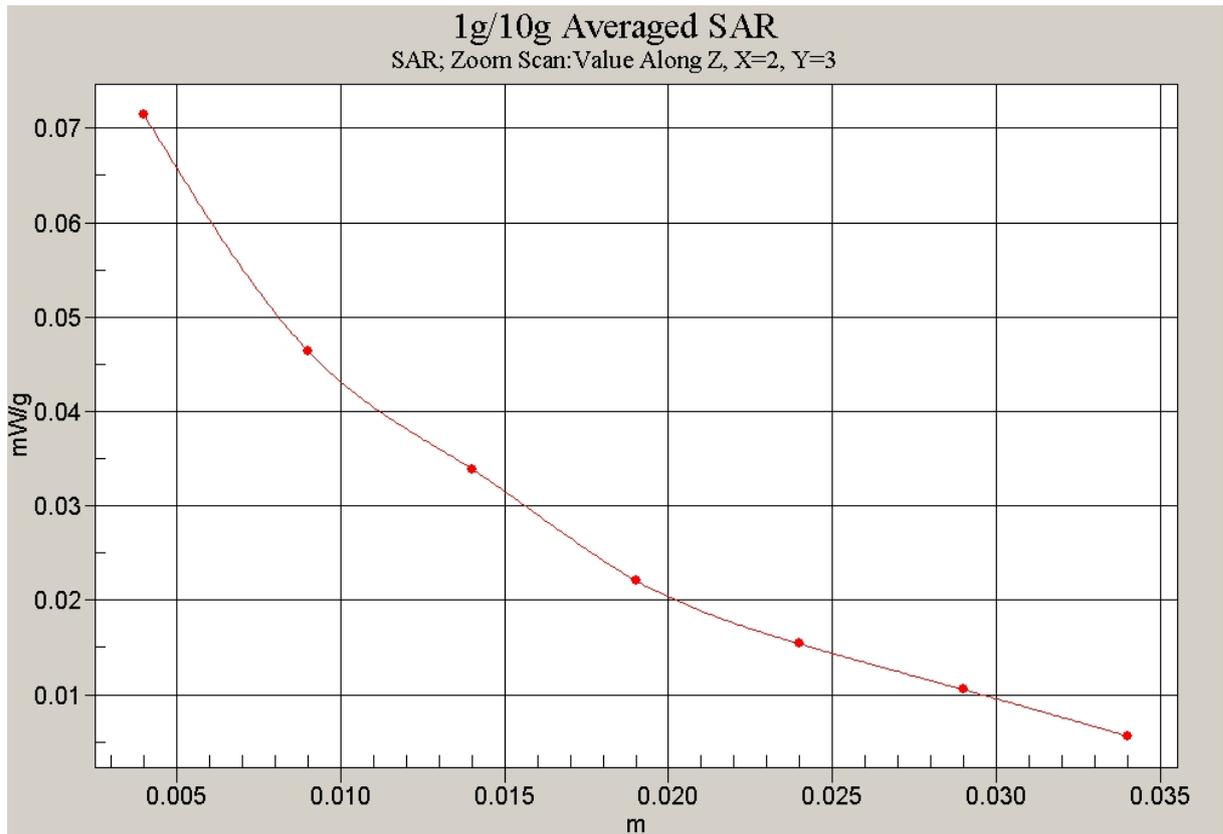


Fig.4 Z-Scan at power reference point (PCS 1900 GPRS CH661 Test Position 2)

1900 GPRS Test Position 3

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 3/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.676 mW/g

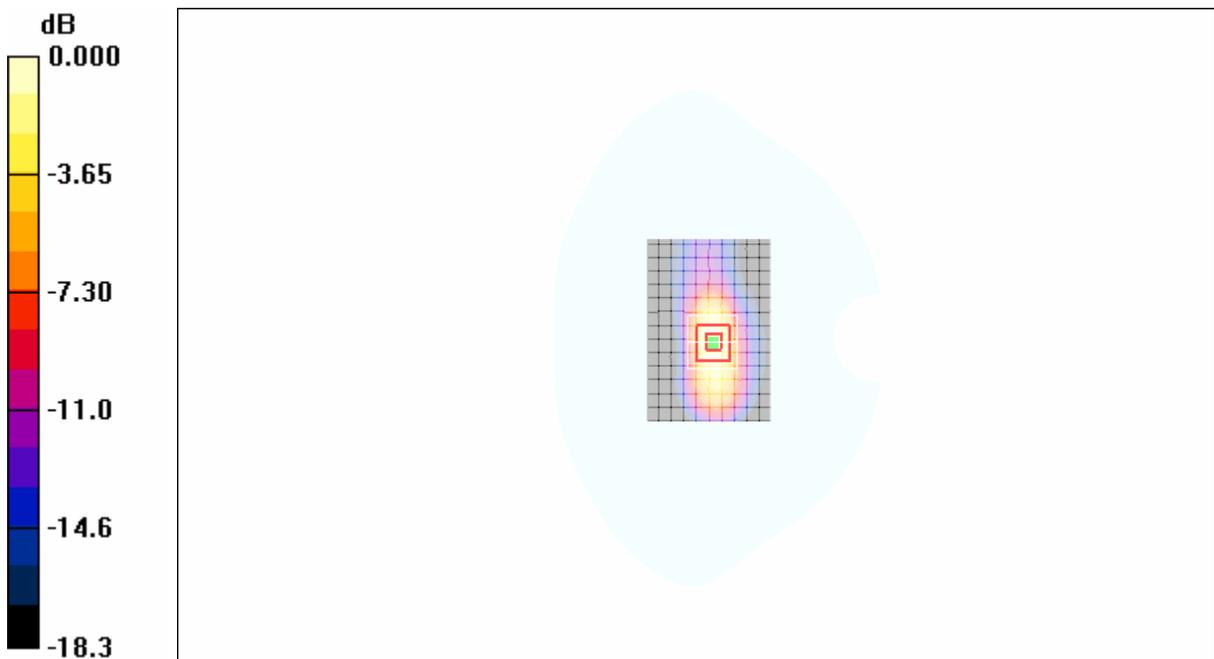
Test Position 3/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm

Reference Value = 21.1 V/m; Power Drift = -0.028 dB

Peak SAR (extrapolated) = 1.11 W/kg

SAR(1 g) = 0.588 mW/g; SAR(10 g) = 0.298 mW/g

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



0 dB = 0.673mW/g

Fig.5 PCS 1900 GPRS CH661 Test Position 3

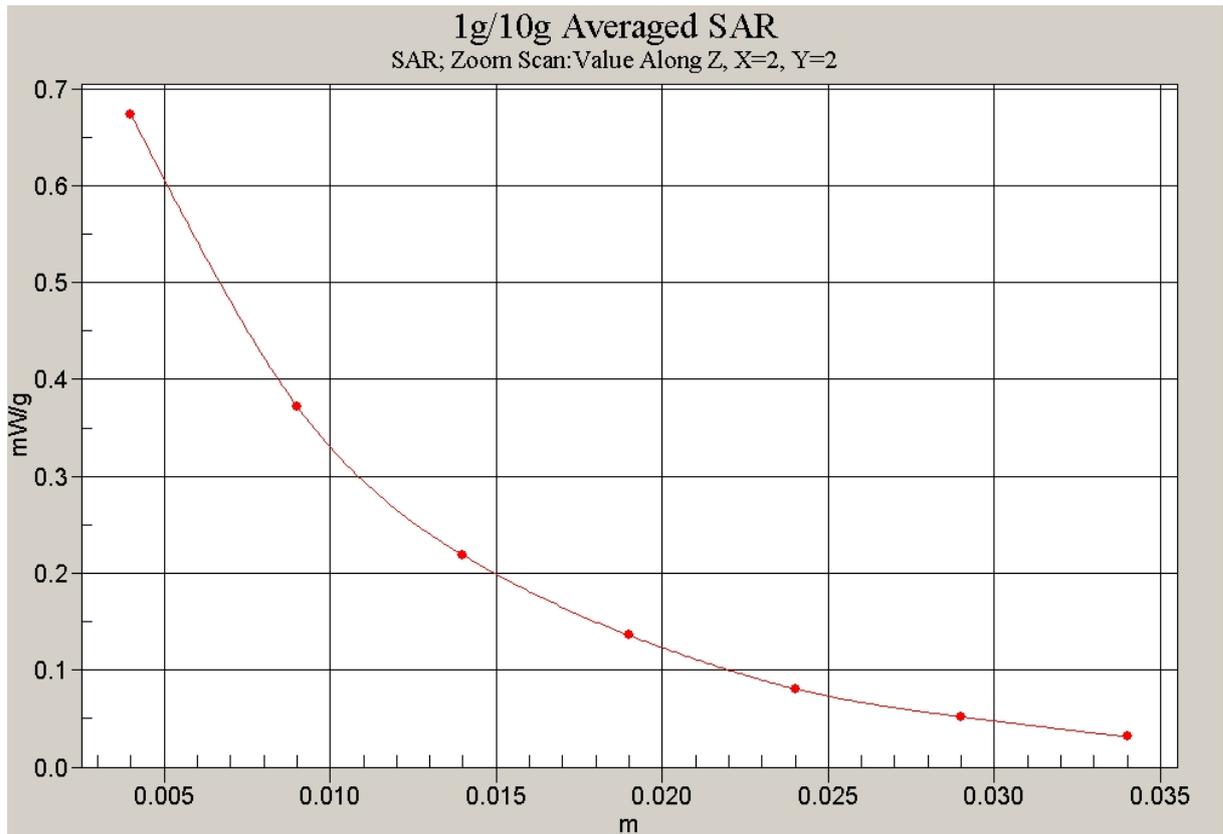


Fig.6 Z-Scan at power reference point (PCS 1900 GPRS CH661 Test Position 3)

1900 GPRS Test Position 4

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 4/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.699 mW/g

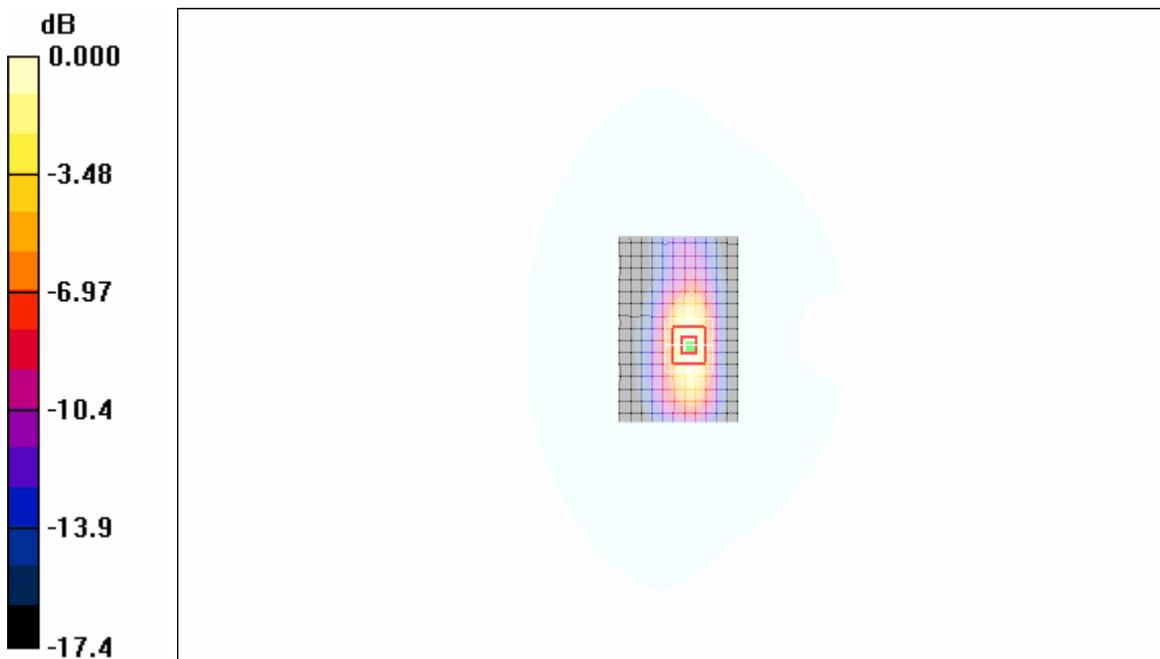
Test Position 4/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm

Reference Value = 20.8 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.582 mW/g; SAR(10 g) = 0.301 mW/g

Maximum value of SAR (measured) = 0.661 mW/g



0 dB = 0.661mW/g

Fig.7 PCS 1900 GPRS CH661 Test Position 4

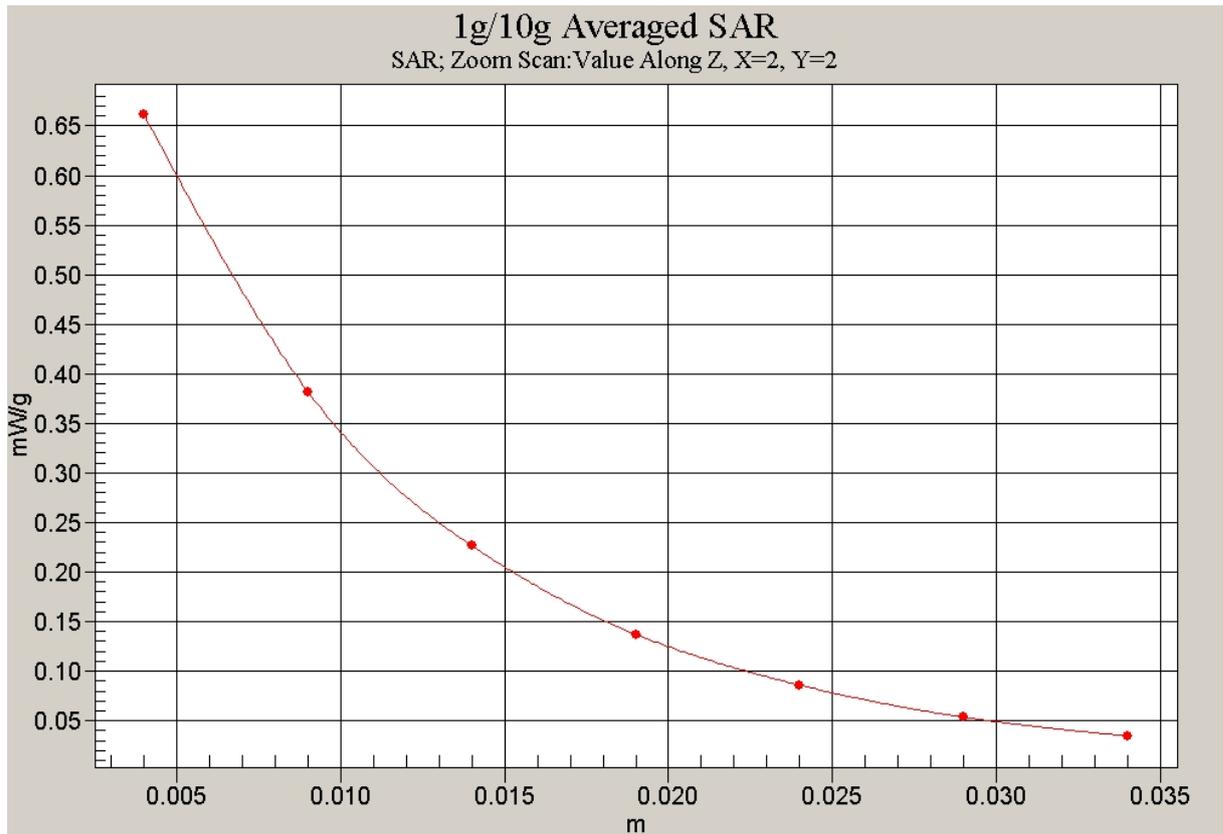


Fig.8 Z-Scan at power reference point (PCS 1900 GPRS CH661 Test Position 4)

1900 GPRS Test Position 5

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 5/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.254 mW/g

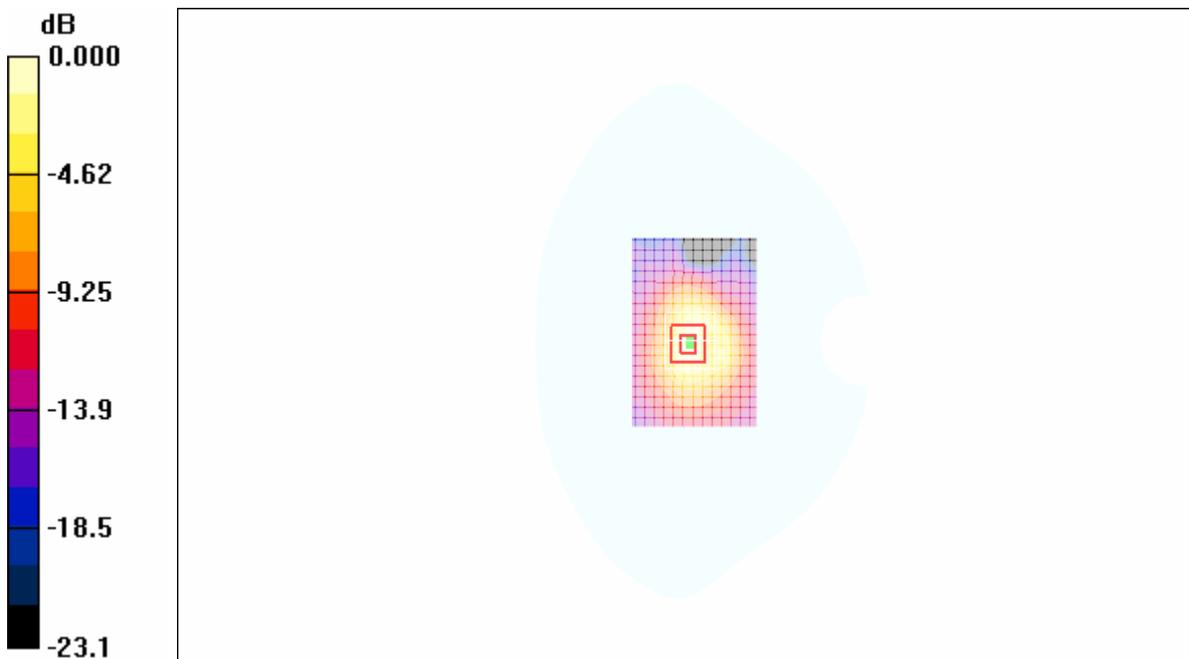
Test Position 5/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.90 V/m; Power Drift = -0.200 dB

Peak SAR (extrapolated) = 0.446 W/kg

SAR(1 g) = 0.206 mW/g; SAR(10 g) = 0.101 mW/g

Maximum value of SAR (measured) = 0.246 mW/g



0 dB = 0.246mW/g

Fig.9 PCS 1900 GPRS CH661 Test Position 5

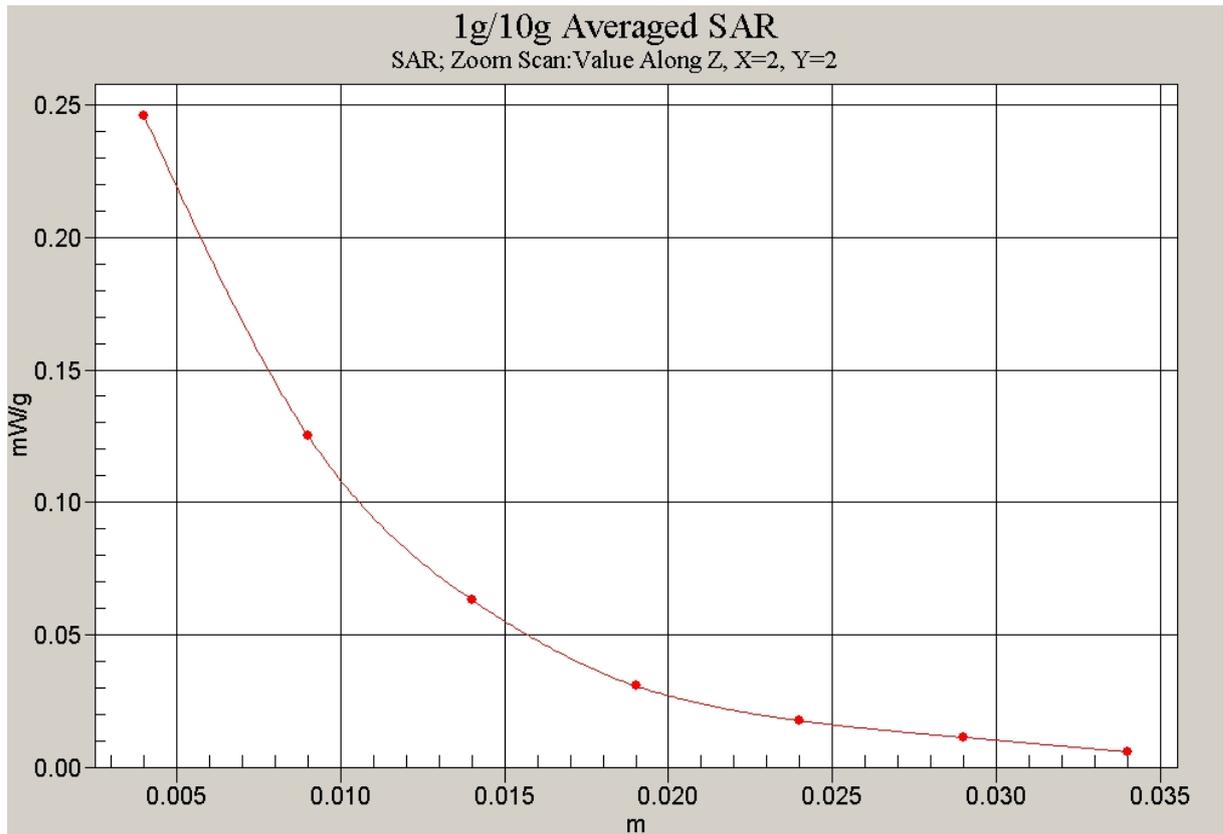


Fig.10 Z-Scan at power reference point (PCS 1900 GPRS CH661 Test Position 5)

1900 EGPRS Test Position 1

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 1/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.073 mW/g

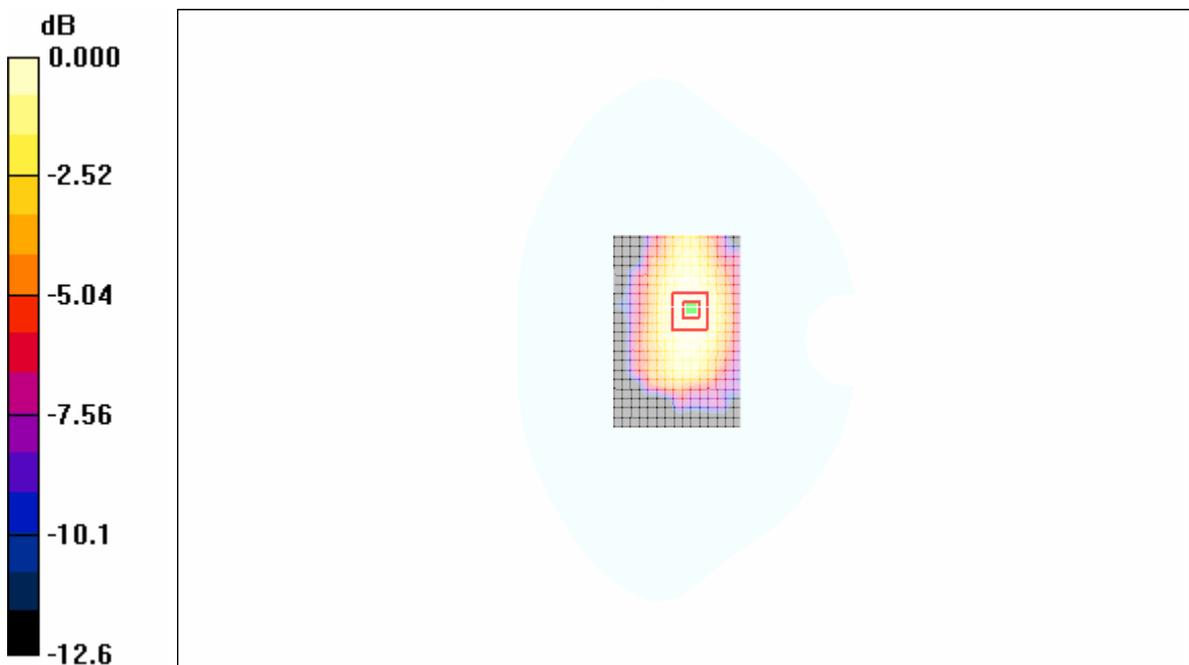
Test Position 1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm

Reference Value = 6.58 V/m; Power Drift = -0.200 dB

Peak SAR (extrapolated) = 0.096 W/kg

SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.042 mW/g

Maximum value of SAR (measured) = 0.069 mW/g



0 dB = 0.069mW/g

Fig. 11 PCS 1900 EGPRS CH661 Test Position 1

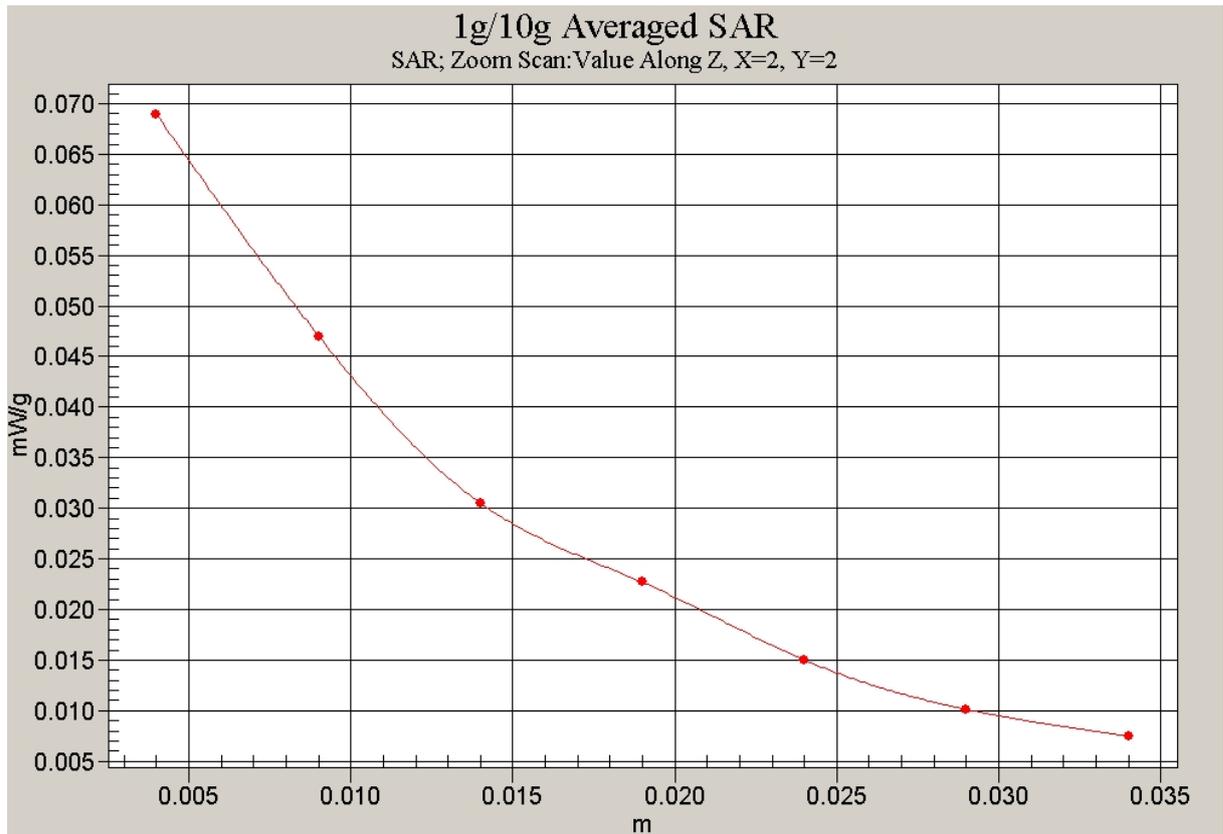


Fig.12 Z-Scan at power reference point (PCS 1900 EGPRS CH661 Test Position 1)

1900 EGPRS Test Position 2

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 2/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.050 mW/g

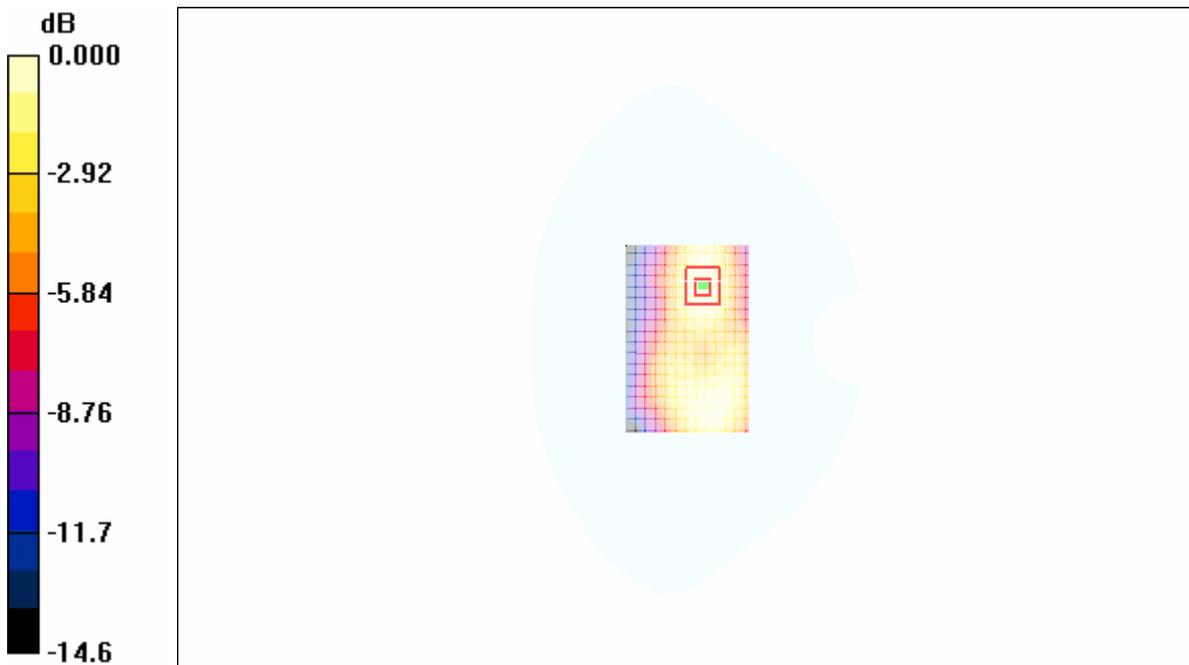
Test Position 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm

Reference Value = 3.94 V/m; Power Drift = -0.173 dB

Peak SAR (extrapolated) = 0.073 W/kg

SAR(1 g) = 0.044 mW/g; SAR(10 g) = 0.028 mW/g

Maximum value of SAR (measured) = 0.048 mW/g



0 dB = 0.048mW/g

Fig. 13 PCS 1900 EGPRS CH661 Test Position 2

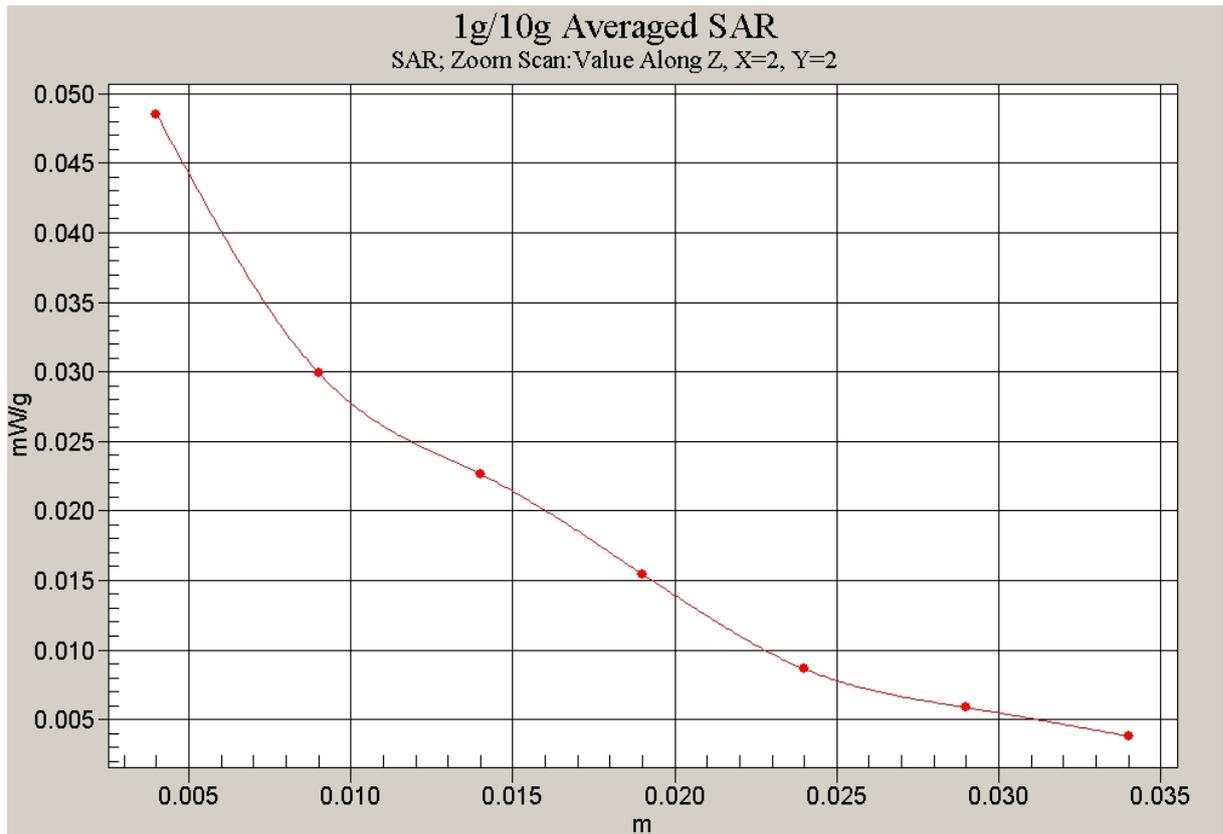


Fig.14 Z-Scan at power reference point (PCS 1900 EGPRS CH661 Test Position 2)

1900 EGPRS Test Position 3

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 3/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.330 mW/g

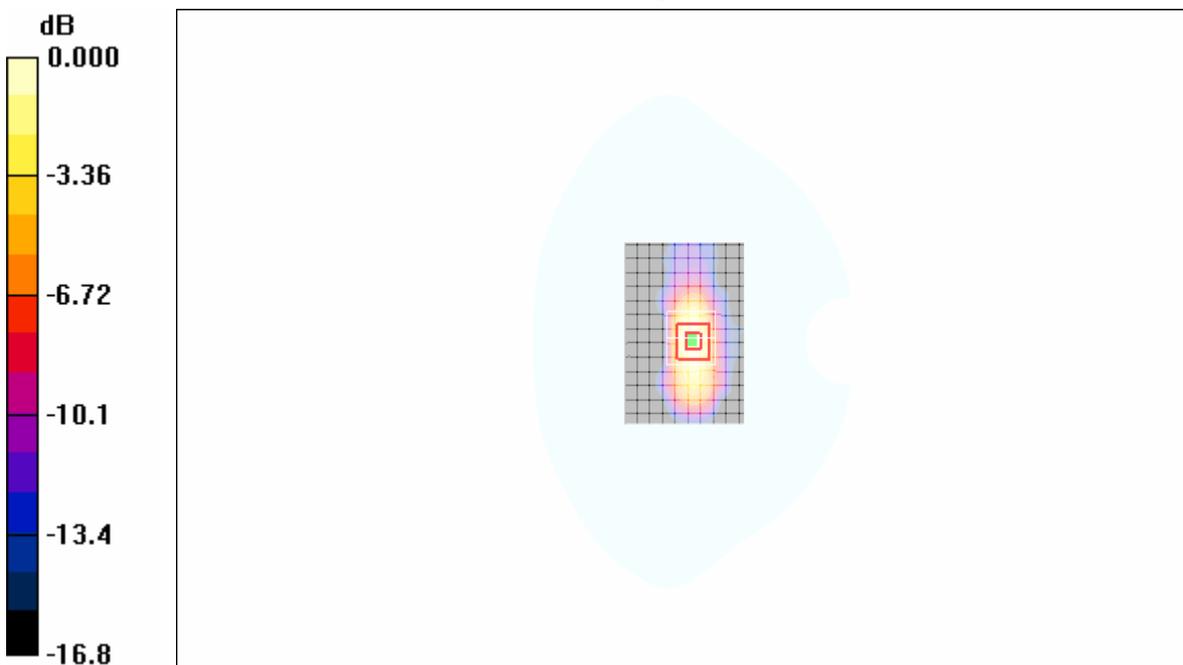
Test Position 3/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.3 V/m; Power Drift = 0.051 dB

Peak SAR (extrapolated) = 0.528 W/kg

SAR(1 g) = 0.292 mW/g; SAR(10 g) = 0.150 mW/g

Maximum value of SAR (measured) = 0.330 mW/g



0 dB = 0.330mW/g

Fig. 15 PCS 1900 EGPRS CH661 Test Position 3

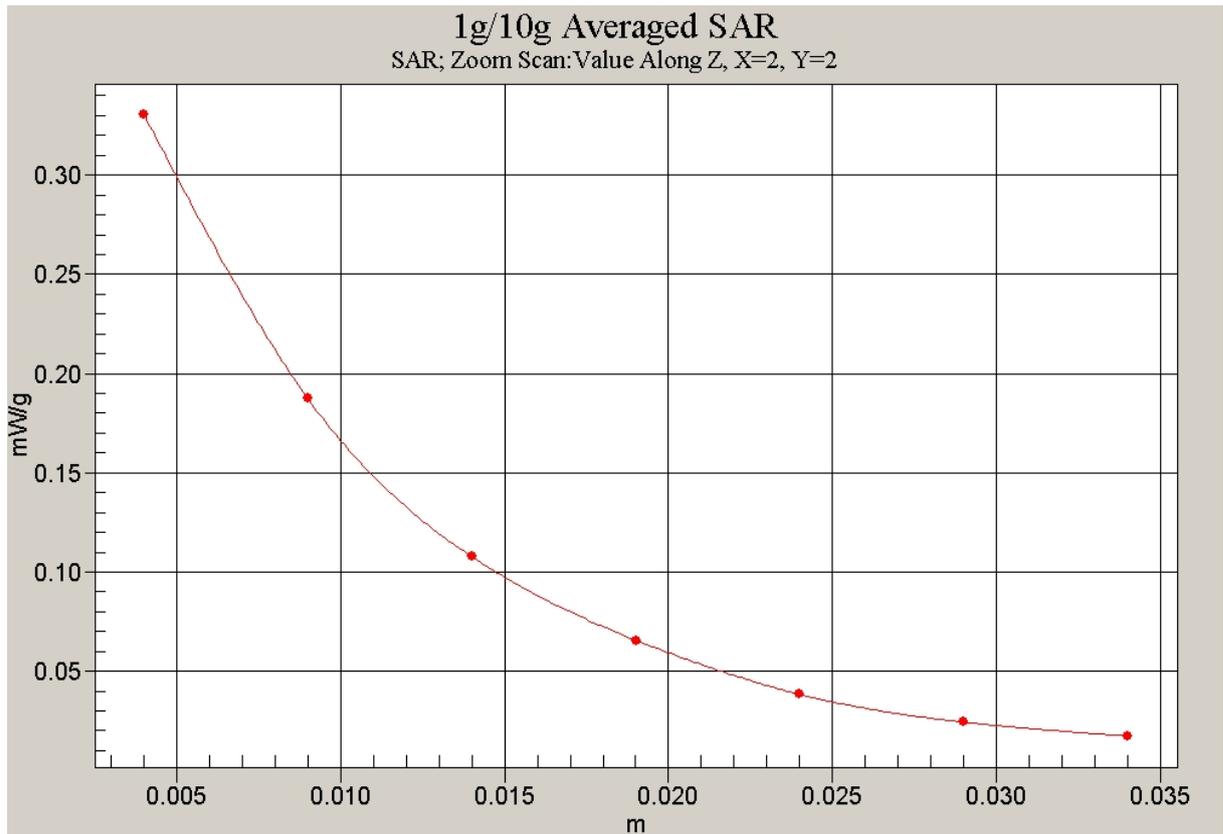


Fig.16 Z-Scan at power reference point (PCS 1900 EGPRS CH661 Test Position 3)

1900 EGPRS Test Position 4

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 4/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.342 mW/g

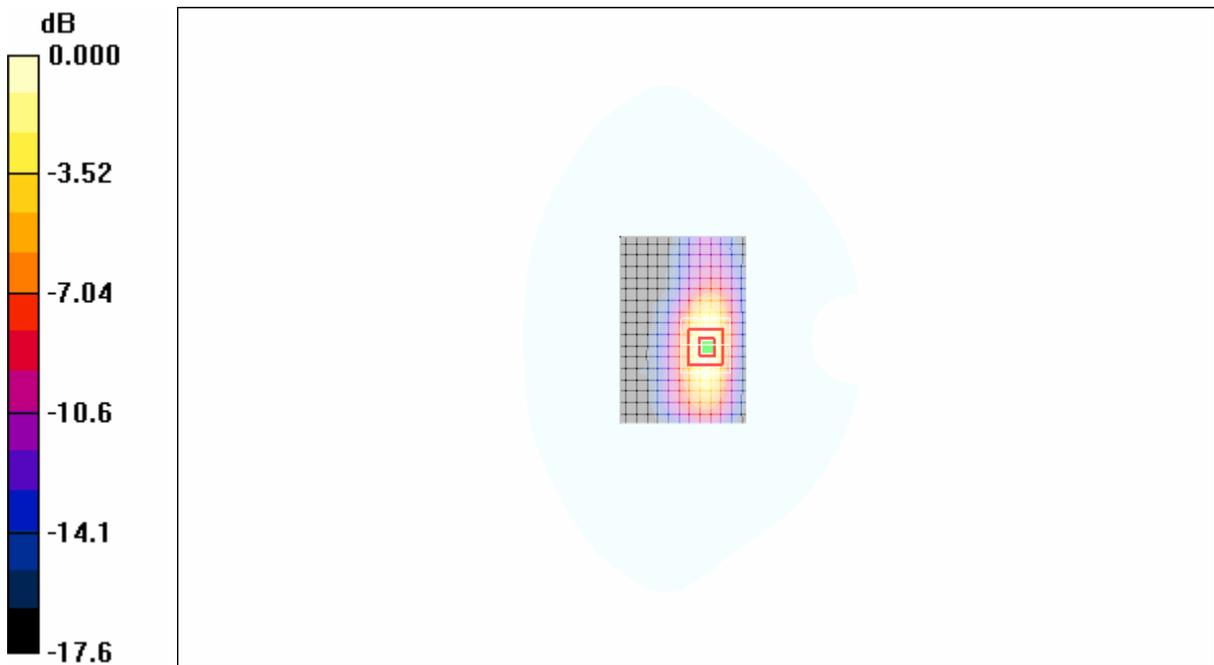
Test Position 4/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.8 V/m; Power Drift = 0.043 dB

Peak SAR (extrapolated) = 0.536 W/kg

SAR(1 g) = 0.295 mW/g; SAR(10 g) = 0.153 mW/g

Maximum value of SAR (measured) = 0.333 mW/g



0 dB = 0.333mW/g

Fig. 17 PCS 1900 EGPRS CH661 Test Position 4

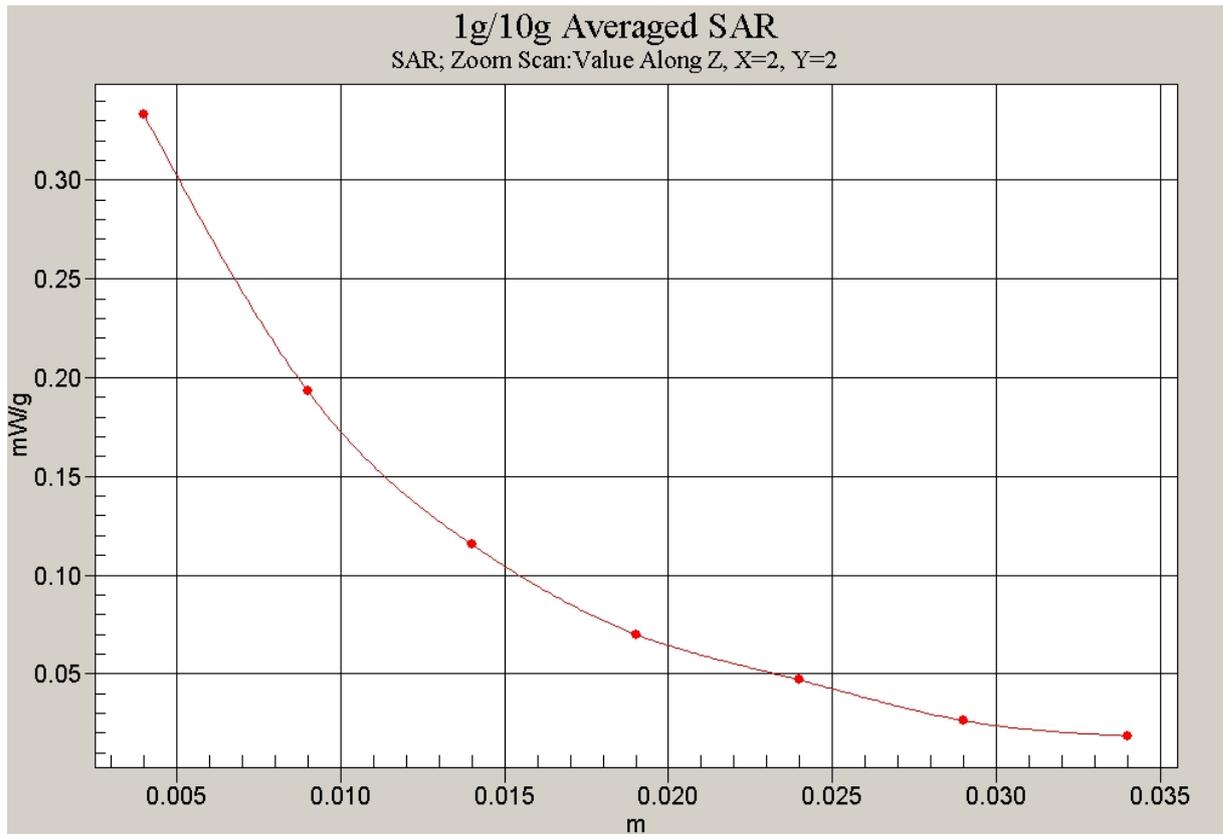


Fig.18 Z-Scan at power reference point (PCS 1900 EGPRS CH661 Test Position 4)

1900 EGPRS Test Position 5

Electronics: DAE3 Sn536

Communication System: GSM 1900MHz GPRS Frequency: 1880 MHz Duty Cycle: 1:4

Probe: ET3DV6 - SN1736 ConvF(4.88, 4.88, 4.88)

Test Position 5/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.132 mW/g

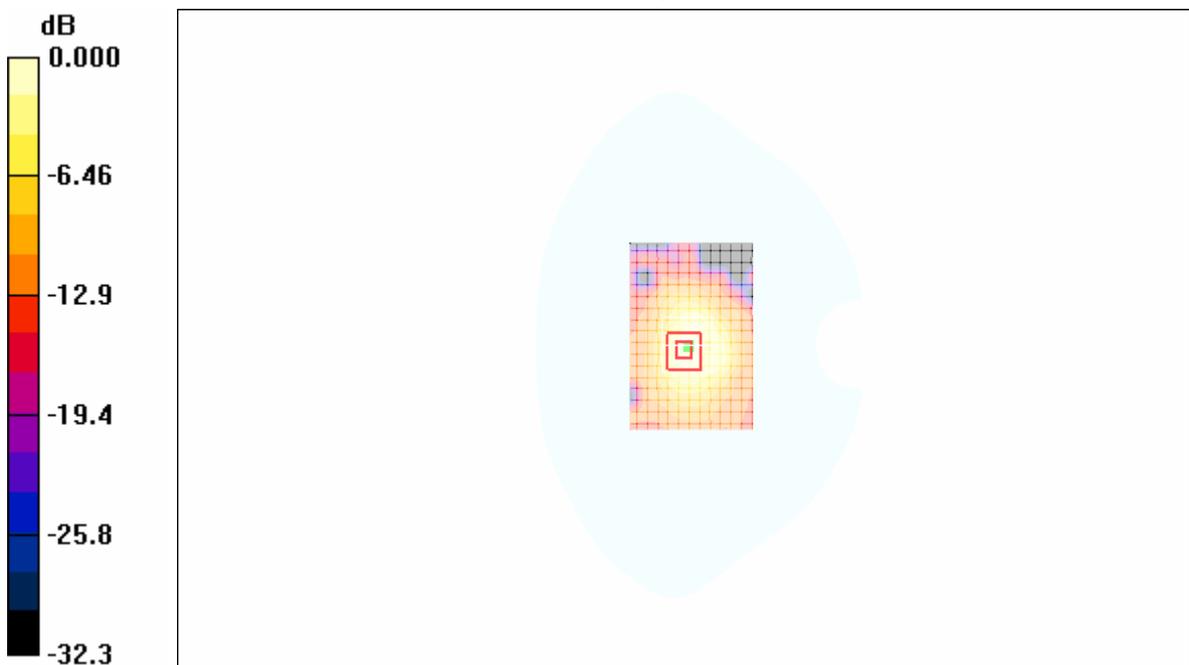
Test Position 5/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm

Reference Value = 7.07 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.159 W/kg

SAR(1 g) = 0.101 mW/g; SAR(10 g) = 0.050 mW/g

Maximum value of SAR (measured) = 0.129 mW/g



0 dB = 0.129mW/g

Fig.19 PCS 1900 EGPRS CH661 Test Position 5

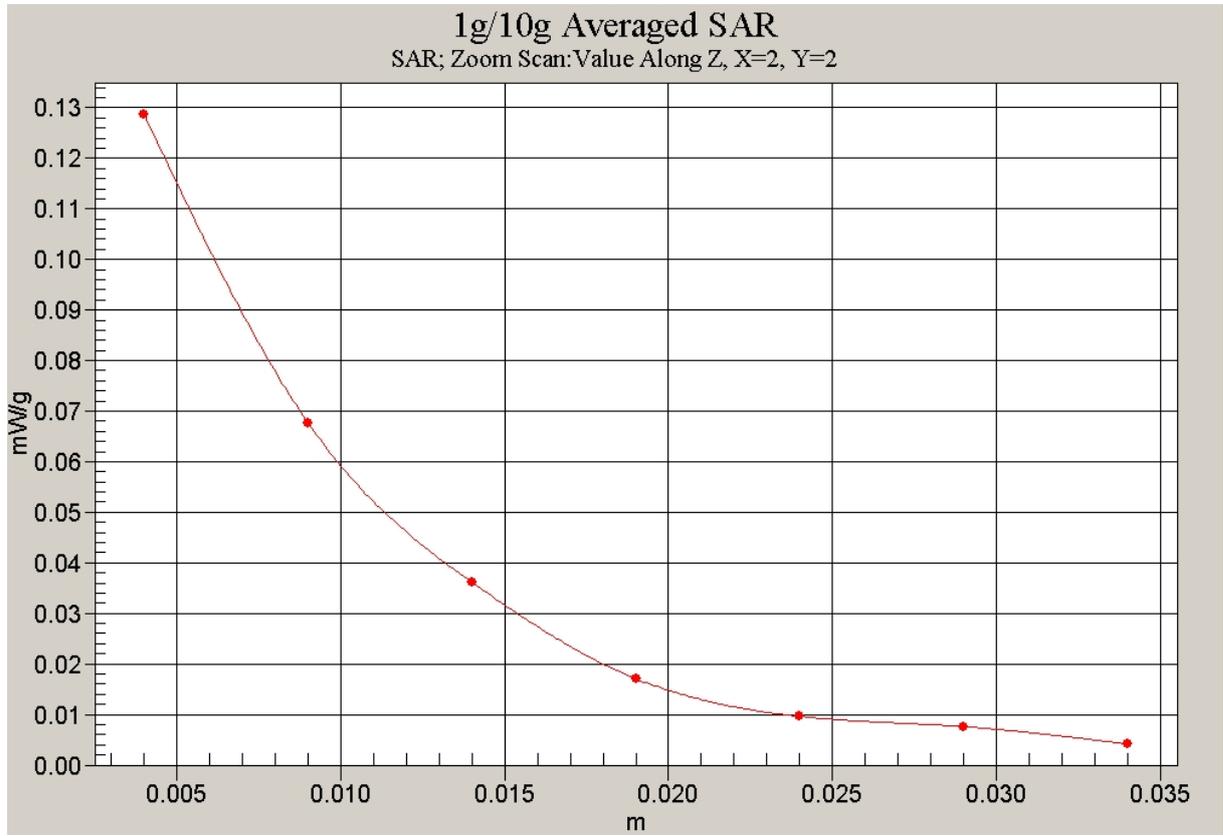


Fig.20 Z-Scan at power reference point (PCS 1900 EGPRS CH661 Test Position 5)

ANNEX D: SYSTEM VALIDATION RESULTS

1900MHzDAE536Probe1736

Electronics: DAE3 Sn536

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

Probe: ET3DV6 - SN1736 ConvF(5.4, 5.4, 5.4)

System Validation/Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm

Reference Value = 92.1 V/m; Power Drift = 0.1 dB

Maximum value of SAR (interpolated) = 11.2 mW/g

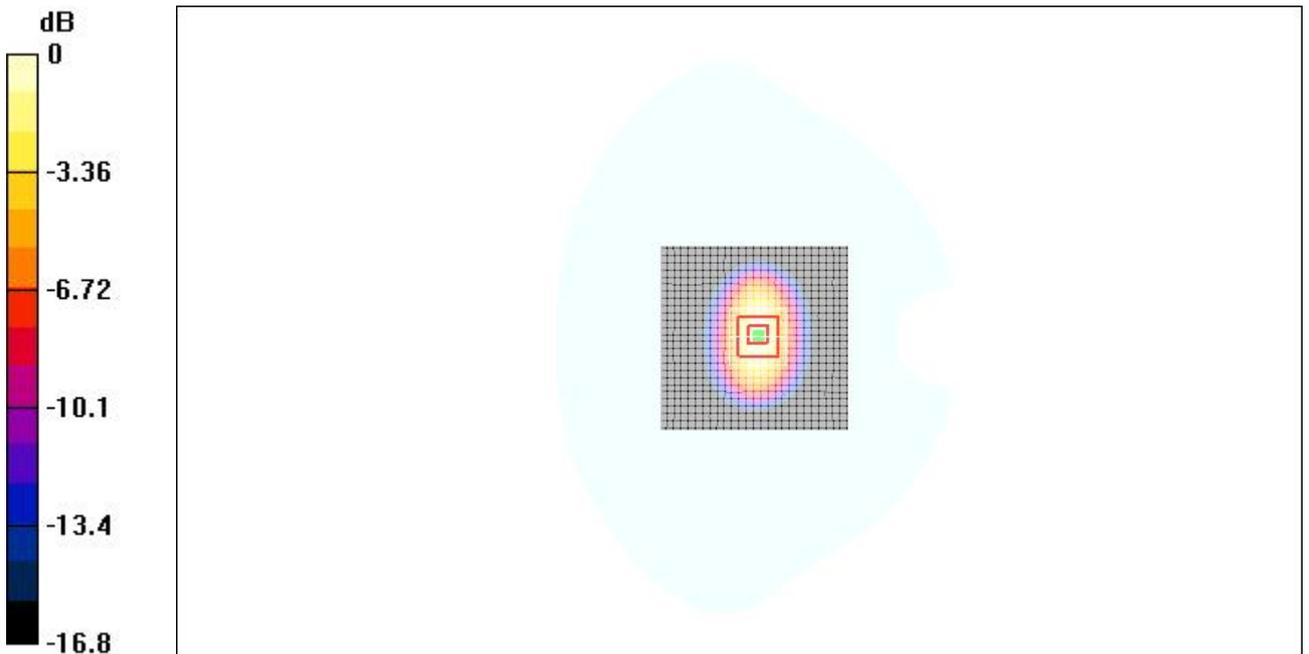
System Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.1 V/m; Power Drift = 0.1 dB

Maximum value of SAR (measured) = 11.3 mW/g

Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 9.91 mW/g; SAR(10 g) = 5.27 mW/g



0 dB = 11.3mW/g

Fig.21 validation 1900MHz 250mW

**Telecommunication Metrology Center
of Ministry of Information Industry**

No. 2006E00813

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ANNEX E: CALIBRATION CERTIFICATE of E-FIELD PROBE

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



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
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 **TMC-Auden**

Certificate No: **ET3-1736_Nov05**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1736**

Calibration procedure(s) **QA CAL-01.v5
Calibration procedure for dosimetric E-field probes**

Calibration date: **November 25, 2005**

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 E4419B	GB41293874	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41495277	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41498087	3-May-05 (METAS, No. 251-00466)	May-06
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference Probe ES3DV2	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
DAE4	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
Reference Probe ES3DV2	SN: 907	21-Jun-05 (SPEAG, No. DAE4-907_Jun05)	Jun-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

Calibrated by:	Name	Function	Signature
	Nico Vetterli	Laboratory Technician	

Approved by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	

Issued: November 25, 2005

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

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



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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

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 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 (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.

ET3DV6 SN:1736

November 25, 2005

Probe ET3DV6

SN:1736

Manufactured:	September 27, 2002
Last calibrated:	July 14, 2005
Recalibrated:	November 25, 2005

Calibrated for DASY Systems

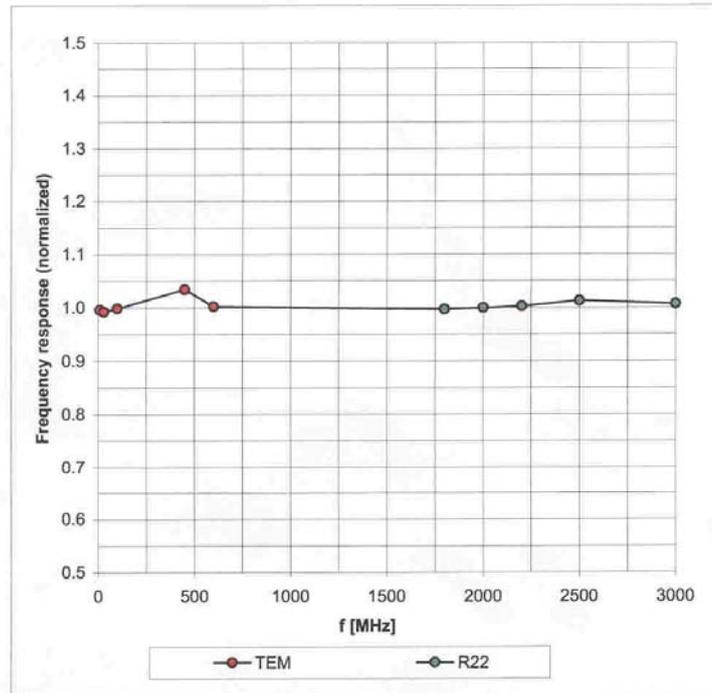
(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1736

November 25, 2005

Frequency Response of E-Field

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

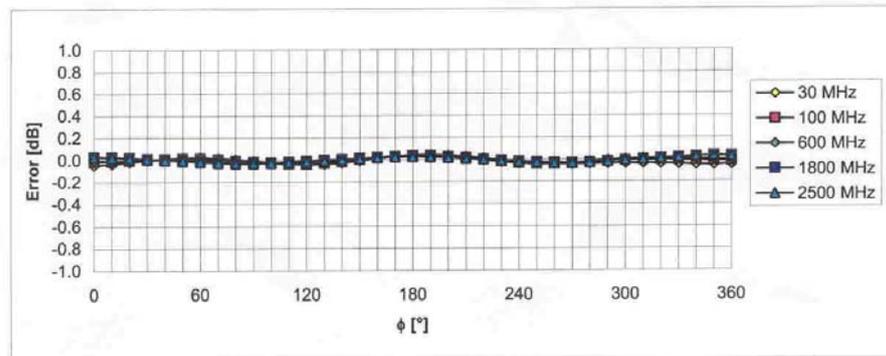
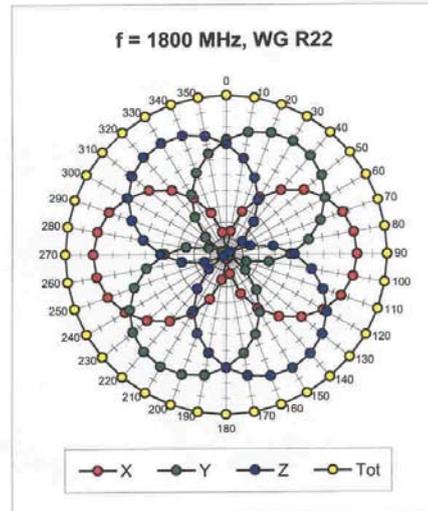
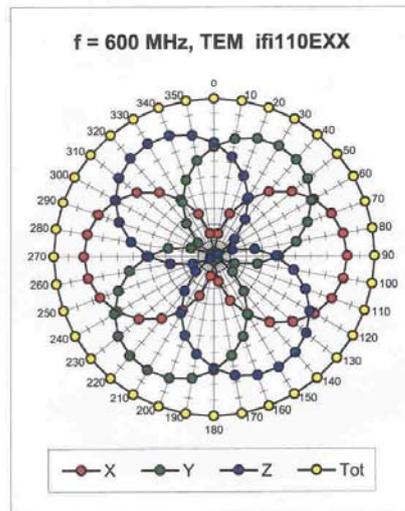


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

ET3DV6 SN:1736

November 25, 2005

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

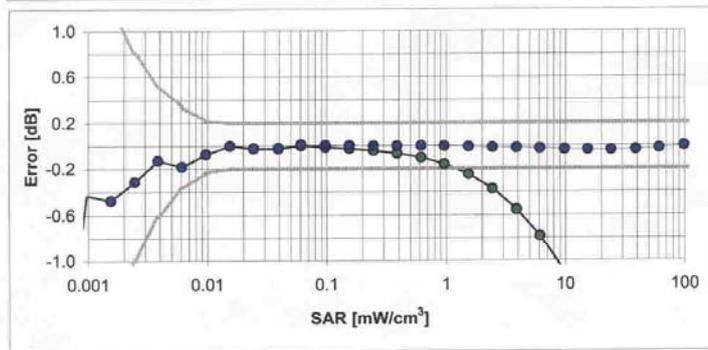
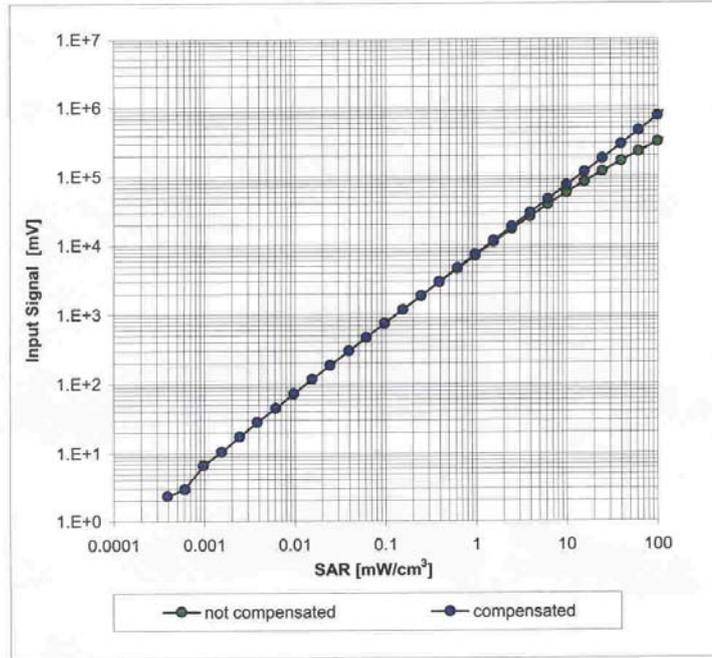


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

ET3DV6 SN:1736

November 25, 2005

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

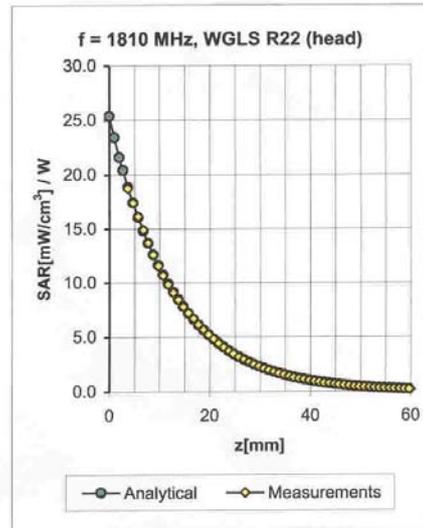
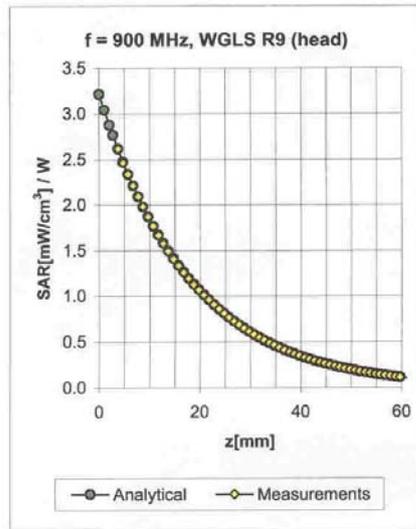


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.56	1.85	6.51 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.57	2.47	5.40 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.62	2.29	4.67 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.12	1.61	7.74 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.47	2.15	6.45 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.53	2.78	4.88 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.65	2.11	4.35 ± 11.8% (k=2)

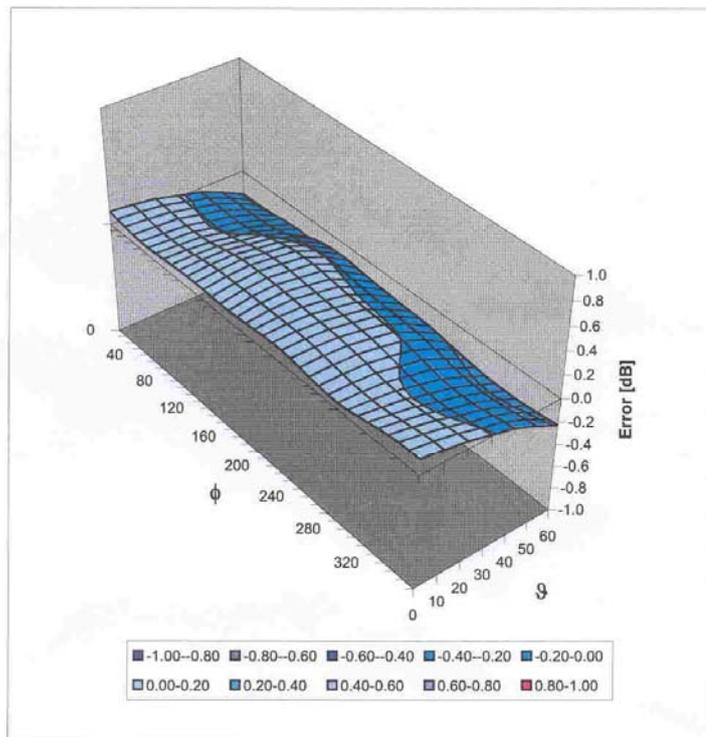
^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the Indicated frequency band.

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Deviation from Isotropy in HSL

Error (ϕ, ϑ), $f = 900$ MHz



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