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SAR TEST REPORT

Dates of Tests: November 29, 2007
Test Report S/N:DR50110711AB
Test Site : DIGITAL EMC CO., LTD.

FCC ID

SG7U802T

APPLICANT

Haier Telecom (Qingdao) Co., Ltd.

FCC Classification:	**Licensed Non-Broadcast Station Transmitter (TNB)**
EUT Type:	**CDMA 1X RTT (800MHz Single Band USB Modem)**
Model Name	**U802T**
Brand Name	**Haier**
Test Device Serial No.:	**Identical prototype**
TX Frequency Range:	**824.70 ~848.31 MHz (CDMA)**
RX Frequency Range:	**869.70 ~893.31 MHz (CDMA)**
Max. RF Output Power:	**0.180W ERP CDMA Cellular Band (22.56dBm)**
Max. SAR Measurement:	**0.376 mW/g CDMA Body SAR**
Application Type:	**Certification**
Rule Part(s):	**§2.1093; FCC/OET Bulletin Supplement C[July 2001]**
Data of issue:	**November 30, 2007**

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE Std. 1528-2003.

I attest to the accuracy of data.   All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief.   I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by : _____
Sun-Kyu Ryu (Engineer)

Reviewed by : _____
Harvey Sung (Chief Engineering Director)

TABLE OF CONTENTS

1. INTROCUCTION/SAR DEFINITION

   In 1974, the International Radiation Protection Association (IRPA) formed a working group on non-ionizing radiation (NIR), which examined the problems arising in the field of Protection against the various types of NIR. At the IRPA Congress in Paris in 1977, this working group because the International Non-Ionizing Radiation Committee (INIRC).

   In cooperation with the Environmental Health Division of the World Health Organization (WHO), the IRPA/INIRC developed a number of health criteria documents on NIR as part of WHO'S Environmental Health Criteria Programme, sponsored by the United Nations Environment Programme (UNEP). Each document includes an overview of the physical characteristics, measurement and instrumentation, sources, and applications of NIR, a thorough review of the literature on biological effects, and an evaluation of the health risks of exposure to NIR. These health criteria have provided the scientific database for the subsequent development of exposure limits and codes of practice relating to NIR.

   At the Eighth International Congress of the IRPA (Montreal, 18-22 May 1992), a new, independent scientific organization-the International Commission on Non-Ionizing Radiation Protection (ICNIRP)-was established as a successor to the IRPA/INIRC. The functions of the Commission are to investigate the hazards that may be association with the different forms of NIR, develop international guidelines on NIR exposure to static and extremely-low-frequency (ELF) electric and magnetic field have been reviewed by UNEP/WHO/IRPA (1984, 1987). Those publications and a number of others, including UNEP/WHO/IRPA (1993) and Allen et al. (1991), provided the scientific rationale for these guidelines.

   A glossary of terms appears in the Appendix.

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ) It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 1.1)

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

Figure 1.1
SAR Mathematical Equation

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

$$ \textbf{SAR} = E^2 / \quad \rho $$

Where:

   σ =   conductivity of the tissue-simulant material (S/m)
   ρ =   mass density of the tissue-simulant material (kg/m3)
   E =   Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

2. SAR MEASUREMENT SETUP

Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. The DASY4 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 2.1).

System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the Micron Pentium IV 500 MHz computer with Windows NT system and SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that 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.
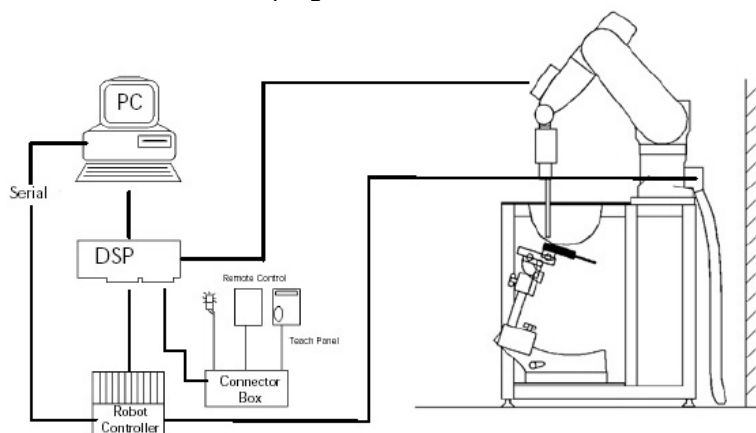
Figure 2.1 SAR Measurement System Setup

System Electronics

The DAE3 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [7].

3. SAR MEASUREMENT SETUP

Probe Measurement System

The SAR measurements were conducted with the dosimetric probe ET3DV6,designed in the classical triangular configuration [7] (see Fig. 3.2) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip (see Fig. 3.3). It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Fig.3.1). The approach is stopped at reaching the maximum.

Figure 3.1 DAE System

Probe Specifications

|	
Calibration:	In air from 10 MHz to 2.5 GHz
	In brain and muscle simulating tissue at
	Frequencies of 450 MHz, 835 MHz, 900 MHz
	1900MHz and 2450MHz
Frequency:	10MHz to 6GHz
	Linearity:±0.2dB (30 MHz to 3 GHz)
Dynamic:	5uW/g to >100mW/g
Range:	Linearity: ±0.2dB
Dimensions:	Overall length: 330 mm
	Tip length :16mm
	Body diameter :12mm
	Tip diameter :6.8 mm
	Distance from probe tip to dipole centers:2.7mm
Application:	General dosimetry up to 3 GHz
	Compliance tests of mobile phones
	Fast automatic scanning in arbitrary phantoms

Δ - BEAM
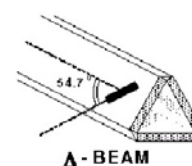
Figure 3.1 Triangular Probe Configuration

Figure 3.2 Probe Thick-Film Technique

4. Probe Calibration Process

Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in [8] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [9] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

Free Space Assessment

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 (see Fig. 4.1), and in a waveguide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity at the proper orientation with the field. The probe is then rotated 360 degrees.

Temperature Assessment *

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 (see Fig. 4.2).

$$\text{SAR} = C\frac{\Delta T}{\Delta t} \qquad\qquad \text{SAR} = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to ΔT / Δt , the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;
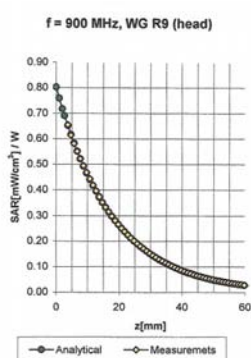

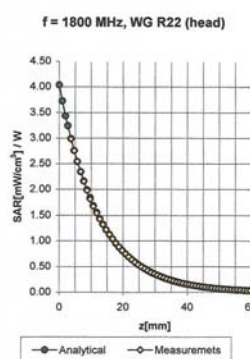**Figure 4.1 E-Field and Temperature Measurements at 900MHz[7]**

Figure 4.2 E-Field and Temperature Measurements at 1900MHz[7]

5. PHANTOM & EQUIVALENT TISSUES

SAM Phantom

Figure 5.1 SAM Twin Phantom

The SAM Twin Phantom V4.0 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 [11][12]. 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 o f 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. (see Fig. 5.1)

Brain & Muscle Simulating Mixture Characterization

Figure 5.2 Simulated Tissue

The brain and muscle mixtures consist of a viscous gel using hydroxethyl cellullose (HEC) gelling agent and saline solution (see Table 6.1). Preservation with a bacteriacide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been incorporated in the following table. Other head and body tissue parameters that have not bee specified in P1528 are derived from the issue dielectric parameters computed from he 4-Cole-Cole equations The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrove [13].(see Fig. 5.2)

Table 5.1   Composition of the Muscle Tissue Equivalent Matter

INGREDIENTS		SIMULATING TISSUE			
		835MHz Brain	835MHz Muscle	1900MHz Brain	1900MHz Muscle
Mixture Percentage					
WATER		41.45	52.50	54.90	40.40
DGBE		0.000	0.000	44.92	58.00
SUGAR		56.00	45.00	0.000	0.000
SALT		1.450	1.400	0.180	0.500
BACTERICIDE		0.100	0.100	0.000	0.100
HEC		1.000	1.000	0.000	1.000
Dielectric Constant	Target	**41.50**	**55.20**	**40.00**	**53.30**
Conductivity (S/m)	Target	**0.900**	**0.970**	**1.400**	**1.520**

Device Holder for Transmitters

Figure 5.2 Mounting Device

In combination with the SAM Twin Phantom V4.0, the Mounting Device (see Fig. 5.2) enables the rotation of the mounted transmitter in spherical coordinates where by the rotation point is the ear opening. The devices can be easily, accurately, and repeatably be positioned according to the FCC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

● Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produce infinite number of configurations [12]. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

6. TEST SYSTEM SPECIFICATIONS

Automated Test System Specifications

Positioner

Robot:	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability:	0.02 mm
No. of axis:	6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor:	Pentium 4 CPU
Clock Speed:	3 GHz
Operating System:	Window 2000
Data Card:	DASY4 PC-Board

Figure 6.1 DASY4 Test System

Data Converter

Features:	Signal, multiplexer,A/D converter. & control logic
Software:	DASY4
Connecting Lines :	Optical downlink for data and status info
	Optical uplink for commands and clock

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing
	Link to DAE 3
	16 bit A/D converter for surface detection system
	serial link to robot
	direct emergency stop output for robot

E-Field Probes

Model:	ET3DV6 S/N: 1702
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	$\pm$0.2dB(30MHz to 3GHz)

Phantom

Phantom:	SAM Twin Phantom (V4.0)
Shell Material :	Vivac Composite
Thickness:	2.0 ± 0.2 mm

7. DOSIMETRIC ASSESSMENT & PHANTOM SPECS

Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

2. The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the Inner surface of the shell. The area covered the entire dimension o f the head and the horizontal grid spacing was 15mm x 15mm.

3. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32mm x 32mm x 34mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see Fig. 7.1):

a. The data at the surface was 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 1.2mm. The extrapolation was based on a least square algorithm [15]. A polynomial of the fourth order was calculated through the points in z-axes. 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 straight-for war dalgorithm. 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) [15][16]. 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.

4. The SAR reference value, at the same location as procedure #1, was re-measured. If the value changed by more than 5%, the evaluation is repeated.

Specific Anthropomorphic Mannequin (SAM) Specifications

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shape and dimensions derived from the anthropometric data of the 90th percentile adult male head dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisected along the mid-sagittal plane into right and left halves (see Fig. 7.2). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimized reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15cm to minimize reflections from the upper surface.

Figure 7.2 SAM Twin Phantom shell

8. DEFINITION OF REFERENCE POINTS
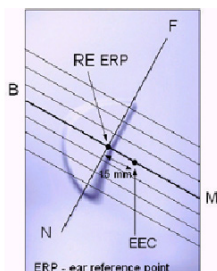
EAR Reference Point

Figure 8.2 Close-up side view of ERPs

Figure 8.1 shows the front,, back and side views of the SAM Twin Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point(ERP), and "RE" is the right ERP.   The ERPs are 15mm posterior to the entrance to the Ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 9.2. The plane Passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck- Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 8.2).   Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5]

Figure 8.1 Front, back and side view of SAM Twin Phantom

Handset Reference Points

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line.   The test device was placed in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Fig. 8.3).   The "test device reference point" was than located at the same level as the center of the ear reference point.   The test device was positioned so that the "vertical centerline" was bisecting the front surface of the handset at it's top and bottom edges, positioning   the "ear reference point" on the outer surface of the both the left   and right head phantoms on the ear reference point.
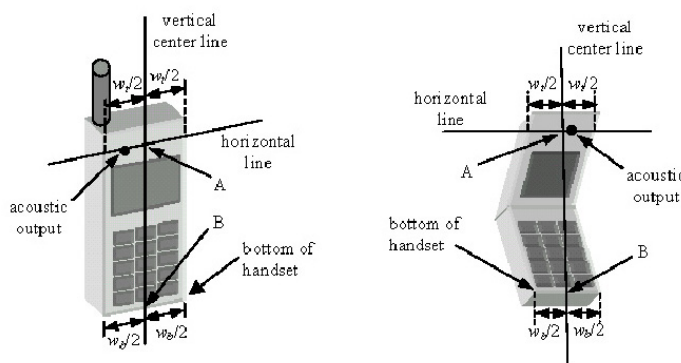

Figure 8.3 Handset Vertical Center & Horizontal Line Reference Points

9. TEST CONFIGURATION POSITIONS(Continued)

Positioning for Cheek/Touch

1. The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 9.1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

Figure 9.1 Front, Side and Top View of Cheek/Touch Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

4. The phone was hen rotated around the vertical centerline until the phone(horizontal line) was symmetrical was respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek).   See Figure 9.2)
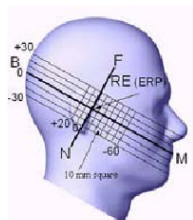

Figure 9.2 Side view w/ relevant markings

9. TEST CONFIGURATION POSITIONS(Continued)

Positioning for Ear / 15 ° Tilt

With the test device aligned in the "Cheek/Touch Position":

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degree.
2. The phone was then rotated around the horizontal line by 15 degree.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 9.3).
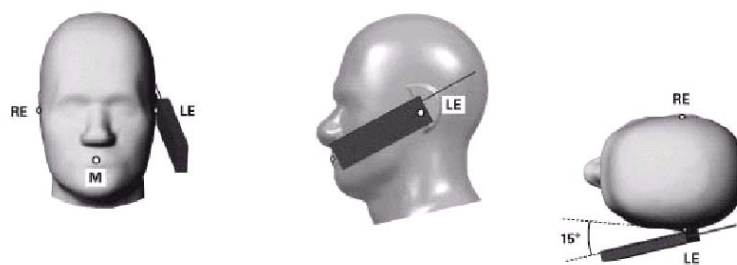

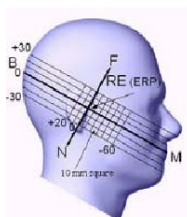Figure 9.3 Front, Side and Top View of Ear/15° Tilt Position

Figure 9.4 Side view w/ relevant markings

9. TEST CONFIGURATION POSITIONS

Body Holster /Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.5). A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body- worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Figure 9.5 Body Belt Clip & Holster Configurations

Body-worn accessories may not always be supplied or available as options for some Devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used.All test position spacings are documented.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing. In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements are included in the user's manual.

10. ICNIRP GUIDELINES RF EXPOSURE LIMITS

Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as   locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

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). In general, occupational/controlled exposure limits are employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential   for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 10.1. Safety Limits for Partial Body Exposure [2]

	HUMAN EXPOSURE LIMITS	
	General Public Exposure (W/kg) or (mW/g)	Occupational Exposure (W/kg) or (mW/g)
Whole-Body average SAR (W/kg)	0.08	0.40
Localized SAR (head and trunk) (W/kg)	1.60	8.00
Localized SAR (limbs) (W/kg)	4.00	20.00

11.IEEE P1528 – MEASUREMENT UNCERTAINTIES

Error Description	Uncertaint value ±%	Probability Distribution	Divisor	(Ci) 1g	Standard (1g)	vi 2 or Veff
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8 %	∞
Axial isotropy	± 4.7	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical isotropy	± 9.6	Rectangular	√3	0.7	± 3.9 %	∞
Boundary Effects	± 1.0	Rectangular	√3	1	± 0.6 %	∞
Probe Linearity	± 4.7	Rectangular	√3	1	± 2.7 %	∞
Detection limits	± 1.0	Rectangular	√3	1	± 0.6 %	∞
Readout Electronics	± 1.0	Normal	1	1	± 1.0 %	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5 %	∞
Integration time	± 2.6	Rectangular	√3	1	± 1.5 %	∞
RF Ambient Conditions	± 3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	± 0.4	Rectangular	√3	1	± 0.2 %	∞
Probe Positioning	± 2.9	Rectangular	√3	1	± 1.7 %	∞
Algorithms for Max. SAR Eval.	± 1.0	Rectangular	√3	1	± 0.6 %	∞
Test Sample Related						
Device Positioning	± 2.9	Normal	1	1	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	± 2.9 %	∞
Physical Parameters						
Phantom Shell	± 4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	± 1.8 %	∞
Liquid conductivity (Meas.)	± 2.5	Normal	1	0.64	± 1.6 %	∞
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.6	± 1.7 %	∞
Liquid permittivity (Meas.)	± 2.5	Normal	1	0.6	± 1.5 %	∞
Combined Standard Uncertainty					± 10.3 %	330
Expanded Uncertainty (k=2)					± 20.6 %	

The above measurement uncertainties are according to IEEE P1528 (2003)

12. SYSTEM VERIFICATION

Tissue Verification

Table 12.1   Simulated Tissue Verification [5]

Date(s)	Target Frequency	Dielectric constant: ε		Conductivity: σ	
		Target	Measured	Target	Measured
Nov. 29 ,2007	835MHz Brain	41.5	40.3	0.90	0.871

Test System Validation

Prior to assessment, the system is verified to the ±10% of the specifications at 835MHz by using the system validation kit(s).   (Graphic Plots Attached)

Table 12.2 System Validation [5]

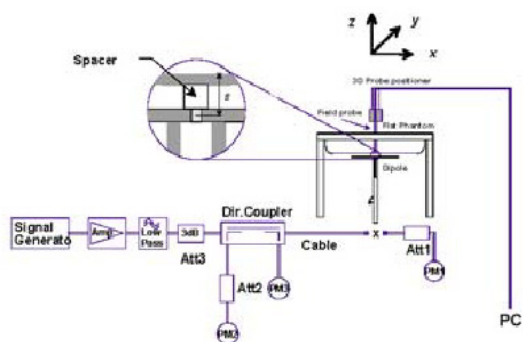| SYSTEM DIPOLE VALIDATION TARGET & MEASURED (835MHz values are normalized to a forward power of 1/4 W)					
Date(s)	System Validation Kit:	Target Frequency	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)	Deviation (%)
Nov. 29 ,2007	D-835V2, S/N: 464	835MHz Brain	2.375	2.38	0.21

Figure 12.1 Dipole Validation Test Setup

13. FCC 3G SAR MEASUREMENT PROCEDURES – MAY 2006

Procedures Used To Establish Test Signal

The CDMA USB Modem was placed into a simulated call using a base station simulator in a shielded chamber. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR [4]. See data pages for actual procedure used in measurement.

Device Test Conditions

This CDMA USB Modem is operated by laptop. So each SAR measurement was taken with a laptop. In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power. If a conducted power deviation of more than 5% occurred, the test was repeated.

SAR Measurement Conditions for CDMA2000

The following procedures were followed according to FCC "SAR Measurement Procedures for 3G Devices", May 2006.

• Output Power Verification

 See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices", May 2006. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E.   SO55 tests were measured with power control bits in "All Up" condition.   .

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 13-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 13-2 was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

Table 13-1
Parameters for Max. Power for RC1

Parameter	Units	Value
$\bar{I}_{or}$	dBm/1.23 MHz	-104
$\dfrac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\dfrac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 13-2
Parameters for Max. Power for RC3

Parameter	Units	Value
$\bar{I}_{or}$	dBm/1.23 MHz	-86
$\dfrac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\dfrac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Head SAR Measurements

• Measure in RC3

- At full rate with Loopback SO55

- According to applicable requirements

   • in Supplement C 01-01 & IEEE 1528

• Measure in RC1 on the maximum output channel

-only(RC3) if maximum average output >= 1/4 dB higher than

-use the exposure configuration that result in the highest SAR for that channel in RC3

   • highest SAR configuration among left & right side, touch& tilt positions with antenna extended and retracted

Body SAR

• measure in RC3 at full rate using TDSO SO32 with

   –   FCH only (may use SO55 instead of SO32)

   –   FCH + SCH (must use TDSO SO32)

   • only if the maximum average output power >= 1/4 dB higher than with FCH only

   • use the exposure configuration that result in the highest SAR for that channel with FCH only

   • monitor output fluctuations and SCH dropout

• measure in RC1

   –   only if the maximum average output power>= 1/4 dB higher than RC3 FCH only & FCH+ SCH

   –   use the body exposure configuration that result in the highest SAR , with antenna extended and retracted, for that channel in RC3

Max. Power Output Table for U802T

Band	Channel	RC1 SO2	RC1 SO55	RC3 SO2	RC3 SO55	RC3 SO32 (Only FCH)	RC3 SO32 (TDSO)
Cellular	1013	24.42	24.54	24.57	24.58	**24.53**	24.54
	384	24.86	24.88	24.84	24.90	**24.80**	24.81
	777	24.71	24.79	24.74	24.84	**24.77**	24.72

14. SAR TEST DATA SUMMARY

Mixture Type : 835MHz Body   PC: TOSHIBA Laptop *Note 8

14.3 MEASUREMENT RESULTS (CDMA_Celluler Body SAR)						
FREQUENCY		Begin Power (dBm)	End Power (dBm)	Device Test Position	Antenna Position	SAR (W/kg)
MHz	Ch					
824.70	1013	24.53	24.44	4.0mm [laptop]	Fixed	0.126
836.52	384	24.80	24.55	4.0mm [laptop]	Fixed	0.164
848.31	777	24.77	24.75	4.0mm [laptop]	Fixed	0.376
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					Body 1.6 W/kg (mW/g) averaged over 1 gram	

NOTE:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [July 2001].

2. All modes of operation were investigated, and worst-case results are reported.

3. Prior to testing the conducted output power was measured.

4. The EUT is tested 2nd hot-spot peak, if it is less than 2dB below the highest peak.

5.Test Signal Call Mode   □ Continuous Tx On   □ Manu.Test Codes   ▣BaseStation Simulator

6. Tissue parameters and temperatures are listed on the SAR plots.

7. Liquid tissue depth is 15.0 cm.±0.1

8. Laptop M/N : Satellite M100   S/N : 57271209K

9. Body SAR for CDMA mode was tested under RC3/SO32(FCH Only)

15. SAR TEST EQUIPMENT

Table 15.1 Test Equipment Calibration

EQUIPMENT SPECIFICATIONS			
Type	Calibration Date	Next Calibration Date	Serial Number
Robot	N/A	N/A	F02/5Q85A1/A/01
Robot Controller	N/A	N/A	F02/5Q85A1/C/01
Joystick	N/A	N/A	D221340031
Hicron Computer 1.1GHz Pentium Celeron ,Window 2000	N/A	N/A	N/A
Data Acquisition Electronics	August 2007	August 2008	614
Dosimetric E-Field Probe	March 2007	March 2008	1702
Dummy Probe	N/A	N/A	N/A
Sam Phantom	N/A	N/A	N/A
Probe Alignment Unit LB	N/A	N/A	321
SPEAG Validation Dipole D835MHz	January 2006	January 2008	464
SPEAG Validation Dipole D1900MHz	March 2007	March 2009	5d029
Head/Body Equivalent Matter(835MHz)	January 2007	January 2008	N/A
Head/Body Equivalent Matter(1900MHz)	January 2007	January 2008	N/A
HP EPM-442A Power Meter	March 2007	March 2008	GB37170267
HP E4421A Signal Generator	July 2007	July 2008	US37230529
Attenuator (10dB)	January 2007	January 2008	BP4387
Attenuator (3dB)	July 2007	July 2008	MY39260700
Low pass filter (1.5GHz)	January 2007	January 2008	N/A
Low pass filter (3.0GHz)	December 2006	December 2007	N/A
Dual Directional Coupler	January 2007	January 2008	50228
Amplifier	January 2007	January 2008	1020 D/C 0221
Network Analyzer	March 2007	March 2008	8753D
HP85070D Dielectric Probe Kit	N/A	N/A	LISO1440118
SEMITEC Engineering	N/A	N/A	Shield Room

NOTE:

The E-field probe was calibrated by SPEAG, by temperature measurement procedure.   Dipole Validation measurement is performed by Digital EMC. before each test.   The brain simulating material is calibrated by Digital EMC using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material.

16. CONCLUSION

Measurement Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease).

Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

17. REFERENCES

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DIGITAL EMC CO., LTD

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:464

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.871 mho/m; ε_r = 40.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
Probe: ET3DV6 - SN1702; ConvF(6.34, 6.34, 6.34); Calibrated: 2007-03-20; Electronics: DAE4 Sn614
Phantom: SAM with 835MHz; Type: SAM; Serial: TP-1223
Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

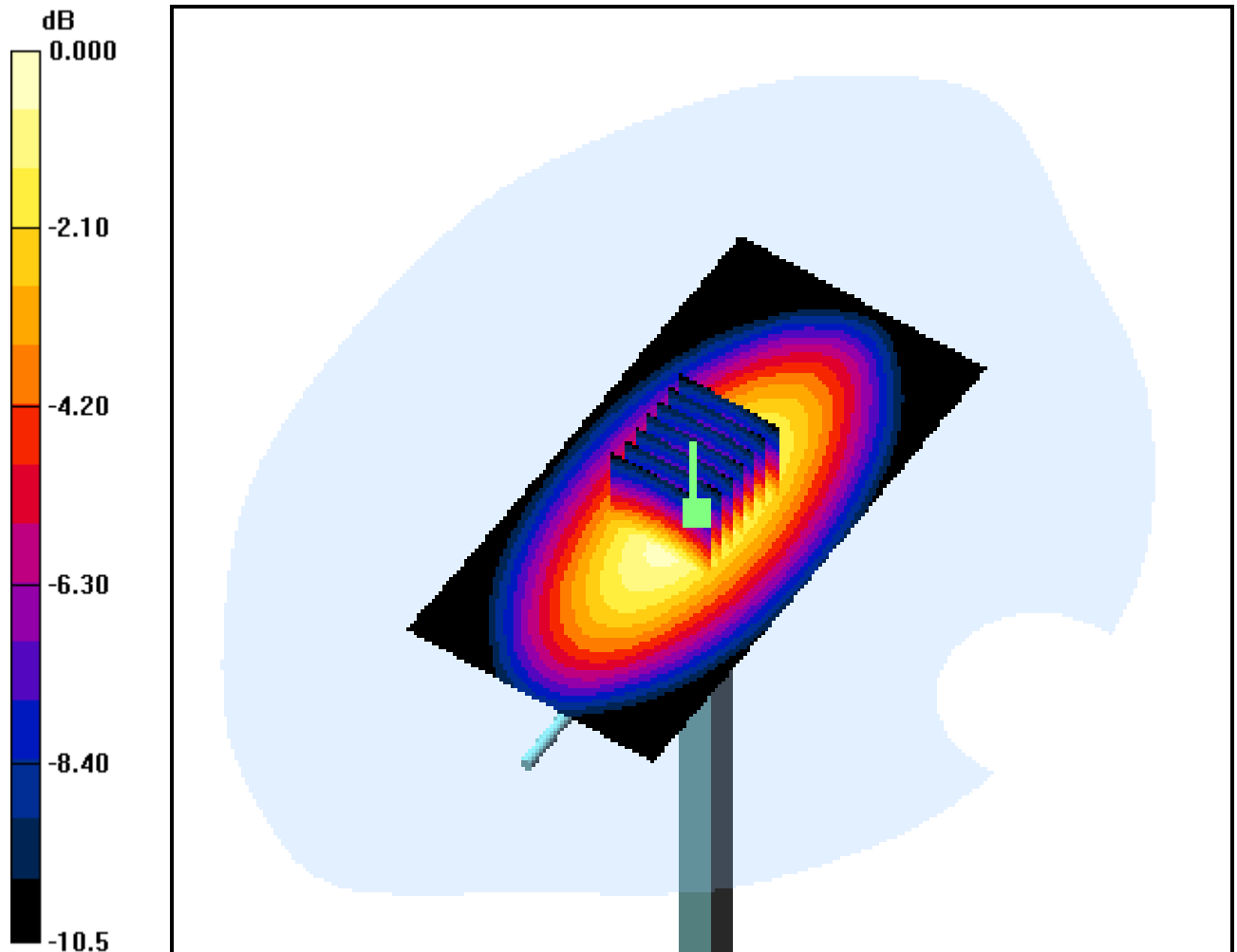Test Date: 2007-11-29; Ambient Temp: 20.5; Tissue Temp: 20.3

Dipole Validation

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Power Drift = -0.002 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.55 mW/g

0 dB = 2.58mW/g

DIGITAL EMC CO., LTD

DUT: U802T; Type: CDMA Modem

Communication System: FCC CDMA; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium parameters used: f = 824.7 MHz; σ = 0.987 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
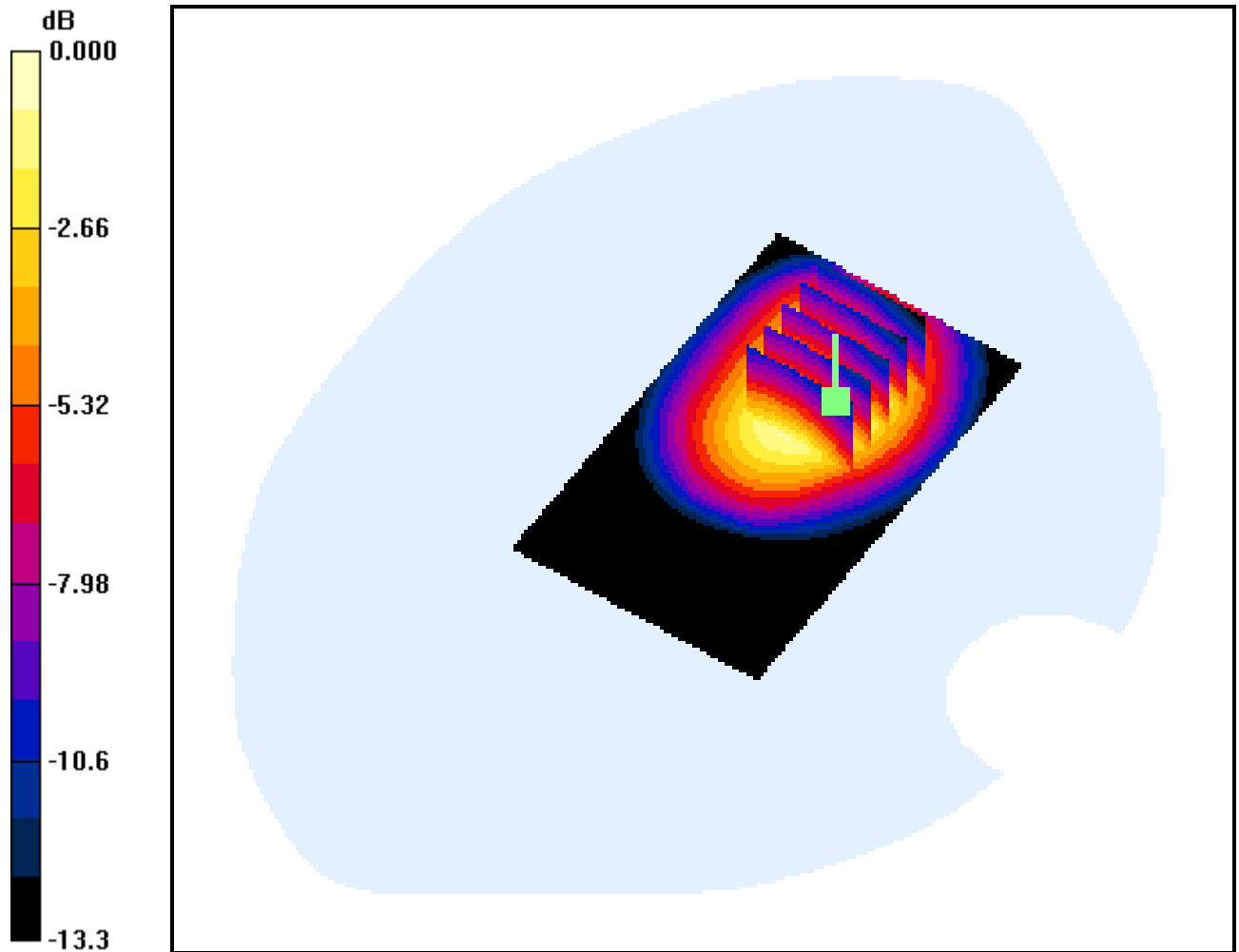Phantom section: Flat Section

DASY4 Configuration:
Probe: ET3DV6 - SN1702; ConvF(6.22, 6.22, 6.22); Calibrated: 2007-03-20; Electronics: DAE4 Sn614
Phantom: SAM with 835MHz; Type: SAM; Serial: TP-1223
Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Test Date: 2007-11-29; Ambient Temp: 20.5; Tissue Temp: 20.3

4.0mm from Body, CDMA_Cellular Ch.1013, Ant Fixed

Area Scan (51x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Power Drift = -0.095 dB
Peak SAR (extrapolated) = 0.186 W/kg
SAR(1 g) = 0.126 mW/g; SAR(10 g) = 0.081 mW/g

0 dB = 0.136mW/g

DIGITAL EMC CO., LTD

DUT: U802T; Type: CDMA Modem

Communication System: FCC CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium parameters used: f = 836.52 MHz; σ = 1 mho/m; ε_r = 53.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
Probe: ET3DV6 - SN1702; ConvF(6.22, 6.22, 6.22); Calibrated: 2007-03-20; Electronics: DAE4 Sn614
Phantom: SAM with 835MHz; Type: SAM; Serial: TP-1223
Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Test Date: 2007-11-29; Ambient Temp: 20.5; Tissue Temp: 20.3

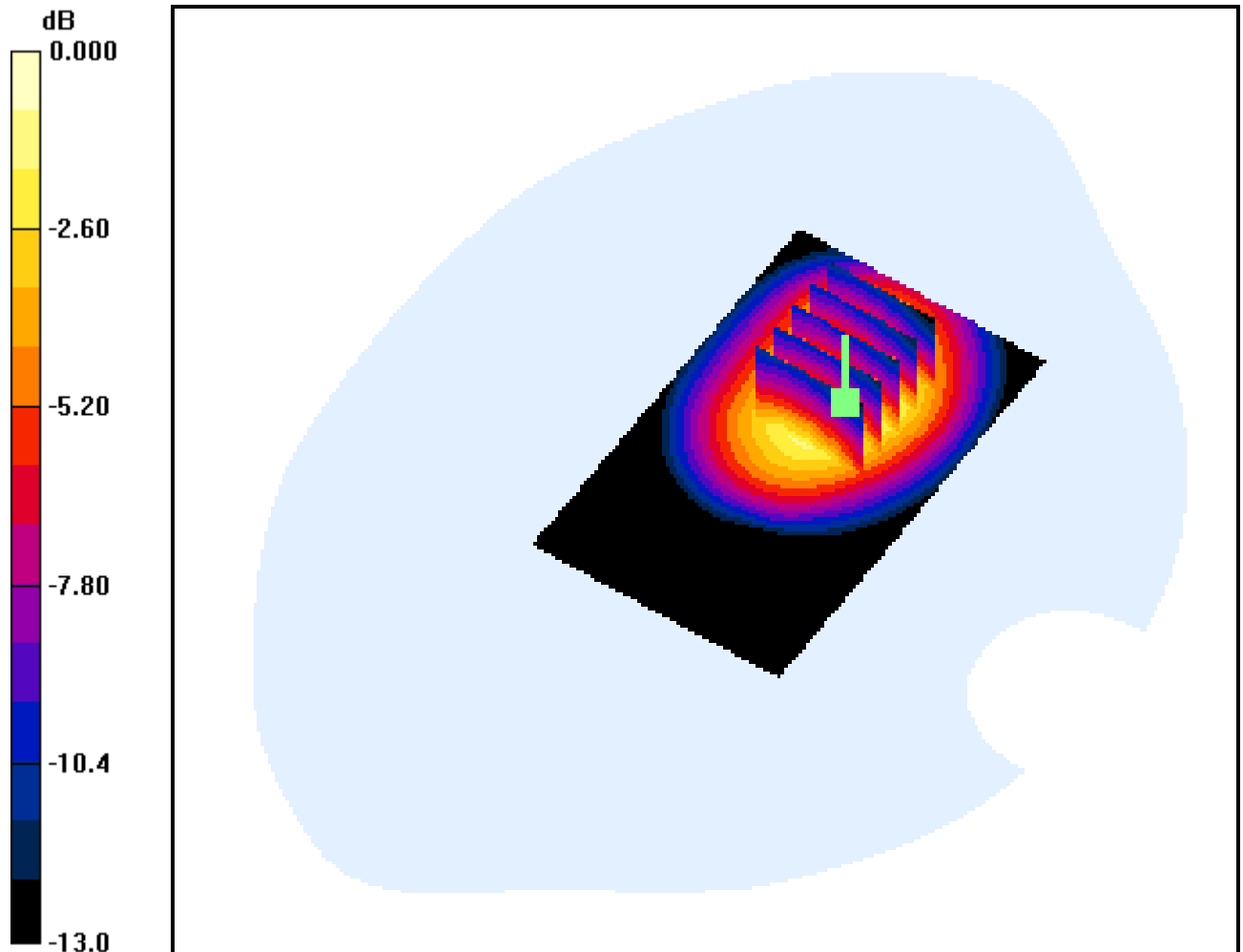**4.0mm from Body, CDMA_Cellular Ch.384, Ant Fixed**

Area Scan (51x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Power Drift = -0.270 dB
Peak SAR (extrapolated) = 0.267 W/kg
SAR(1 g) = 0.164 mW/g; SAR(10 g) = 0.101 mW/g

0 dB = 0.183mW/g

DIGITAL EMC CO., LTD

DUT: U802T; Type: CDMA Modem

Communication System: FCC CDMA; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: f = 848.31 MHz; σ = 1.01 mho/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
Probe: ET3DV6 - SN1702; ConvF(6.22, 6.22, 6.22); Calibrated: 2007-03-20; Electronics: DAE4 Sn614
Phantom: SAM with 835MHz; Type: SAM; Serial: TP-1223
Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Test Date: 2007-11-29; Ambient Temp: 20.5; Tissue Temp: 20.3

4.0mm from Body, CDMA_Cellular Ch.777, Ant Fixed, Horizontal

Area Scan (51x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Power Drift = -0.025 dB
Peak SAR (extrapolated) = 0.616 W/kg
SAR(1 g) = 0.376 mW/g; SAR(10 g) = 0.233 mW/g

0 dB = 0.419mW/g

DIGITAL EMC CO., LTD

DUT: U802T; Type: CDMA Modem

Communication System: FCC CDMA; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: f = 848.31 MHz; σ = 1.01 mho/m; $ε_r$ = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
Probe: ET3DV6 - SN1702; ConvF(6.22, 6.22, 6.22); Calibrated: 2007-03-20; Electronics: DAE4 Sn614
Phantom: SAM with 835MHz; Type: SAM; Serial: TP-1223
Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Test Date: 2007-11-29; Ambient Temp: 20.5; Tissue Temp: 20.3

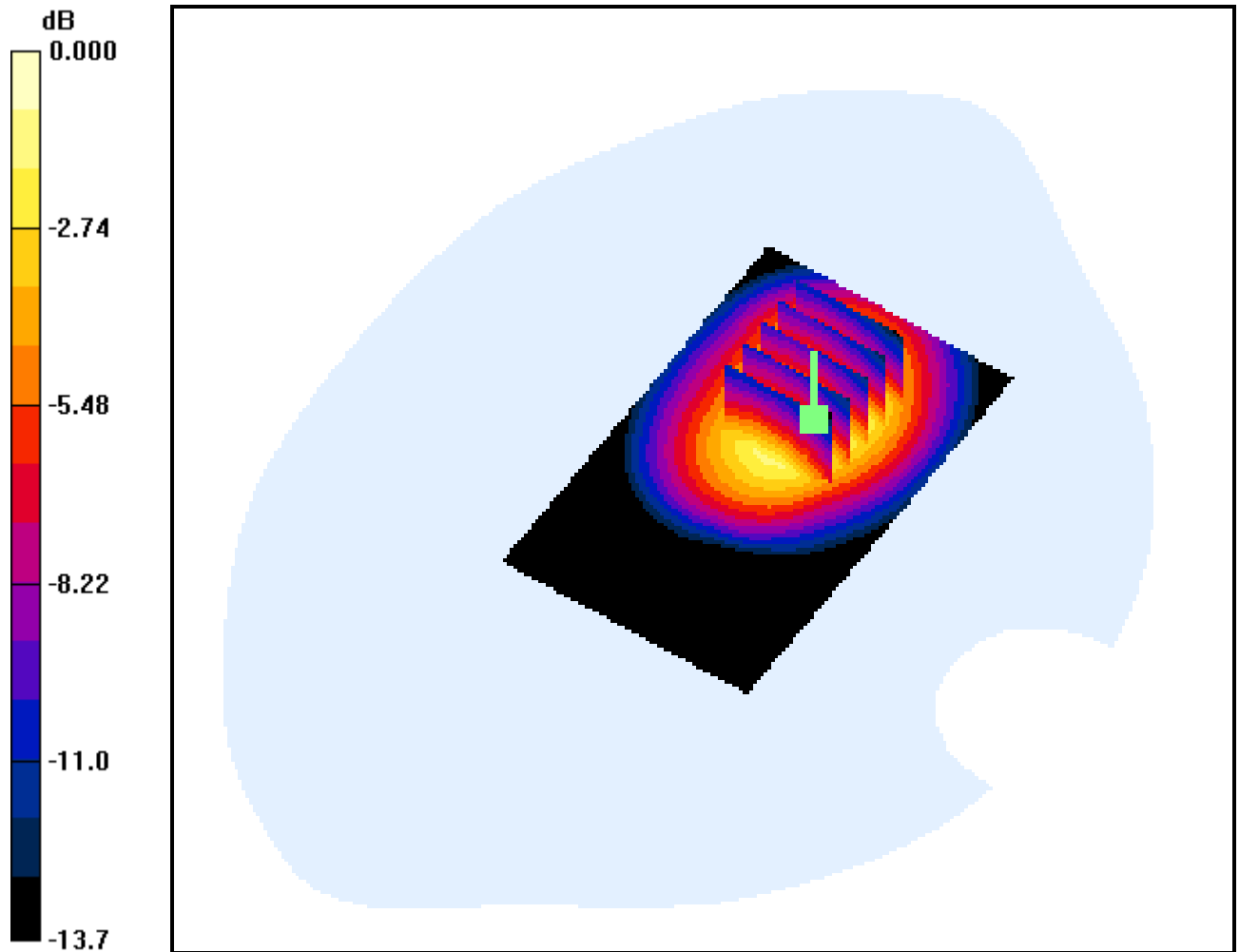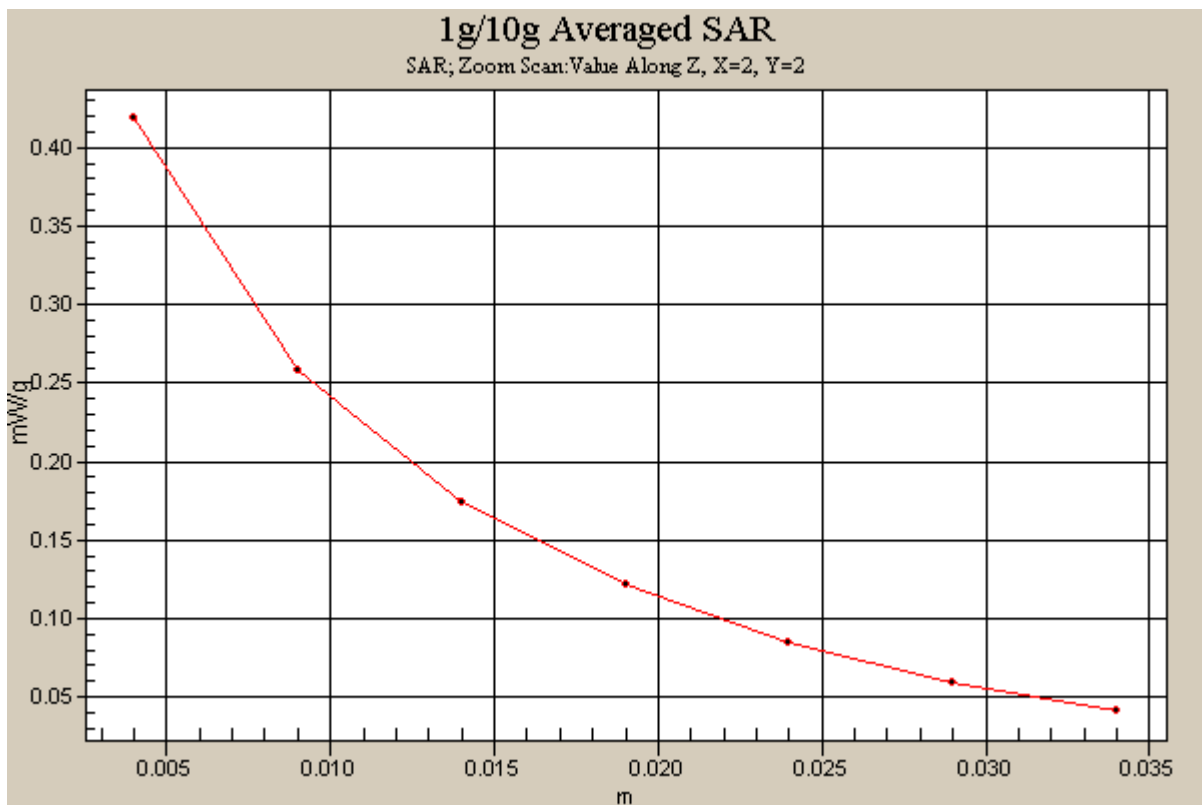**4.0mm from Body, CDMA_Cellular Ch.777, Ant Fixed, Horizontal**

Area Scan (51x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Power Drift = -0.025 dB
Peak SAR (extrapolated) = 0.616 W/kg
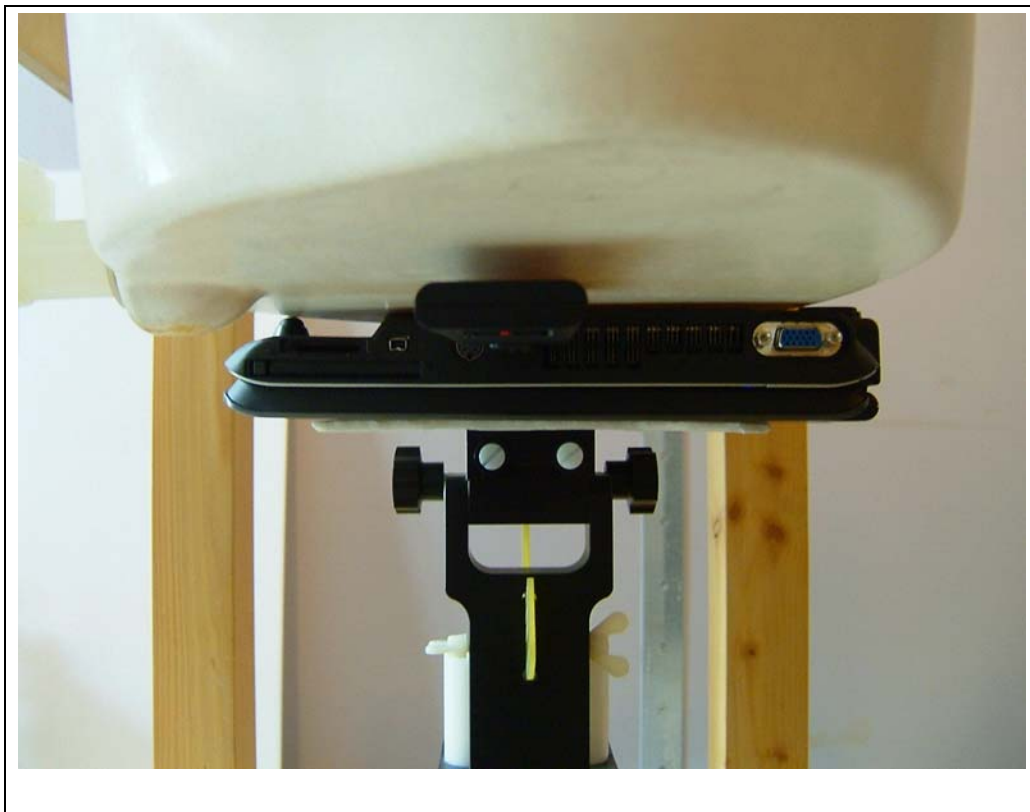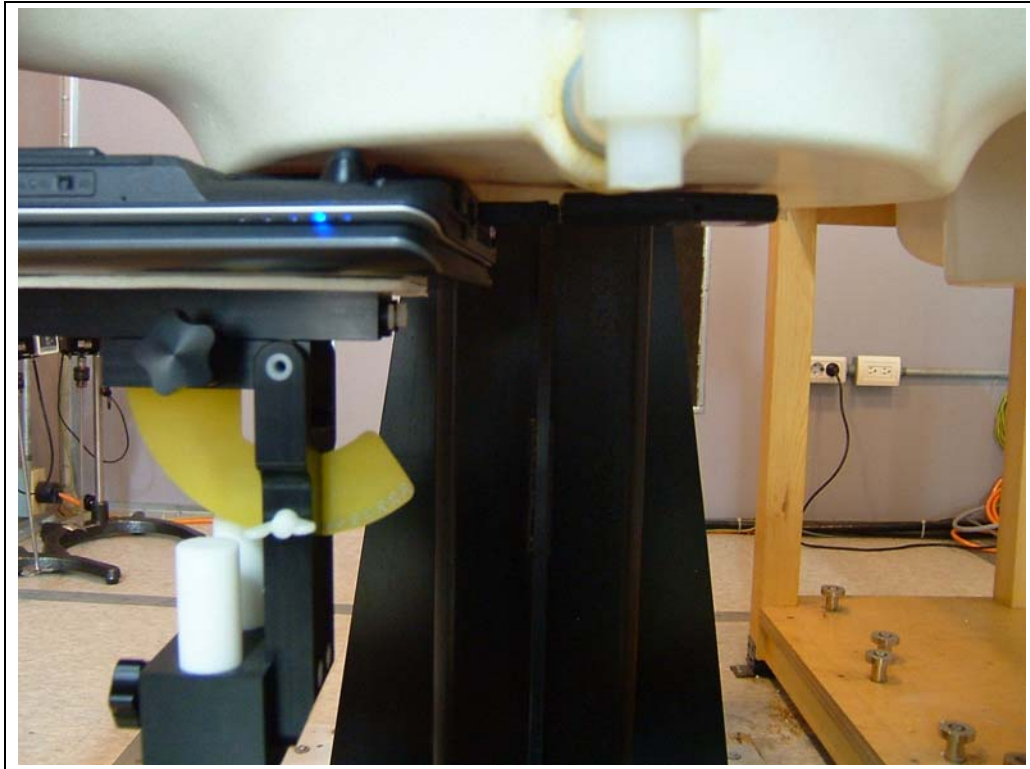**SAR(1 g) = 0.376 mW/g; SAR(10 g) = 0.233 mW/g**

SAR   TEST   SET   UP   PHOTO

View 1

Company Name :
Haier Telecom(i)Pvt.Ltd.

Model Name : USO2T

[CDMA USB Modem]

View 2

View 3

PROBE CALIBRATION

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

ilac-MRA

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

Accreditation No.: **SCS 108**

Client   **Digital EMC (Dymstec)**

Certificate No: **ET3-1702_Mar07**

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1702
Calibration procedure(s)	QA CAL-01.v5 and QA CAL-12.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	March 20, 2007
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	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

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

Issued: March 21, 2007

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

ilac-MRA

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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
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,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:

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

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).

- *NORM(f)x,y,z = NORMx,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*.

- *DCPx,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 ≤ 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 NORMx,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 ET3DV6

SN:1702

Manufactured: July 3, 2002
Last calibrated: March 23, 2006
Recalibrated: March 20, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1702

Sensitivity in Free Space[A]

			Diode Compression[B]	
NormX	**1.62** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**93** mV
NormY	**1.68** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**95** mV
NormZ	**1.65** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**98** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL   **900 MHz**   **Typical SAR gradient: 5 % per mm**

		3.7 mm	4.7 mm
Sensor Center to Phantom Surface Distance			
SAR_{be} [%]	Without Correction Algorithm	7.6	4.3
SAR_{be} [%]	With Correction Algorithm	0.7	0.1

TSL   **1810 MHz**   **Typical SAR gradient: 10 % per mm**

		3.7 mm	4.7 mm
Sensor Center to Phantom Surface Distance			
SAR_{be} [%]	Without Correction Algorithm	13.3	9.1
SAR_{be} [%]	With Correction Algorithm	0.5	0.3

Sensor Offset

Probe Tip to Sensor Center   **2.7** mm

---

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 E^2-field uncertainty inside TSL (see Page 8).

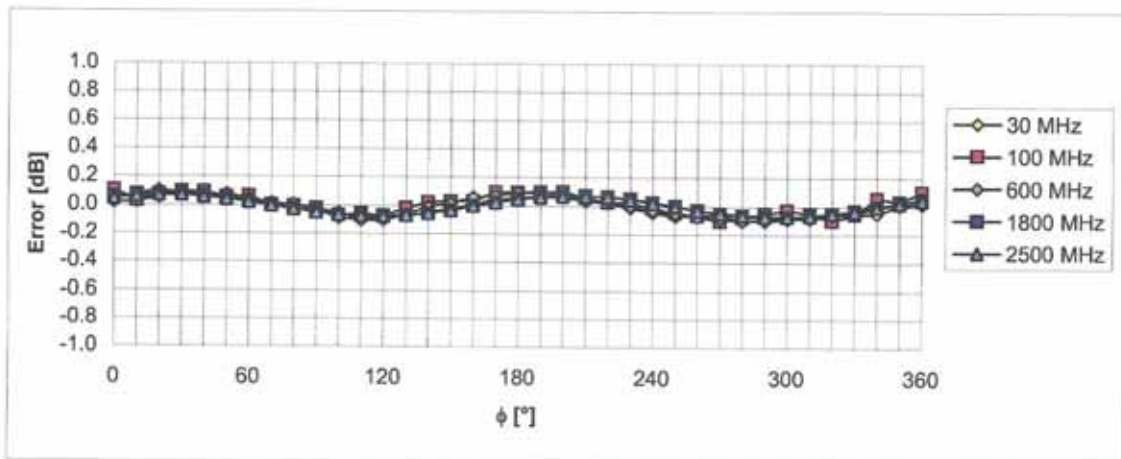[B] Numerical linearization parameter: uncertainty not required.
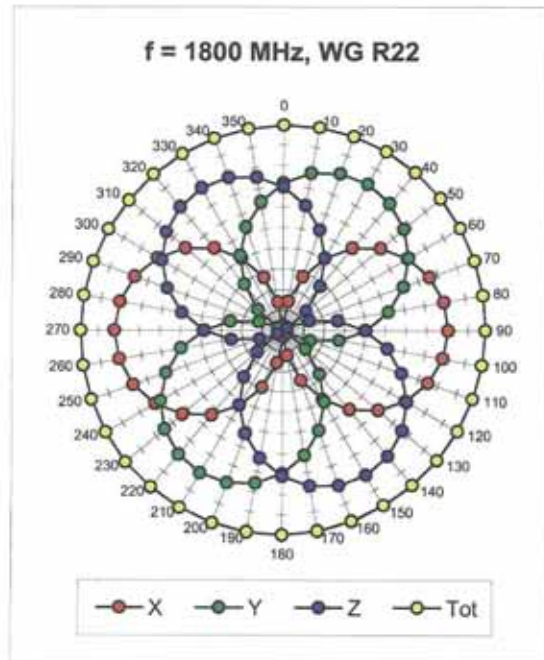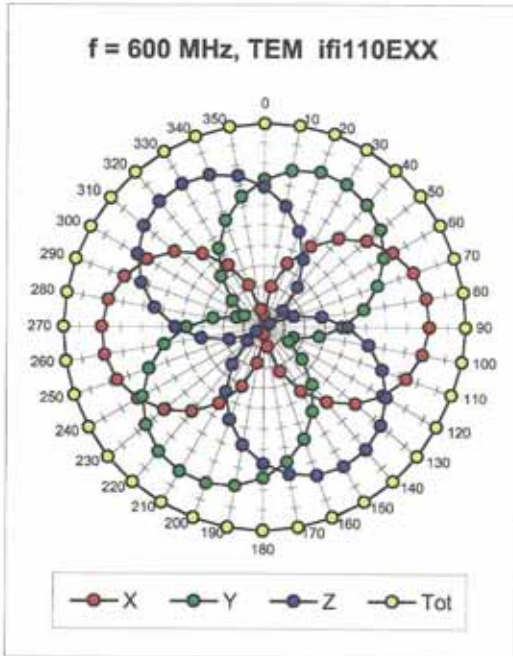
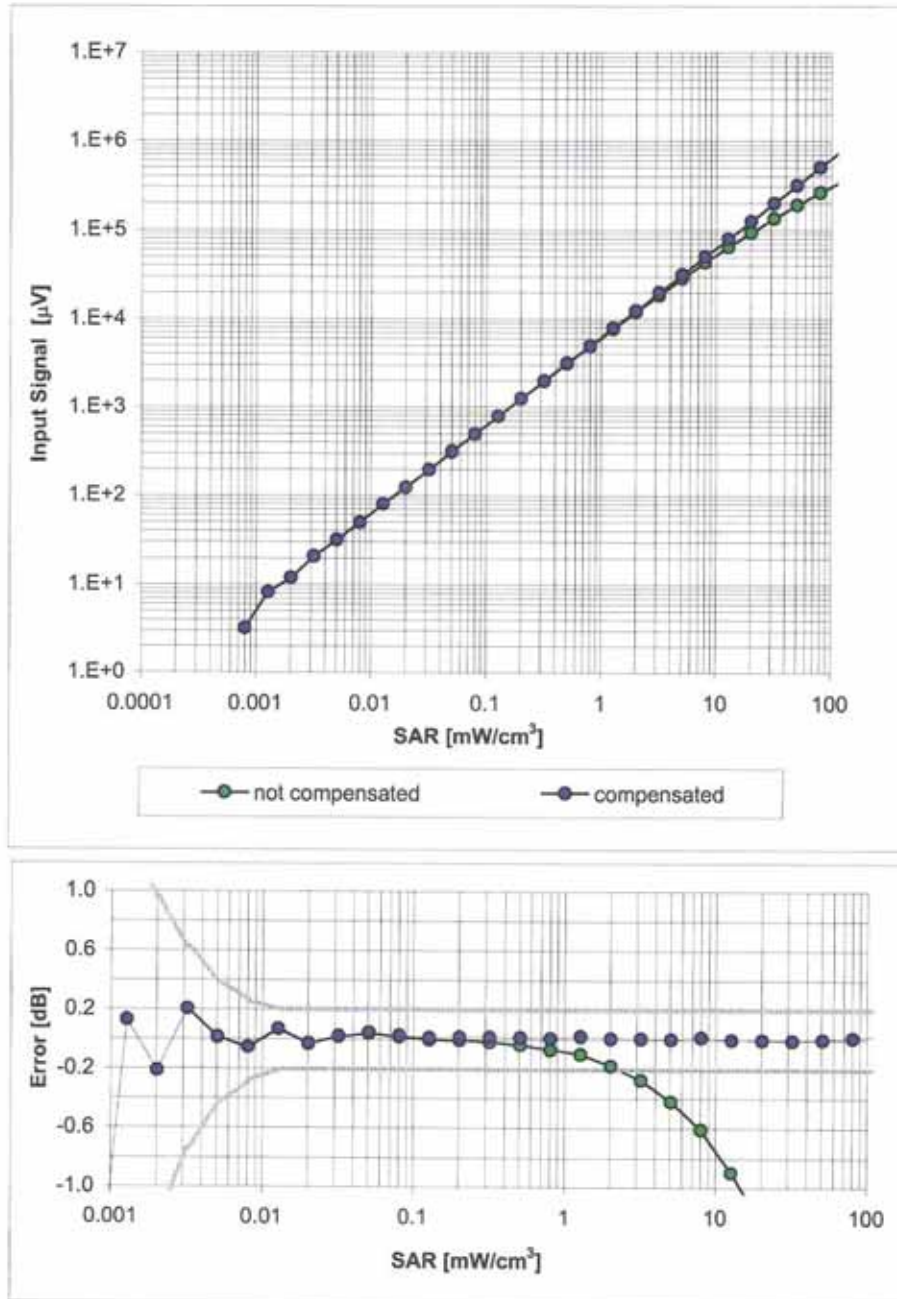# Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)
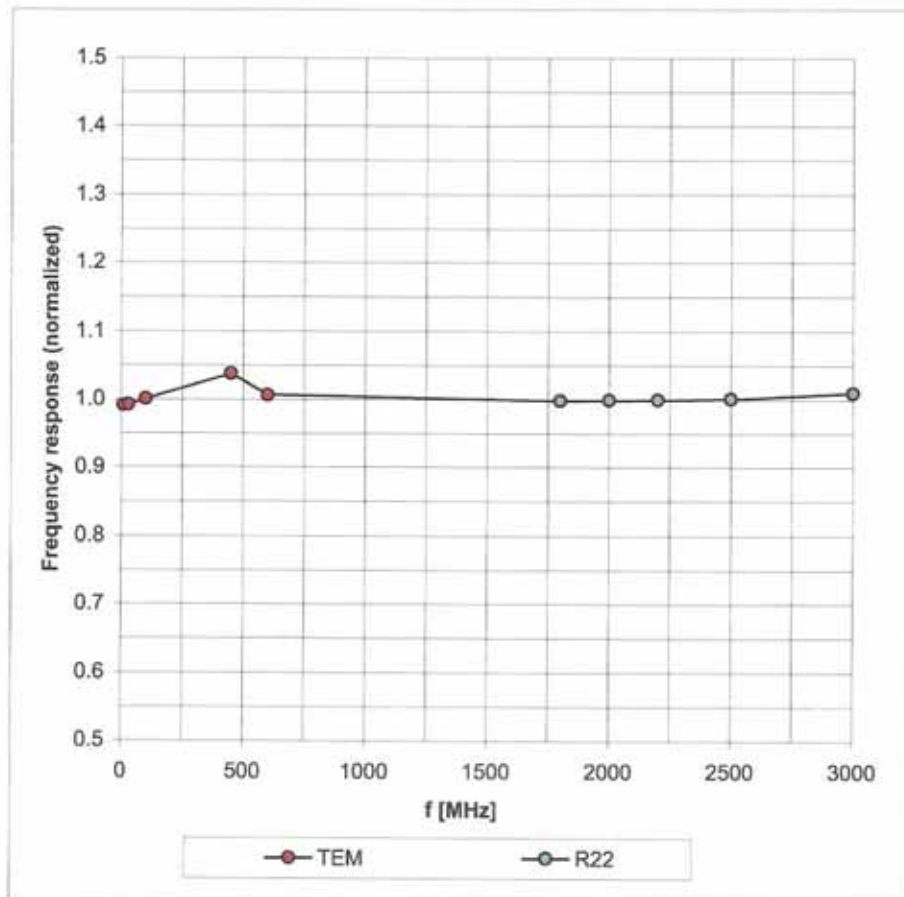
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$

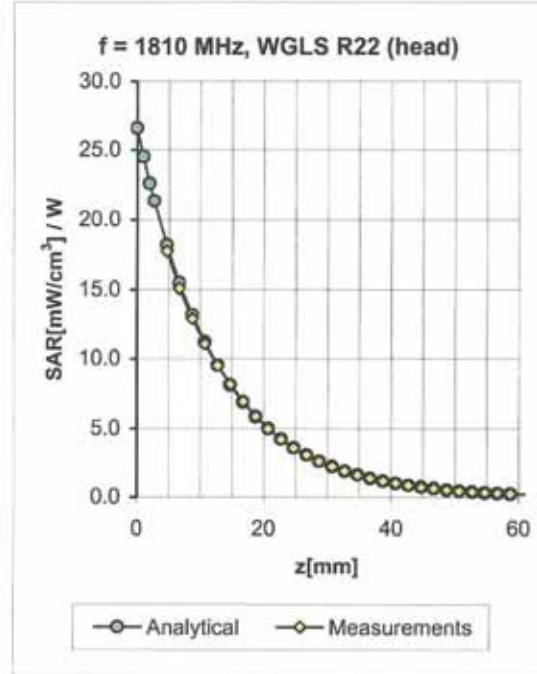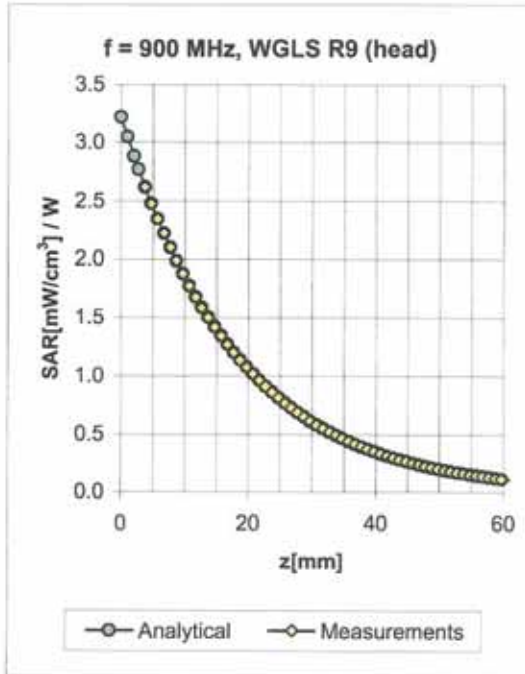### f = 600 MHz, TEM ifi110EXX

f = 1800 MHz, WG R22

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

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

Conversion Factor Assessment

f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.36	1.83	7.52	± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.32	2.45	6.34	± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.47	2.83	5.27	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.56	2.28	4.61	± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.30	1.90	8.09	± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.29	2.88	6.22	± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.58	2.64	4.93	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.54	2.21	4.13	± 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.

Deviation from Isotropy in HSL
Error (φ, ϑ), f = 900 MHz
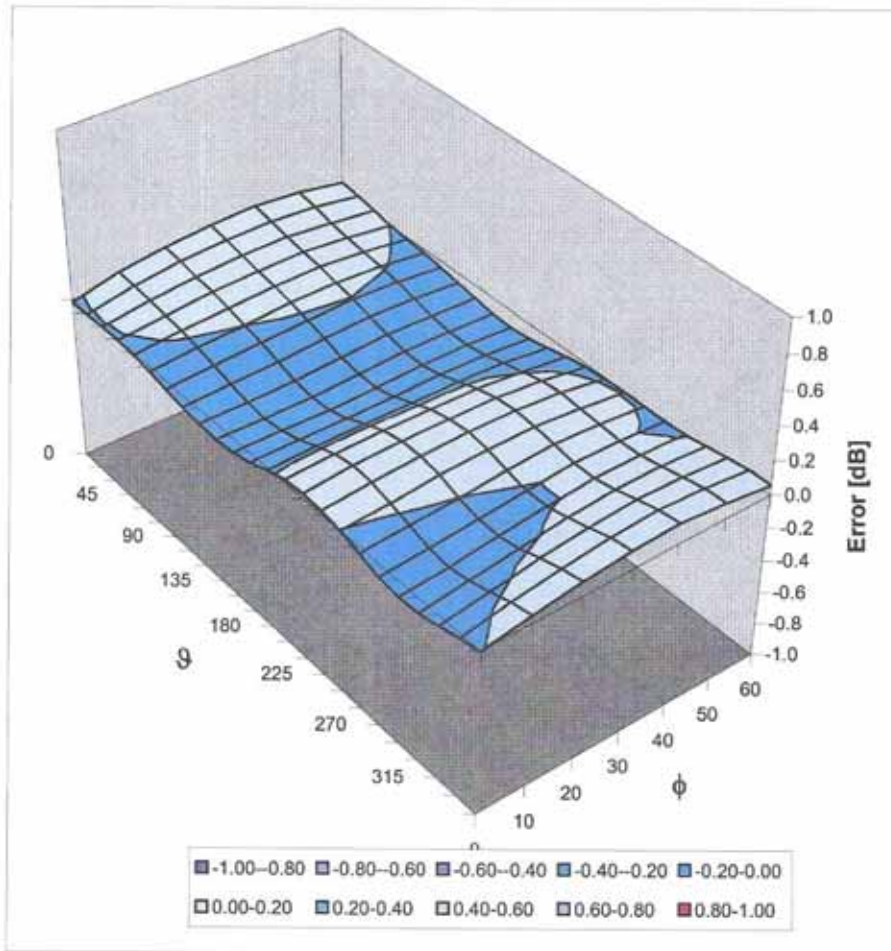
Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DIPOLE   CALIBRATION

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

S	Schweizerischer Kalibrierdienst
C	Service suisse d'étalonnage
	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   **Digital EMC (Dymstec)**

Certificate No: **D835V2-464_Jan06**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 464
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	January 19, 2006
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference Probe ET3DV6	SN 1507	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 20, 2006

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

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

Accredited by the Swiss Federal Office of Metrology and Accreditation   Accreditation No.: **SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

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

b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.

- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.

- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.

- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.

- *SAR measured:* SAR measured at the stated antenna input power.

- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.

- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

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

DASY Version	DASY4	V4.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.1 ± 6 %	0.91mho/m ± 6 %
Head TSL temperature during test	(21.9 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	250 mW input power	2.30 mW / g
SAR normalized	normalized to 1W	9.20 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**9.09 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.47 mW / g
SAR normalized	normalized to 1W	5.88 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**5.83 mW / g ± 16.5 % (k=2)**

---

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6 Ω - 2.0 jΩ
Return Loss	- 33.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.380 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 27, 2002

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:464

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB;
Medium parameters used: f = 835 MHz; σ = 0.91 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(6.09, 6.09, 6.09); Calibrated: 28.10.2005

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 15.12.2005

- Phantom: Flat Phantom 4.9L; Type: QD000P49AA

- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Pin = 250 mW; d = 10 mm/Area Scan (71x81x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.46 mW/g

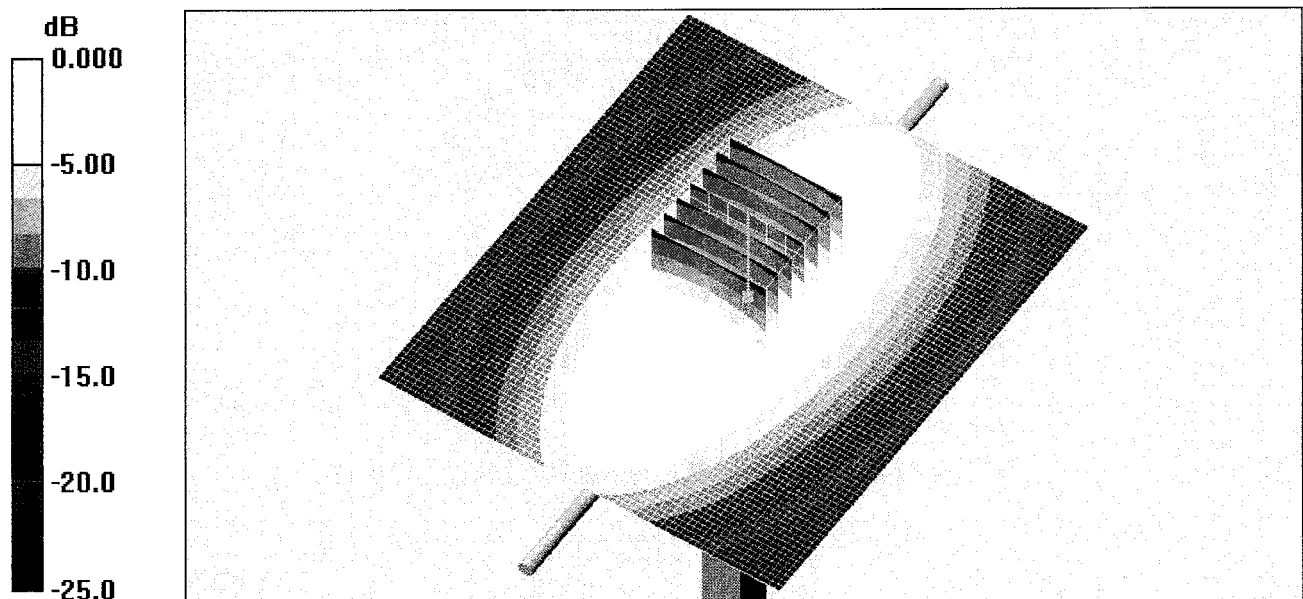# Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.1 V/m; Power Drift = -0.006 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.3 mW/g; SAR(10 g) = 1.47 mW/g
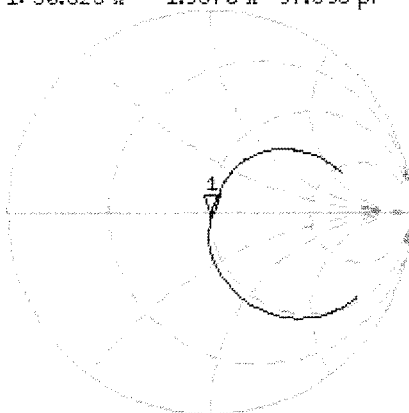Maximum value of SAR (measured) = 2.48 mW/g

0 dB = 2.48mW/g

Impedance Measurement Plot for Head TSL

19 Jan 2006 11:53:51

CH1 S11   1 U FS   1: 50.625 Ω   -1.9570 Ω 97.395 pF   835.000 000 MHz
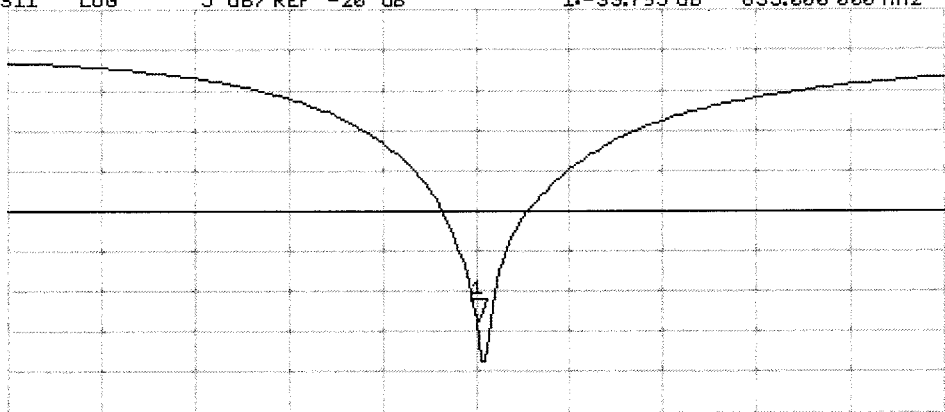
*

Del

CΔ

Avg
16

↑

CH2 S11   LOG   5 dB/ REF -20 dB   1:-33.795 dB   835.000 000 MHz

CΔ

Avg
16

↑

CENTER 835.000 000 MHz   SPAN 400.000 000 MHz