TEST REPORT

Your Ref:

Date: 03 Aug 2005

Our Ref: 56S050648/01

DID: +65-6885 1476

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COMPLIANCE REPORT ON TESTING IN ACCORDANCE WITH
SAR (SPECIFIC ABSORPTION RATE) REQUIREMENTS

Supplement C (Edition 01-01)
FCC OET Bulletin 65 (Edition 97-01)

OF A

2.4GHZ WIRELESS HEADPHONE
[Models : NTED-800]

TEST FACILITY Telecoms & EMC, Testing Group, PSB Corporation
1 Science Park Drive, Singapore 118221

PREPARED FOR Nasaco Electronics Pte Ltd
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JOB NUMBER 56S050648

TEST PERIOD 29 July 2005

PREPARED BY

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Product Manager

PSB TEST Your Peace of Mind

ISO 9001 JQA-QMA 10040

ilac-MRA ACCREDITED LABORATORY SAC-SINGLAS

LA-2001-0212-A
LA-2001-0213-F
LA-2001-0214-E
LA-2001-0215-B
LA-2001-0216-G
LA-2001-0217-G

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.

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TEST SUMMARY

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The product was tested in accordance with the following standards.

Test Results Summary

Test Standards	Description	Pass / Fail
• Supplement C (Edition 01-01) to FCC OET Bulletin 65 (Edition 97-01) • ANSI/IEEE Standard C95.1-1993	SAR Measurement (Wireless) Device at head phantom	Pass *

Note:

1. The worst-case SAR value was found to be **0.136W/kg** which is lower than the maximum limit of 1.60 W/kg, over 1g of tissue.

* Based on spatial peak uncontrolled exposure / general population level:
Head: 1.60 W/kg, over 1g of tissue.

Modifications

No modifications were made.

DEVICE DESCRIPTION

Description	The Equipment Under Test (EUT) is a **2.4GHz Wireless Headphone**.
Device Category	Portable Device
Exposure Environment	General Population/Uncontrolled exposure
Test Device Type	Production Unit
Model	NTED-800
Brand Name	Nasaco
Serial Numbers	Nil
FCC ID	LLP-NTED800

DEVICE OPERATING CONFIGURATION

Operating Frequencies	Wireless Mode Channel 1 (2402MHz) Channel 39 (2441MHz) Channel 78 (2480MHz)
Operating Temperature Tolerance	-20 to +50 Degree Celsius
Operating Voltage Tolerance	3 to 4.5 Volt DC
Continuous Transmission Tolerance	The EUT is able to transmit for about 120 minutes at the maximum power under fully battery charged condition.
Rated Output Power	15dBm ± 5dBm Maximum
Antenna Type	SMD Chip Antenna
EUT Crest Factor	1.0
Input Power	Rechargeable Ni MH Battery , AAA size, 1.2V DC 800mAh (Qty 3)
Accessories	Charger

MANUFACTURER

Manufacturer Address	Nasaco Electronics (HK) Ltd RM 1106, Eastern Centre, 1065 King's Road Hong Kong
DID	(852) 2563 0592
Fax	(852) 2565 9613

DEVICE OPERATING CONDITION

The EUT was exercised by operating at the following frequencies 2.402GHz, 2.441GHz and 2.48GHz. For every SAR measurement, the EUT was set to maximum output power level using fully charged battery.

TEMPERATURE AND HUMIDITY

Wireless Mode (Head)

Ambient Temperature:	24 ± 1^0 C
Tissue Temperature:	24 ± 1^0 C
Humidity:	54% to 59%

The measurement results were obtained with the EUT tested in the conditions described in this report (Annex A).

Table 1 - SAR Test Results (Wireless) – Device at head phantom

Phantom Configuration	Device Test Positions	Antenna Position	SAR (W/kg), over 1g Tissue Device Test Channel & Frequency		
			Channel: 1 2402MHz	Channel: 39 2441MHz	Channel: 78 2480MHz
Left Side of	Cheek / Touch	fixed	0.136	0.118	0.090
Right Side of	Cheek / Touch	fixed	0.075	0.072	0.085
Output Power (dBm) Before Test			19.1	19.6	18.8
Output Power (dBm) After Test			18.6	18.8	18.4

Remarks:

1. All modes of operations were investigated and the worst-case SAR levels are reported.
2. Three fully charged Ni MH Batteries, AAA size, 1.2V DC 800mAh were used during operation.
3. For **Wireless mode**, the worst-case SAR value was found to be **0.136W/Kg** (over a 1g tissue) at **Channel 1** which is lower than the maximum limit of 1.60 W/Kg, please refer to the above table.
4. The SAR limit of 1.60W/Kg (Spatial Peak level for Uncontrolled Exposure / General Population) is based on the Test Standards:
   a) Supplement C (Edition 01-01) to FCC OET Bulletin 65 (Edition 97-01)
   b) ANSI/IEEE Standard C95.1-1993

Ambient Temperature: **24 ± 1^0 C**
Tissue Temperature: **24 ± 1^0 C**
Humidity: **54% to 59%**

Test Laboratory: PSB Corporation, Telecoms and EMC. **Date: 29/Jul/2005**
File Name: Left Head_0 Deg_CH 1_Data 4.da4
Program Name: Job Nos.: 56S050648
Phantom section: Left Section
DUT: Wireless Headset
Communication System: 2450 Mhz_Wireless Mode
Frequency: 2402 MHz
Duty Cycle: 1:1
Medium: 2450MHz Head TissueMedium parameters used: σ = 1.8736 mho/m, ε_r = 38.84; ρ = 1000 kg/m^3
DASY4 Configuration:
Electronics: DAE4 Sn627 Calibrated: 12/Jul/2005
Phantom: SAM 12 Measurement SW: DASY4, V4.5 Build 19
Probe: EX3DV4 - SN3541 ConvF(7.54, 7.54, 7.54) Calibrated: 18/Jul/2005
Postprocessing SW: SEMCAD, V1.8 Build 146
Sensor-Surface: 4mm (Mechanical Surface Detection)

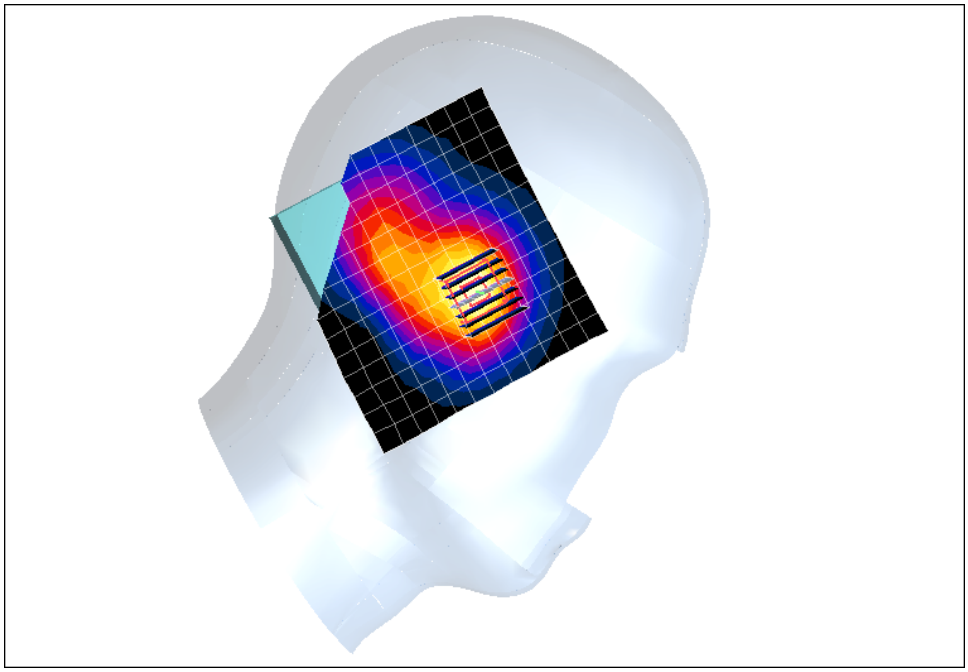
Left Head_0 Deg_CH 1_Data 4/Area Scan (13x14x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.154 mW/g

Left Head_0 Deg_CH 1_Data 4/Zoom Scan (7x7x7)/Cube 0:

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

Reference Value = 8.35 V/m; Power Drift = -0.895 dB
Peak SAR (extrapolated) = 0.242 W/kg
SAR(1 g) = 0.136 mW/g; SAR(10 g) = 0.077 mW/g
Maximum value of SAR (measured) = 0.146 mW/g



Ambient Temperature: **24 ± 1^0 C**
Tissue Temperature: **24 ± 1^0 C**
Humidity: **54% to 59%**

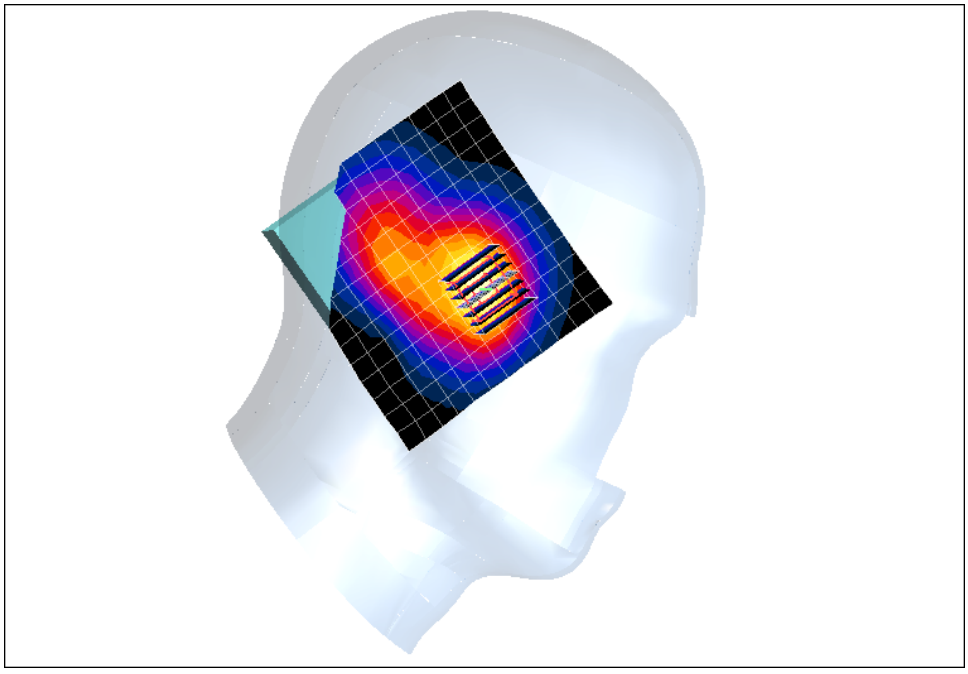
Test Laboratory: PSB Corporation, Telecoms and EMC. **Date: 29/Jul/2005**
File Name: Left Head_0 Deg_CH 39_Data 5.da4
Program Name: Job Nos.: 56S050648
Phantom section: Left Section
DUT: Wireless Headset
Communication System: 2450 Mhz_Wireless Mode
Frequency: 2441 MHz
Duty Cycle: 1:1
Medium: 2450MHz Head TissueMedium parameters used: σ = 1.8736 mho/m, ε_r = 38.84; ρ = 1000 kg/m^3
DASY4 Configuration:
Electronics: DAE4 Sn627 Calibrated: 12/Jul/2005
Phantom: SAM 12 Measurement SW: DASY4, V4.5 Build 19
Probe: EX3DV4 - SN3541 ConvF(7.54, 7.54, 7.54) Calibrated: 18/Jul/2005
Postprocessing SW: SEMCAD, V1.8 Build 146
Sensor-Surface: 4mm (Mechanical Surface Detection)

Left Head_0 Deg_CH 39_Data 5/Area Scan (13x14x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.130 mW/g

Left Head_0 Deg_CH 39_Data 5/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.18 V/m; Power Drift = -0.536 dB
Peak SAR (extrapolated) = 0.210 W/kg
SAR(1 g) = 0.118 mW/g; SAR(10 g) = 0.067 mW/g
Maximum value of SAR (measured) = 0.124 mW/g



Ambient Temperature: **24 ± 1^0 C**
Tissue Temperature: **24 ± 1^0 C**
Humidity: **54% to 59%**

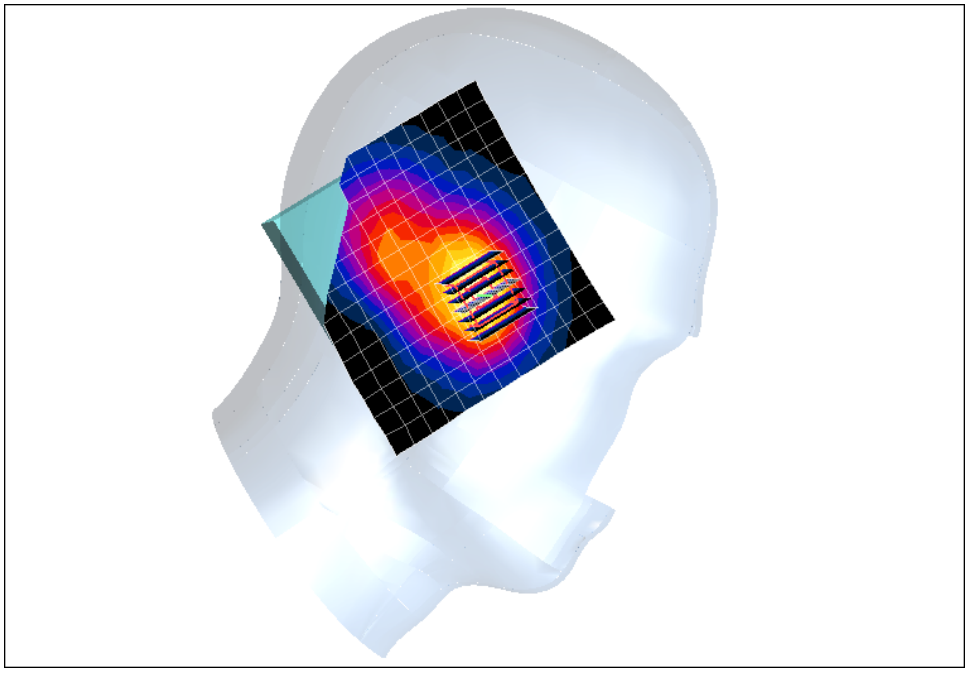
Test Laboratory: PSB Corporation, Telecoms and EMC. **Date: 29/Jul/2005**
File Name: Left Head_0 Deg_CH 78_Data 6.da4
Program Name: Job Nos.: 56S050648
Phantom section: Left Section
DUT: Wireless Headset
Communication System: 2450 Mhz_Wireless Mode
Frequency: 2480 MHz
Duty Cycle: 1:1
Medium: 2450MHz Head TissueMedium parameters used: σ = 1.8736 mho/m, ε_r = 38.84; ρ = 1000 kg/m^3
DASY4 Configuration:
Electronics: DAE4 Sn627 Calibrated: 12/Jul/2005
Phantom: SAM 12 Measurement SW: DASY4, V4.5 Build 19
Probe: EX3DV4 - SN3541 ConvF(7.54, 7.54, 7.54) Calibrated: 18/Jul/2005
Postprocessing SW: SEMCAD, V1.8 Build 146
Sensor-Surface: 4mm (Mechanical Surface Detection)

Left Head_0 Deg_CH 78_Data 6/Area Scan (13x14x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.099 mW/g

Left Head_0 Deg_CH 78_Data 6/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.27 V/m; Power Drift = -0.398 dB
Peak SAR (extrapolated) = 0.163 W/kg
SAR(1 g) = 0.090 mW/g; SAR(10 g) = 0.051 mW/g
Maximum value of SAR (measured) = 0.096 mW/g



Ambient Temperature: 24 ± 1^0 C
Tissue Temperature: 24 ± 1^0 C
Humidity: 54% to 59%

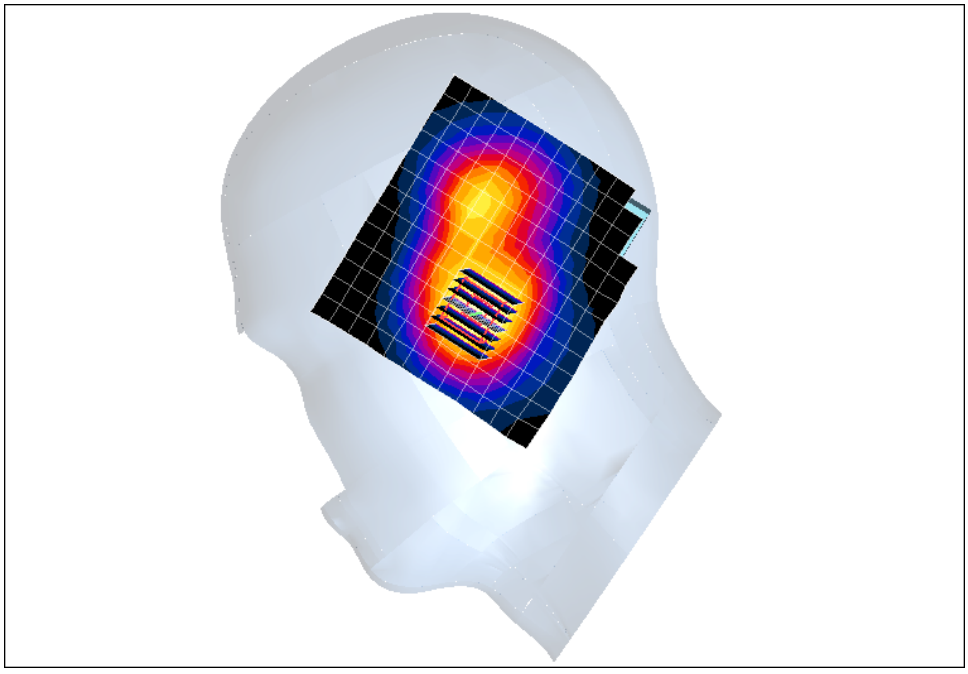
Test Laboratory: PSB Corporation, Telecoms and EMC. **Date: 29/Jul/2005**
File Name: Right Head_0 Deg_CH 1_Data 1.da4
Program Name: Job Nos.: 56S050648
Phantom section: Right Section
DUT: Wireless Headset
Communication System: 2450 Mhz_Wireless Mode
Frequency: 2402 MHz
Duty Cycle: 1:1
Medium: 2450MHz Head TissueMedium parameters used: $\sigma = 1.8736$ mho/m, $\varepsilon_r = 38.84$; $\rho = 1000$ kg/m^3
DASY4 Configuration:
Electronics: DAE4 Sn627 Calibrated: 12/Jul/2005
Phantom: SAM 12 Measurement SW: DASY4, V4.5 Build 19
Probe: EX3DV4 - SN3541 ConvF(7.54, 7.54, 7.54) Calibrated: 18/Jul/2005
Postprocessing SW: SEMCAD, V1.8 Build 146
Sensor-Surface: 4mm (Mechanical Surface Detection)

Right Head_0 Deg_CH 1_Data 1/Area Scan (13x14x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.091 mW/g

Right Head_0 Deg_CH 1_Data 1/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.54 V/m; Power Drift = -1.67 dB
Peak SAR (extrapolated) = 0.137 W/kg
SAR(1 g) = 0.075 mW/g; SAR(10 g) = 0.044 mW/g
Maximum value of SAR (measured) = 0.081 mW/g



Ambient Temperature: 24 ± 1^0 C
Tissue Temperature: 24 ± 1^0 C
Humidity: 54% to 59%

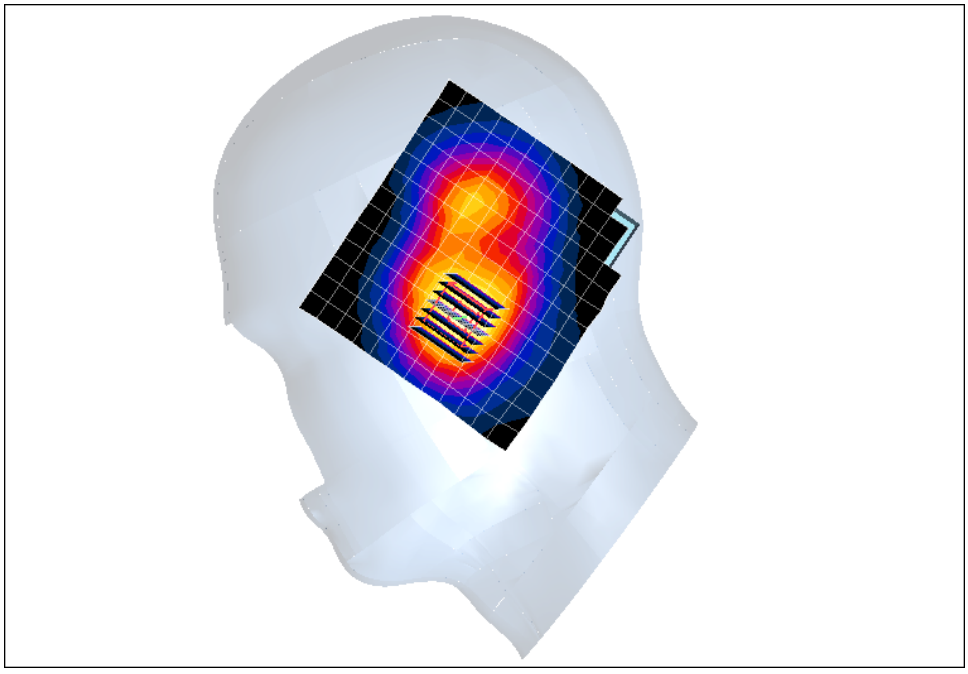
Test Laboratory: PSB Corporation, Telecoms and EMC. **Date: 29/Jul/2005**
File Name: Right Head_0 Deg_CH 39_Data 2.da4
Program Name: Job Nos.: 56S050648
Phantom section: Right Section
DUT: Wireless Headset
Communication System: 2450 Mhz_Wireless Mode
Frequency: 2441 MHz
Duty Cycle: 1:1
Medium: 2450MHz Head TissueMedium parameters used: $\sigma = 1.8736$ mho/m, $\varepsilon_r = 38.84$; $\rho = 1000$ kg/m^3
DASY4 Configuration:
Electronics: DAE4 Sn627 Calibrated: 12/Jul/2005
Phantom: SAM 12 Measurement SW: DASY4, V4.5 Build 19
Probe: EX3DV4 - SN3541 ConvF(7.54, 7.54, 7.54) Calibrated: 18/Jul/2005
Postprocessing SW: SEMCAD, V1.8 Build 146
Sensor-Surface: 4mm (Mechanical Surface Detection)

Right Head_0 Deg_CH 39_Data 2/Area Scan (13x14x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.082 mW/g

Right Head_0 Deg_CH 39_Data 2/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.04 V/m; Power Drift = -1.42 dB
Peak SAR (extrapolated) = 0.131 W/kg
SAR(1 g) = 0.072 mW/g; SAR(10 g) = 0.041 mW/g
Maximum value of SAR (measured) = 0.077 mW/g



Ambient Temperature: **24 ± 1^0 C**
Tissue Temperature: **24 ± 1^0 C**
Humidity: **54% to 59%**

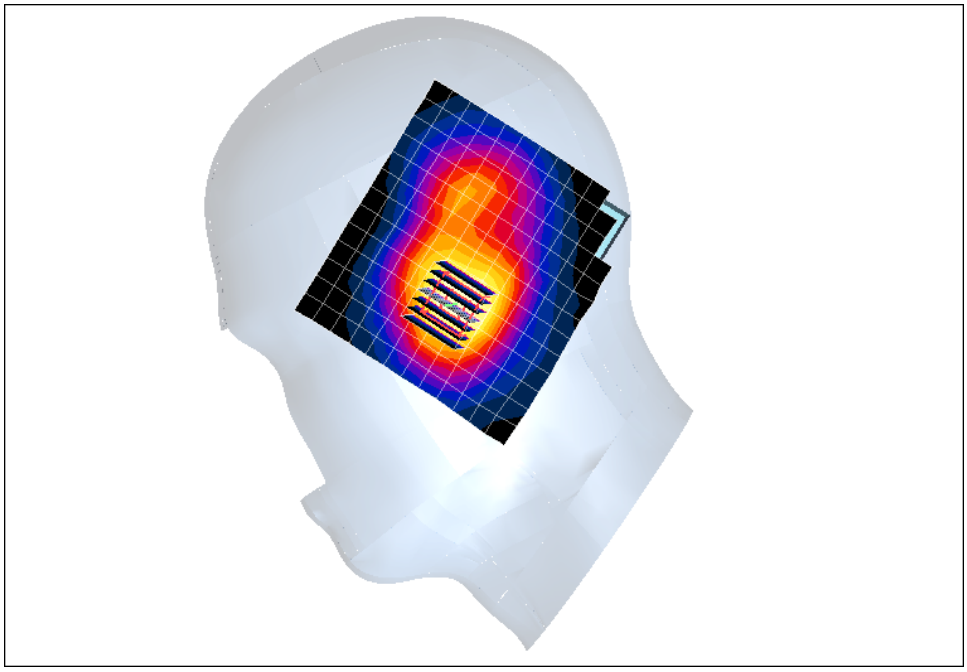
Test Laboratory: PSB Corporation, Telecoms and EMC. **Date: 29/Jul/2005**
File Name: Right Head_0 Deg_CH 78_Data 3.da4
Program Name: Job Nos.: 56S050648
Phantom section: Right Section
DUT: Wireless Headset
Communication System: 2450 Mhz_Wireless Mode
Frequency: 2480 MHz
Duty Cycle: 1:1
Medium: 2450MHz Head TissueMedium parameters used: σ = 1.8736 mho/m, ε_r = 38.84; ρ = 1000 kg/m^3
DASY4 Configuration:
Electronics: DAE4 Sn627 Calibrated: 12/Jul/2005
Phantom: SAM 12 Measurement SW: DASY4, V4.5 Build 19
Probe: EX3DV4 - SN3541 ConvF(7.54, 7.54, 7.54) Calibrated: 18/Jul/2005
Postprocessing SW: SEMCAD, V1.8 Build 146
Sensor-Surface: 4mm (Mechanical Surface Detection)

Right Head_0 Deg_CH 78_Data 3/Area Scan (13x14x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.092 mW/g

Right Head_0 Deg_CH 78_Data 3/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.45 V/m; Power Drift = -0.734 dB
Peak SAR (extrapolated) = 0.157 W/kg
SAR(1 g) = 0.085 mW/g; SAR(10 g) = 0.049 mW/g
Maximum value of SAR (measured) = 0.091 mW/g



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May 2005

ANNEX A

TEST INSTRUMENTATION
&
GENERAL PROCEDURE

A.1 General Test Procedure

In the SAR measurement, the positioning of the probes must be performed with sufficient accuracy to obtain repeatable measurements in the presence of rapid spatial attenuation phenomena. The accurate positioning of the E-field probe is accomplished by using a high precision robot. The robot can be taught to position the probe sensor following a specific pattern of points. In a first sweep, the sensor is positioned as close as possible to the interface, with the sensor enclosure touching the inside of the fiberglass shell. The SAR is measured on a grid of points, which covers the curved surface of the phantom in an area larger than the size of the EUT. After the initial scan, a high- resolution grid is used to locate the absolute maximum measured energy point. At this location, attenuation versus depth scan will be accomplished by the measurement system to calculate the SAR value.

A.2 SAR Test Instrumentation

SAR Measurement System

- **Positioning Equipment**
  Type: High Precision Industrial Robot, RX90.
  Precision: High precision (repeatability 0.02mm)
  Reliability: High reliability (industrial design)

- **Compaq Computer**
  Type: 2.4GHz Pentium
  Memory: 512MB SDRAM
  Operating System: Windows 2000
  Dell Monitor: 17” LCD

- **Dosimetric E-Field Probe**
  Type: ET3DV6
  Isotropy Error (∅): ±0.25dB
  Dynamic Range: 0.01 – 100 W/kg

- **Phantom & Tissue**
  Phantom: “Phantom SAM 12” and “450MHz Phantom” were manufactured by SPEAG.
  Tissue: Simulated Tissue with electrical characteristics similar to those of the human at normal body temperature (23 ± 1°C)
  Shell: Fiberglass shell phantom with 2mm thickness for “Phantom SAM 12”.
  Fiberglass shell phantom with 2mm or 6mm thickness for “450MHz Flat Phantom”.

A.3 Test Setup

Phantom

The "Phantom SAM 12", manufactured by SPEAG is a fiberglass shell phantom with 2 mm shell thickness. It has three measurement areas:

- Left hand
- Right hand
- Flat phantom

The "450MHz Flat Phantom", manufactured by SPEAG is a fiberglass shell phantom with 2mm or 6mm shell thickness. It has one measurement areas:

- Flat phantom

1) The "Phantom SAM 12" table comes in the sizes: A 100x50x85 cm (LxWxH).
2) The "450MHz Flat Phantom – 6mm Shell Thickness" table comes in the sizes: A 82x44x18 cm (LxWxH) is used for System Validation Test.
3) The "450MHz Flat Phantom – 2mm Shell Thickness" table comes in the sizes: A 82x44x18 cm (LxWxH) is used for SAR Measurement.

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different solutions).

Simulated tissue

Simulated Tissue: Suggested in a paper by George Hartsgrove and colleagues in University of Ottawa Ref.: Bioelectromagnetics 8:29-36 (1987)

This simulated tissue is mainly composed of water, sugar and salt. At higher frequencies, in order to achieve the proper conductivity, the solution does not contain salt. Also, at these frequencies, D.I. water and alcohol is preferred.
Tissue Density : Approximately 1.25 g/cm^3

- **Preparation**
  The ingredients (i.e. water, sugar, salt, etc) required to prepare the simulated tissue are carefully weighed and poured into a clean container for mixing. A stirring paddle, that is attached to a hand drill is used to stir the solution for a duration of about 30 minutes or more. When the ingredients are completely dissolved, the solution is left in the container for the air bubbles to disappear.

- **Measurement of Electrical Characteristics of Simulated Tissue**
  1) S-PARAMETER Network Analyzer, Agilent 8753ES (30kHz – 6GHz)
  2) Agilent 85070D Dielectric Probe Kit

ELECTRICAL CHARACTERISTIC MEASUREMENT SETUP

- **Description of the Agilent 85070D Dielectric Probe Kit**

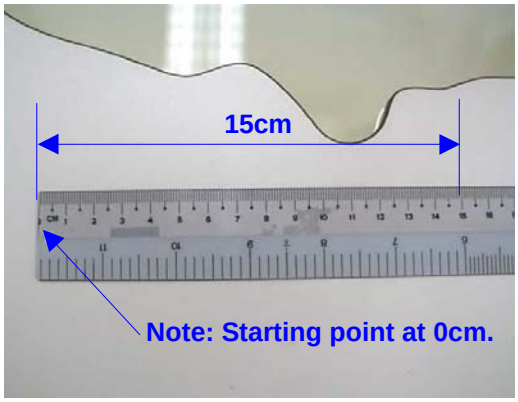
  The 85070D is a dielectric probe that is used to measure the intrinsic electrical properties of materials in the RF and microwave frequency bands. The 85070D software allows you to measure the complex dielectric constant (also called permittivity) of liquids and semi-solids, incuding the dielectric loss factor of loss tangent.

  To obtain data at hundreds of frequencies in seconds, simply immerse the probe into liquids or semi-solids - no special fixtures or containers are required. The 85070D must be used in conjunction with an Agilent network analyzer. The network analyzer provides the high frequency stimulus, and measures the reflected response.

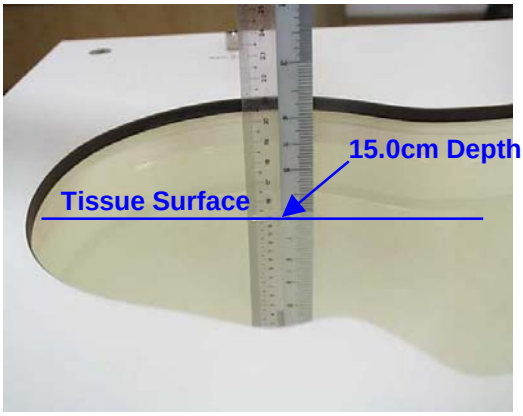
  The probe transmits a signal into the material under test (MUT). The measured reflected response from the materials is then related to its dielectric properties. A computer controls the system, and runs software that guides the user through a measurement sequence. An effort is made to keep the results dielectric constant and conductivity within 5 % of published data.

Tissue Depth

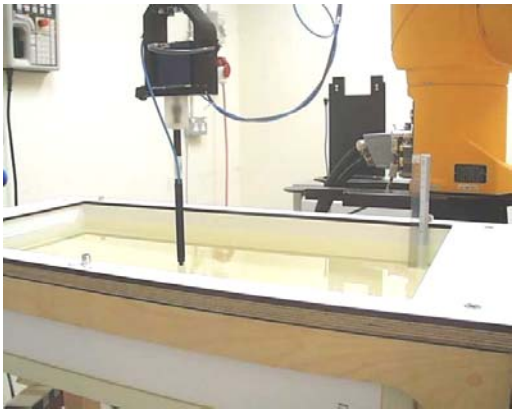
The tissue depth at the "Phantom SAM 12", "450MHz Flat Phantom – 6mm Shell Thickness" and "450MHz Flat Phantom – 2mm Shell Thickness" is approximately 15cm ±0.5cm.



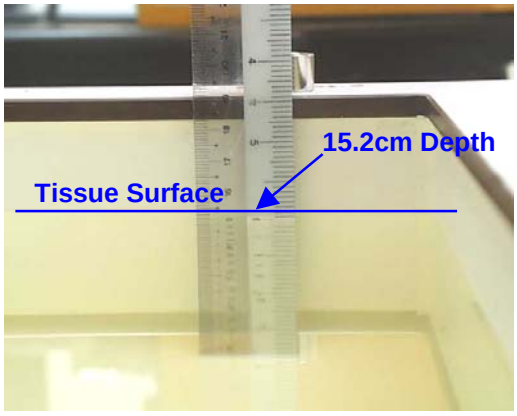
At "Phantom SAM 12"



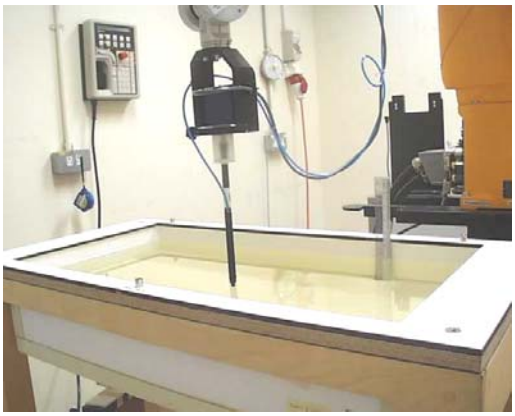
Tissue – 15.0cm Depth



At "450MHz Flat Phantom – 6mm Shell Thickness"



Tissue – 15.2cm Depth



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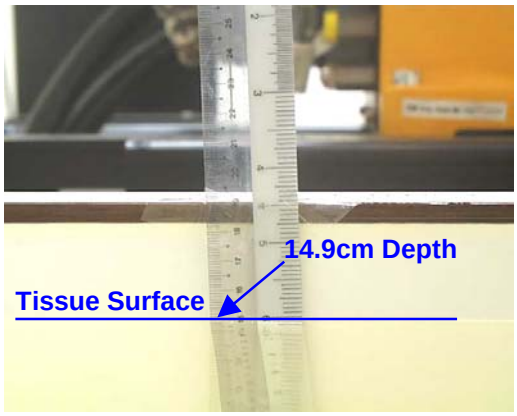
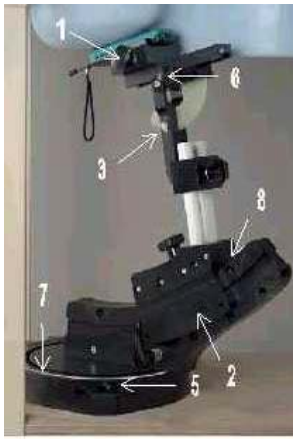


Tissue – 14.9cm Depth

Positioning of EUT



The DASY4 holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65º. The intended use position in the CENELEC document is has a rotation angle of 65º and an inclination angle of 80º. The rotation centers for both scales is the ear opening. Thus the device needs no repositioning when changing the angles. The device rotation around the device axis is not changed in the holder. In the CENELEC standard it is always 0º. If the standard changes, a support will be provided with the new angle.

1. **"Cheek/Touch Position"** – the device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom. This test position is established:

i) When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.

ii) (Or) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

For existing head phantoms – when the handset loses contact with the phantom at the pivotingpoint, rotation should continue until the device touches the cheek of the phantom or breaks its last contact from the ear spacer.

2. **"Ear/Tilt Position"** – With the handset aligned in the "Cheek/Touch Position":

i) If the earpiece of the handset is not in full contact with the phantom's ear spacer (in the "Cheek/Touch position") and the peak SAR location for the "Cheek/Touch" position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.

ii) (Otherwise) The handset should be moved (translated) away from the cheek perpendicular to the line passes through both "ear reference points" (note: one of these ear reference points may not physically exist on a split head model) for approximate 2-3 cm. While it is in this position, the handset is tilted away from the mouth with respect to the "test device reference point" by 15°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both "ear reference points" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously. This test position may require a device holder or positioner to achieve the translation and tilting with acceptable positioning repeatability.

3. **Body Worn Configuration**

All body worn accessories are tested for the FCC RF exposure compliance. The phone is positioned into carrying case (if available) and placed below of the flat phantom. Headset or ear piece (if available) is connected during measurements.

TEST INSTRUMENTATION & GENERAL PROCEDURES ANNEX A

Instrument	Model	S/No	Cal Due Date	
Boonton RF Power Meter (Dual Channel)	4532	97701	-	✓
Boonton Power Sensor	51075	31534	-	✓
Boonton Power Sensor	51075	32097	22 Sep 2005	✓
S-Parameter Network Analyzer (30kHz – 6GHz)	8753ES	MY40001026	12 Oct 2005	✓
Agilent 85070D Dielectric Probe Kit	85075D	21356	-	✓
Anritsu RF Signal Generator (10MHz – 20GHz)	68347C	04306	-	✓
Amplifier Research Power Amplifier (800MHz – 4.2GHz)	25S1G4A	29346	-	✓
Agilent Dual Directional Coupler	HP778D	18289	-	✓
R&S Universal Radio Communication Tester	CMU-200	837728/071	9 Mar 2006	✓
900MHz System Validation Dipole	D900V2	1d006	13 July 2006	
1800MHz System Validation Dipole	D1800V2	2d095	14 July 2006	
2450MHz System Validation Dipole	D2450V2	752	12 July 2006	✓
Data Acquisition Electronics (DAE)	DAE 4	627	12 July 2006	✓
Dosimetric E-field Probe	EX3DV4	3541	18 July 2006	✓
Dosimetric E-field Probe	EX3DV4	3542	26 July 2005	

ANNEX B

TEST SETUP PHOTOGRAPHS

TEST SETUP PHOTOGRAPHS ANNEX B

SAR Test Setup Photograph

SAR Test Setup (Device at Head Phantom)

TEST SETUP PHOTOGRAPHS ANNEX B

SAR Test Setup Photograph

SAR Test Setup At Flat Phantom

TEST SETUP PHOTOGRAPHS ANNEX B

Conducted Power Measurement Setup

Conducted Power Measurement Setup

TEST SETUP PHOTOGRAPHS ANNEX B

EUT PHOTOGRAPHS

Front of EUT

ANNEX C

TISSUE SIMULANT DATA SHEETS

Type of Tissue	**Head**
Target Frequency (MHz)	2450
Target Dielectric Constant	39.2
Target Conductivity (S/m)	1.8
Composition (by weight)	Water 20000g (56.69%) Glycol 15278g (43.31%) Sugar (0%) Salt (0%) HEC (0%) Preventol D7 (0%)
Measured Dielectric Constant	38.84
Measured Conductivity (S/m)	1.8736

Probe Name	Dosimetric E-field Probe EX3DV4
Probe Serial Number	3541
Sensor Offset (mm)	1.2
Conversion Factor	7.54 ± 11.8 %
Probe Calibration Due Date (DD/MM/YY)	18 July 2006

Head Tissue at 2450MHz

Frequency	e'	e''	Conductivity
2440000000	38.87	13.78	1.8678
2441000000	38.86	13.77	1.8669
2442000000	38.85	13.76	1.8664
2443000000	38.86	13.78	1.8699
2444000000	38.85	13.76	1.8679
2445000000	38.87	13.78	1.8715
2446000000	38.84	13.77	1.8710
2447000000	38.86	13.76	1.8705
2448000000	38.83	13.77	1.8733
2449000000	38.83	13.78	1.8746
2450000000	**38.84**	**13.77**	**1.8736**
2451000000	38.82	13.77	1.8756
2452000000	38.82	13.76	1.8749
2453000000	38.82	13.77	1.8759
2454000000	38.82	13.76	1.8765
2455000000	38.80	13.77	1.8781
2456000000	38.81	13.76	1.8779
2457000000	38.79	13.78	1.8803
2458000000	38.79	13.76	1.8784
2459000000	38.80	13.77	1.8811
2460000000	38.78	13.76	1.8811
2461000000	38.78	13.78	1.8840
2462000000	38.78	13.78	1.8846
2463000000	38.77	13.77	1.8842
2464000000	38.76	13.77	1.8851
2465000000	38.76	13.78	1.8877
2466000000	38.76	13.78	1.8883
2467000000	38.74	13.78	1.8882
2468000000	38.74	13.79	1.8904
2469000000	38.75	13.78	1.8902
2470000000	38.73	13.79	1.8926
2471000000	38.73	13.79	1.8936
2472000000	38.73	13.80	1.8945
2473000000	38.73	13.79	1.8951
2474000000	38.72	13.80	1.8964
2475000000	38.72	13.80	1.8977
2476000000	38.71	13.80	1.8978
2477000000	38.70	13.80	1.8994
2478000000	38.71	13.81	1.9018
2479000000	38.70	13.81	1.9026
2480000000	38.68	13.82	1.9038

(e' = Dielectric Constant)
(e" = Loss Factor)

Tested by: LGL
Date : 29th July 05
Frequency: 2450MHz
Mixture: Head Tissue
Tissue temp: 24°C

Composition		
Tap Water	0.0g	0.00%
Ultra Pure Water	20000.0g	56.69%
Sugar	0.0g	0.00%
Glyco	15278.0g	43.31%
Salt	0.0g	0.00%
Preventol D7	0.0g	0.00%
Total Weight	35278.0g	100.0%

Result (FCC)	Dielectric Constant	Conductivity
Measured	38.84	1.8736
Target (FCC)	39.2	1.8
Low Limit	37.24	1.71
High Limit	41.16	1.89
% Off Target	-0.92	4.09

ANNEX D

SAR VALIDATION RESULTS

SAR Validation – Head Tissue at 2450MHz (Dipole forward power = 250mW)

Ambient Temperature: **24 ± 1^0 C**
Tissue Temperature: **24 ± 1^0 C**
Humidity: **54% to 59%**

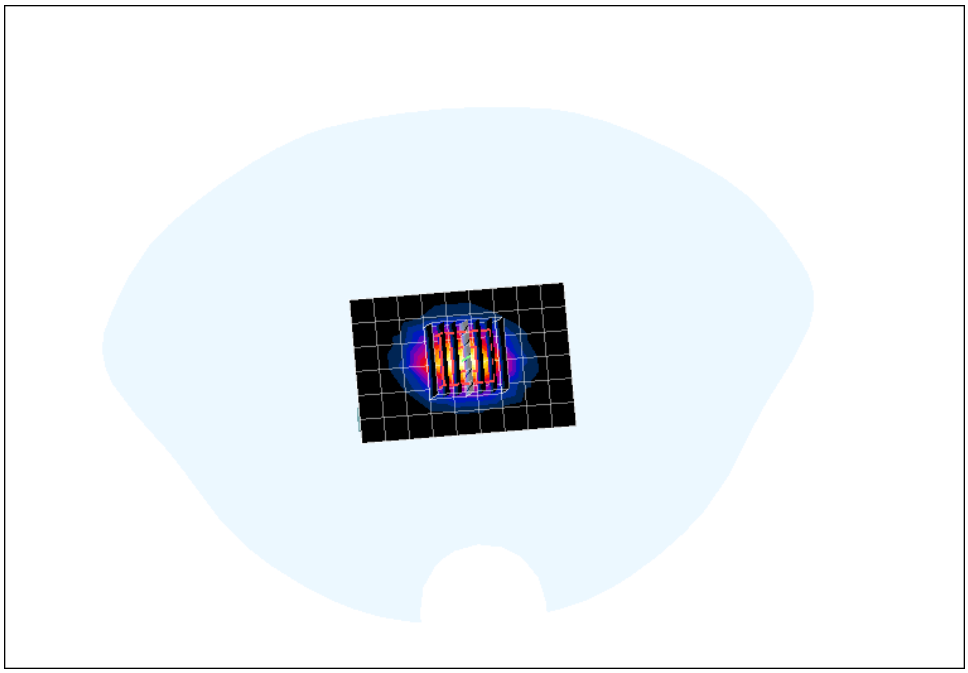
Test Laboratory: PSB Corporation, Telecoms and EMC. **Date: 29/Jul/2005**
File Name: 2450MHz Head_System Validation.da4
Program Name: Job Nos.: 56S050648
Phantom section: Flat Section
DUT: Dipole 2450MHz
Communication System: CW
Frequency: 2450 MHz
Duty Cycle: 1:1
Medium: 2450MHz Head TissueMedium parameters used: σ = 1.8736 mho/m, ε_r = 38.84; ρ = 1000 kg/m^3
DASY4 Configuration:
Electronics: DAE4 Sn627 Calibrated: 12/Jul/2005
Phantom: SAM 12 Measurement SW: DASY4, V4.5 Build 19
Probe: EX3DV4 - SN3541 ConvF(7.54, 7.54, 7.54) Calibrated: 18/Jul/2005
Postprocessing SW: SEMCAD, V1.8 Build 146
Sensor-Surface: 4mm (Mechanical Surface Detection)

900MHz Head_System Validation/Area Scan (7x10x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.3 mW/g

900MHz Head_System Validation/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.2 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 14.4 mW/g; SAR(10 g) = 6.53 mW/g
Maximum value of SAR (measured) = 16.4 mW/g



ANNEX E

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

All test measurement carried out are traceable to national standards. The uncertainty of measurement at a confidence level of 95%, with a coverage of 2, is **±20.6%.**

Error Description	Uncertainty Value ± %	Probability Distribution	Divisor	ci 1g	Standard Unc.(1g)	Vi or Veff
Measurement System						
Probe Calibration	± 4.8	normal	1	1	± 4.8	∞
Axial isotropy	± 4.7	rectangular	√3	(1-cp)^1/2	± 1.9	∞
Hemispherical Isotropy	± 9.6	rectangular	√3	(cp)^1/2	± 3.9	∞
Spatial resolution	± 0.0	rectangular	√3	1	± 0.0	∞
Boundary effects	± 1.0	rectangular	√3	1	± 0.6	∞
Linearity	± 4.7	rectangular	√3	1	± 2.7	∞
System Detection limit	± 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 Positioning Mechanical Tolerance	± 0.4	rectangular	√3	1	± 0.2	∞
Probe Positioning with respect to Phantom Shell	± 2.9	rectangular	√3	1	± 1.7	∞
Extrapolation, Interpolation and Integration Algorithms for Max. SAR Evaluation	± 1.0	rectangular	√3	1	± 0.6	∞
Test Sample Related						
Device positioning	± 2.9	normal	1	1	± 2.9	145
Device holder uncertainty	± 3.6	normal	1	1	± 3.6	5
Power drift	± 5.0	rectangular	√3	1	± 2.9	∞
Phantom and Tissue Parameters						
Phantom uncertainty	± 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
Coverage Factor for 95%		**k=2**				
Extended Standard Uncertainty					± 20.6	

ANNEX F

SAR PROBE CALIBRATION CERTIFICATES

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 **PSB** Certificate No: **EX3-3541_Jul05**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3541
Calibration procedure(s)	QA CAL-01.v5 and QA CAL-14.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	July 18, 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 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	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

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 18, 2005

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
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., ϑ = 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) 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:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 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 EX3DV4

SN:3541

Manufactured:	May 3, 2004
Last calibrated:	June 26, 2004
Recalibrated:	July 18, 2005

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

EX3DV4 SN:3541 July 18, 2005

DASY - Parameters of Probe: EX3DV4 SN:3541

Sensitivity in Free Space[A] Diode Compression[B]

NormX	**0.51** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**92** mV
NormY	**0.44** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**92** mV
NormZ	**0.41** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**92** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

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

Sensor Center to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	3.8	1.6
SAR_{be} [%]	With Correction Algorithm	0.0	0.0

TSL **1750 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	4.8	2.8
SAR_{be} [%]	With Correction Algorithm	1.0	0.8

Sensor Offset

Probe Tip to Sensor Center	**1.2** 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%.

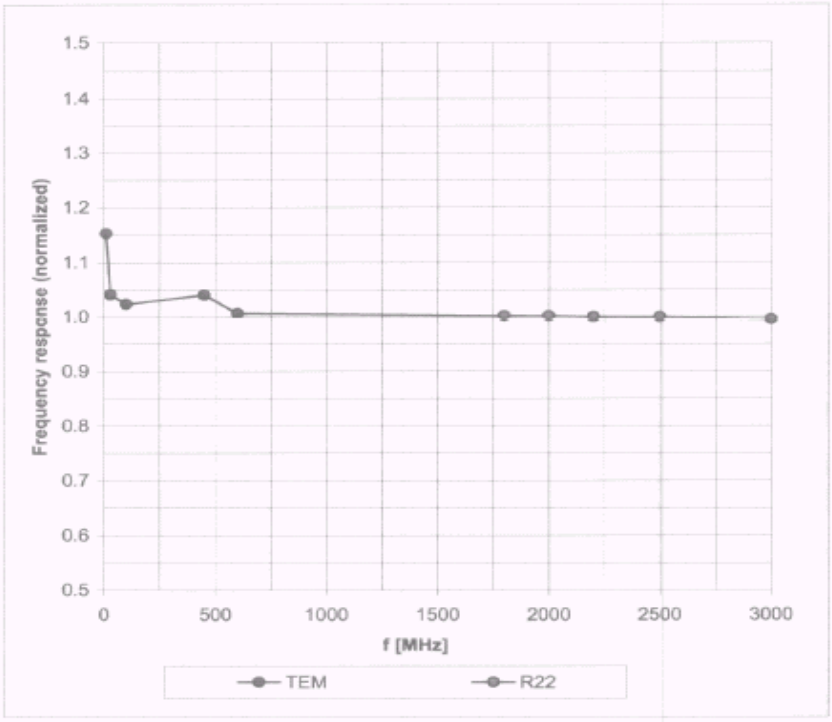
[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

EX3DV4 SN:3541 July 18, 2005

Frequency Response of E-Field

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

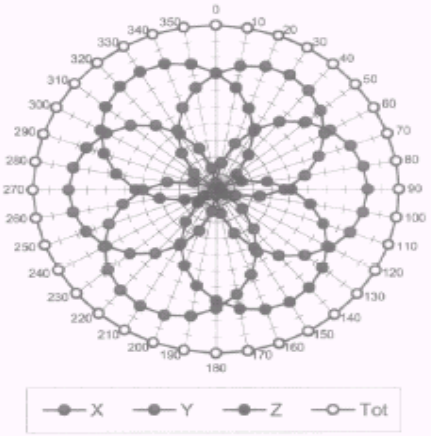


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

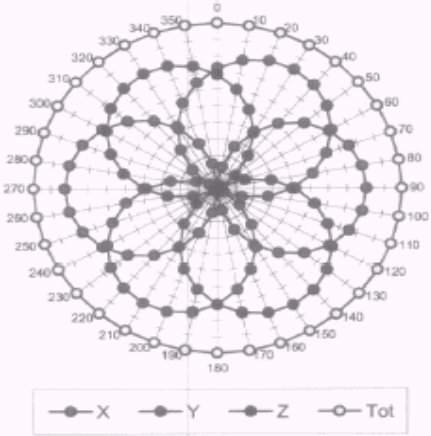
EX3DV4 SN:3541 July 18, 2005

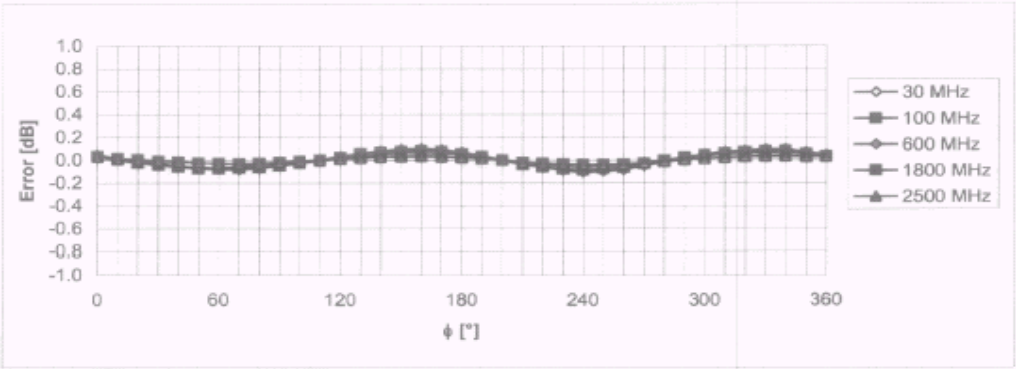
Receiving Pattern (ϕ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX



f = 1800 MHz, WG R22



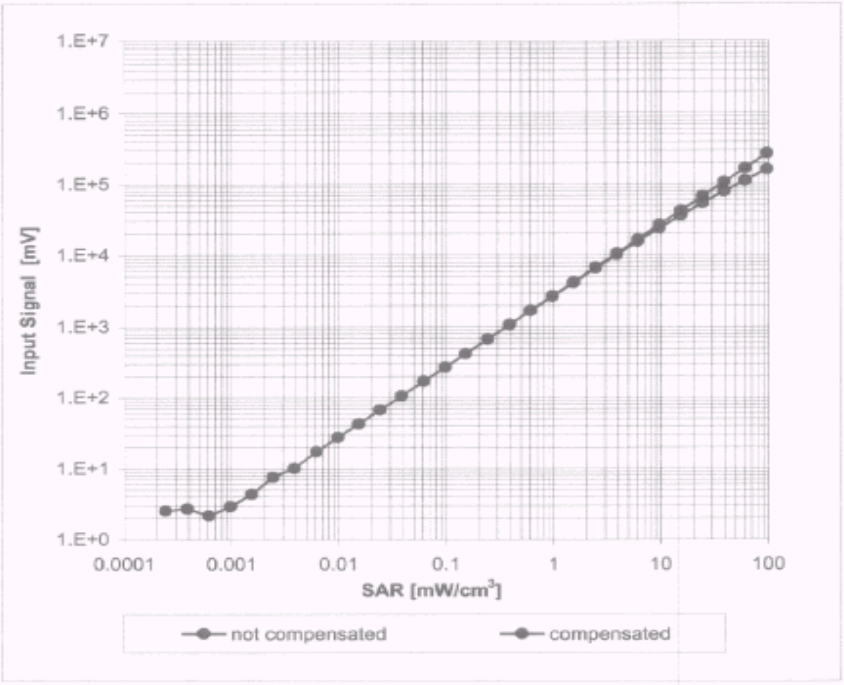


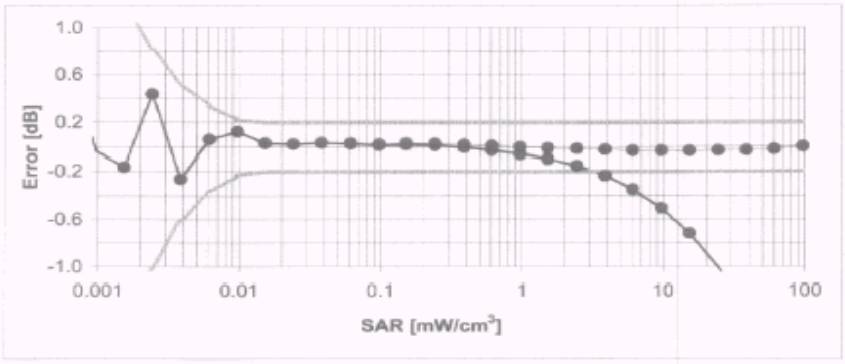
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4 SN:3541 July 18, 2005

Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)

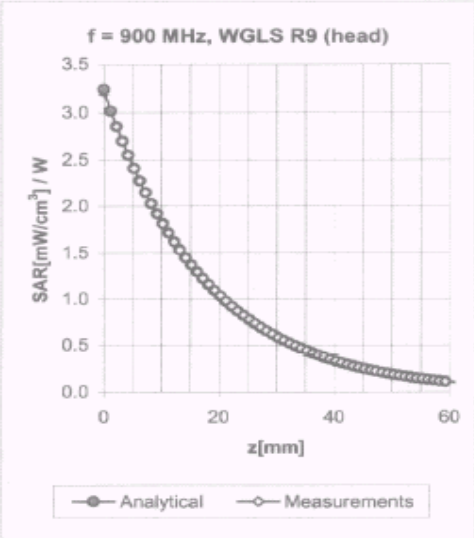


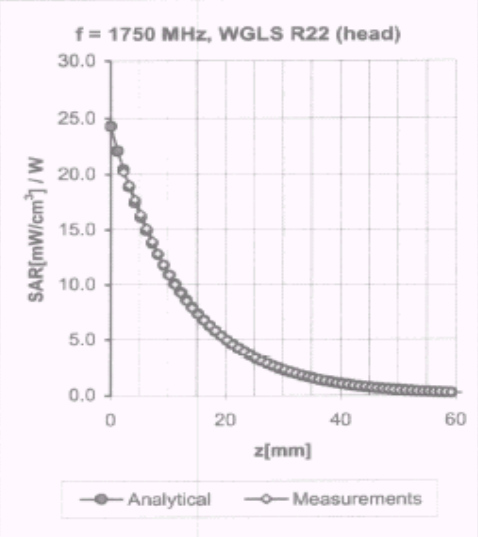


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

EX3DV4 SN:3541 July 18, 2005

Conversion Factor Assessment





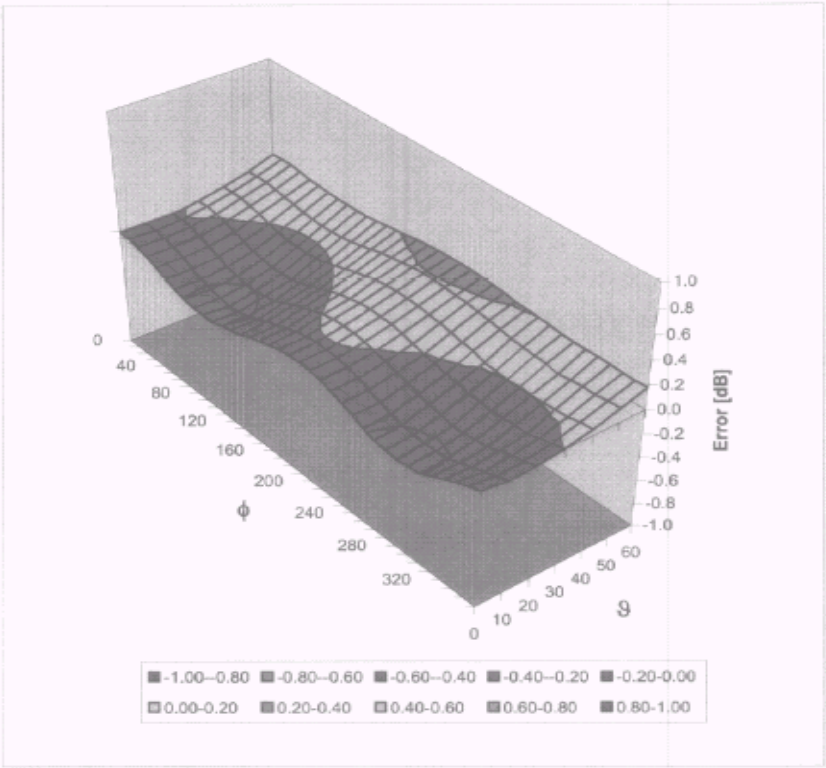
f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.16	1.42	9.59 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.23	1.20	9.37 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.62	0.91	8.17 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.57	0.97	8.04 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.74	0.75	7.54 ± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.27	1.13	9.64 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.42	0.89	9.31 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.43	1.54	7.72 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.38	1.80	7.68 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.79	0.72	7.69 ± 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.

EX3DV4 SN:3541 July 18, 2005

Deviation from Isotropy in HSL

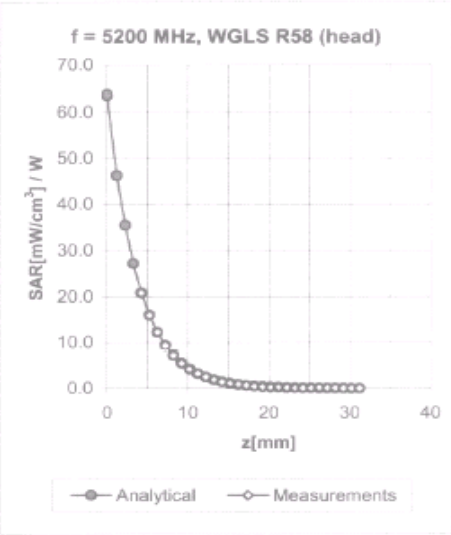
Error (ϕ, ϑ), f = 900 MHz

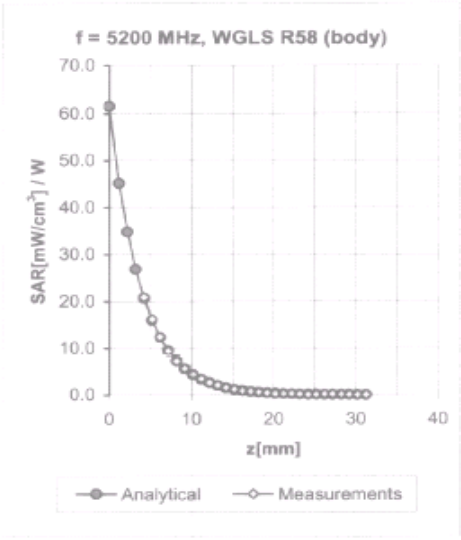


Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

EX3DV4 SN:3541 July 18, 2005

Appendix[D]





f [MHz][D]	Validity [MHz]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
5200	± 50	Head	36.0 ± 5%	4.66 ± 5%	0.42	1.80	5.20 ± 13.6% (k=2)
5500	± 50	Head	35.6 ± 5%	4.96 ± 5%	0.42	1.80	5.00 ± 13.6% (k=2)
5800	± 50	Head	35.3 ± 5%	5.27 ± 5%	0.48	1.80	4.65 ± 13.6% (k=2)
5200	± 50	Body	49.0 ± 5%	5.30 ± 5%	0.48	1.95	4.97 ± 13.6% (k=2)
5500	± 50	Body	48.6 ± 5%	5.65 ± 5%	0.50	1.90	4.60 ± 13.6% (k=2)
5800	± 50	Body	48.2 ± 5%	6.00 ± 5%	0.45	1.90	4.51 ± 13.6% (k=2)

[D] Accreditation for ConvF assessment above 3000 MHz is currently applied for.

ANNEX G

REFERENCES

The methods and procedures used for the measurements contained in this report are details in the following reference standards:

Publications	Year	Title
Supplement C (Edition 01-01) to FCC OET Bulletin 65 (Edition 97-01)	2001	"Evaluating Compliance with FCC Guidelines for Human Exposure to radio Frequency Fields"
IEEE Standard 1528-200X	2000	"Product Performance Standards Relative to the safe Use of Electromagnetic Energy"
ANSI/IEEE C95.3	1992	"Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave"
ANSI/IEEE C95.1	1992	"Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz"
ACA, Radio Communications (EMR Human Exposure)	2000 (No.2)	“Radiocommunication (Electromagnetic Radiation – Human Exposure)”
EN50360	2001	Product Standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz – 3GHz)
EN50361	2001	Basic Standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phone (300MHz – 3GHz)