



Company Internal
REPORT

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

No.

BGGIN05:262

Approved

Checked

Date

Rev

Reference

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

050905

B

File

Report issued by Accredited SAR Laboratory

For

PY7AD022011 (W900i)

Date of test: 28, 29 July and 01, 05, 31 August 2005

Laboratory: Sony Ericsson SAR Test Laboratory
Sonyericsson Mobile Communications AB
Nya Vattentorget
SE-221 82 LUND, Sweden

Testing Engineer: *Hamid Kami Shirazi*
Kami.shirazi@sonyericsson.com
+4646232644

Testing Approval *Ramadan Plicanic*
Ramadan.Plicanic@sonyericsson.com
+46 46 19 38 62

Statement of Compliance

Sony Ericsson Mobile Communications AB declares under its sole responsibility that the product

Sony Ericsson Type AAD-3022011-BV ; FCC ID: PY7AD022011 ; IC:4170B-AD022011

to which this declaration relates, is in conformity with the appropriate RF exposure standards recommendations and guidelines. It also declares that the product was tested in accordance with the appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below.

(None)

This laboratory is accredited to ISO/IEC 17025 (SWEDAC accreditation no. 1847).



Laboratories are accredited by the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) under the terms of Swedish legislation. The accredited laboratory activities meet the requirements in SS-EN ISO/IEC 17025 (2000). This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report.

Sony Ericsson encourages all feedback, both positive and negative, on this report.
© Sony Ericsson Mobile Communication AB, 2005



Company Internal
REPORT

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

No.

BGGIN05:262

Approved

Checked

Date

Rev

Reference

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

050905

B

File

1 Table of contents

2 INTRODUCTION..... 3

3 DEVICE UNDER TEST..... 3

 3.1 ANTENNA DESCRIPTION 3

 3.2 DEVICE DESCRIPTION 3

4 TEST EQUIPMENT..... 4

 4.1 DOSIMETRIC SYSTEM 4

 4.2 ADDITIONAL EQUIPMENT 4

5 ELECTRICAL PARAMETERS ON THE TISSUE SIMULATING LIQUID 5

6 SYSTEM ACCURACY VERIFICATION..... 5

7 SAR MEASUREMENT UNCERTAINTY 6

8 TEST RESULTS 7

9 REFERENCES 8

10 APPENDIX 9

 10.1 PHOTOGRAPHS OF THE DEVICE UNDER TEST 10

 10.2 DEVICE POSITION ON SAM TWINS PHANTOM 11

 10.3 ATTACHMENT 12



Company Internal
REPORT

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

050905

B

Reference

File

2 Introduction

In this test report, compliance of the Sony Ericsson PY7AD022011 (W900i) portable telephone with RF safety guidelines is demonstrated. The applicable RF safety guidelines and the SAR measurement specifications used for the test are described in the *SAR Measurement Specifications of Wireless Handsets* [1].

3 Device under Test

3.1 Antenna Description

| | | |
|----------------------|-------------------------------------|-------|
| Type | Internal | |
| Location | On the back side near to microphone | |
| Dimensions | Max length | 40 mm |
| | Max width | 18 mm |
| Configuration | PIFA | |

3.2 Device description

| | | |
|---|-----------------------------------|-------------------------|
| Device model | PY7AD022011 (W900i) | |
| Serial number | BF7ZA50107 | |
| Mode | GSM1900 | GSM1900-GPRS 2 slots |
| Multiple Access Scheme | TDMA | TDMA |
| Maximum Output Power Setting | 30.0 dBm | 30.0dBm |
| Factory Tolerance in Power Setting | 0.5 dB | 0.5dB |
| Maximum Peak Output Power | 30.5 dBm | 30.5 |
| Crest Factor | 8 | 4 |
| Transmitting Frequency Range(MHz) | 1850.2 – 1909.8 | |
| Prototype or Production Unit | Preproduction | |
| Device Category | Portable | |
| RF exposure environment | General population / uncontrolled | |



Company Internal
REPORT

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

No.

BGGIN05:262

Approved

Checked

Date

Rev

Reference

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

050905

B

File

4 Test equipment

4.1 Dosimetric system

SAR measurements were made using the DASY3 professional system (software version 3.1c) with SAM twin phantom, manufactured by Schmid & Partner Engineering AG (SPEAG). The list of calibrated equipment is given below.

| <i>Description</i> | <i>Serial Number</i> | <i>Due Date</i> |
|--------------------------------|----------------------|-----------------|
| DASY3 DAE V1 | 419 | March, 2006 |
| E-field probe ET3DV6 | 1585 | March, 2006 |
| Dipole Validation Kit, D900V2 | 111 | March, 2007 |
| Dipole Validation Kit, D1800V2 | 297 | March, 2007 |
| Dipole Validation Kit, D1900V2 | 5d002 | March, 2007 |

4.2 Additional equipment

| <i>Description</i> | <i>Inventory Number</i> | <i>Due Date</i> |
|-------------------------------|-------------------------|-----------------|
| Signal generator ESG-D4000A | INV 462935 | 11, 2006 |
| Directional coupler HP778D | INV 2903 | 11, 2005 |
| Power meter R&S NRVD | INV 483920 | 01, 2006 |
| Power sensor R&S NRV-Z5 | INV 2333 | 11, 2005 |
| Power sensor R&S NRV-Z5 | INV 2334 | 11, 2005 |
| Termination 65N50-0-11 | INV 2903 | 02, 2006 |
| Network analyzer HP8753C | INV421671 | 09, 2005 |
| S-parameter test set HP85047A | INV 421670 | 09, 2005 |
| Dielectric probe kit HP8507D | INV 20 000 053 | Self cal |



Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

Reference

050905

B

File

5 Electrical parameters on the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity, ϵ_r , and the conductivity, σ , of the tissue simulating liquids were measured with the dielectric probe kit. These values are shown in the table below. The mass density, ρ , entered into the DASY3 software is also given. Recommended limits for permittivity ϵ_r , conductivity σ and mass density ρ are also shown.

| f (MHz) | Tissue type | Limits / Measured | Dielectric Parameters | | |
|---------|-------------|----------------------|-----------------------|----------------|-----------------------------|
| | | | ϵ_r | σ (S/m) | ρ (g/cm ³) |
| 1900 | Head | Measured, 28/07/2005 | 39.4 | 1.40 | 1.00 |
| | | Recommended | 40.0 | 1.40 | 1.00 |
| 1900 | Head | Measured, 29/07/2005 | 38.0 | 1.47 | 1.00 |
| | | Recommended | 40.0 | 1.40 | 1.00 |
| 1900 | Body | Measured, 04/08/2005 | 51.4 | 1.56 | 1.00 |
| | | Recommended | 53.3 | 1.52 | 1.00 |

6 System accuracy verification

A system accuracy verification of the DASY3 was performed using the dipole validation kit listed in section 3.1. The system verification test was conducted on the same day as the measurement of the DUT. Measurement made in ambient temperature 22-23 °C and humidity 40-50%. The obtained results are displayed in the table below.

RF noise had been measured in liquid when all RF equipment in lab was set off. Measured value was 0.0005 mW/g in 1g mass.

| f (MHz) | Tissue type | Measured / Reference | SAR (W/kg) 1g/10g | Dielectric Parameters | | | Liquid t(°C) |
|---------|-------------|----------------------|----------------------|-----------------------|----------------|-----------------------------|-----------------|
| | | | | ϵ_r | σ (S/m) | ρ (g/cm ³) | |
| 1900 | Head | Measured, 28/07/2005 | 39.6/20.0 | 39.4 | 1.40 | 1.00 | 22 |
| | | Reference | 39.2/20.6 | 39.6 | 1.45 | 1.00 | - |
| 1900 | Head | Measured, 29/07/2005 | 39.7/20.3 | 38.0 | 1.47 | 1.00 | 22 |
| | | Reference | 39.2/20.6 | 39.6 | 1.45 | 1.00 | - |
| 1900 | Head | Measured, 01/08/2005 | 39.3/20.1 | 38.0 | 1.40 | 1.00 | 22 |
| | | Reference | 39.2/20.6 | 39.6 | 1.45 | 1.00 | - |
| 1900 | Body | Measured, 04/08/2005 | 41.3/21.0 | 51.4 | 1.56 | 1.00 | 22 |
| | | Reference | 39.6/20.9 | 51.6 | 1.58 | 1.00 | - |



Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

050905

B

Reference

File

7 SAR measurement uncertainty

SAR measurement uncertainty evaluation for Sonyericsson W900i Phone

| Uncertainty Component | Uncer. (%) | Prob Dist. | Div. | C _i | 1900 Head | 1900 Body |
|--|------------|------------|------|----------------|---------------|--------------|
| Measurement System | | | | | | |
| Probe Calibration | ±4.4 | N | 1 | 1 | ±4.4 | ±4.4 |
| Axial Isotropy | ±4.7 | R | √3 | 0.5 | ±1.4 | ±1.4 |
| Spherical Isotropy | ±9.6 | R | √3 | 0.5 | ±2.8 | ±2.8 |
| Spatial resolution | ±0.0 | R | √3 | 1 | ±0.0 | ±0.0 |
| Boundary effect | ±5.5 | R | √3 | 1 | ±3.2 | ±3.2 |
| Probe linearity | ±4.7 | R | √3 | 1 | ±2.7 | ±2.7 |
| Detection limit | ±1.0 | R | √3 | 1 | ±0.6 | ±0.6 |
| Readout electronics | ±1.0 | N | 1 | 1 | ±1.0 | ±1.0 |
| Response time | ±0.8 | R | √3 | 1 | ±0.5 | ±0.5 |
| Integration time | ±1.4 | R | √3 | 1 | ±0.8 | ±0.8 |
| RF Ambient Conditions | ±3.0 | R | √3 | 1 | ±1.7 | ±1.7 |
| Mech. Constraints of robot | ±0.4 | R | √3 | 1 | ±0.2 | ±0.2 |
| Probe positioning | ±2.9 | R | √3 | 1 | ±1.7 | ±1.7 |
| Extrap, interpolation and integration | ±3.9 | R | √3 | 1 | ±2.3 | ±2.3 |
| Measurement System Uncertainty | | | | | ±7.7 | ±7.7 |
| Test Sample Related | | | | | | |
| Device positioning | ±6.0 | N | 0.89 | 1 | ±6.7 | ±6.7 |
| Device holder uncertainty | ±5.0 | N | 0.84 | 1 | ±5.9 | ±5.9 |
| Power drift | 3.7/3.5 | R | √3 | 1 | ±2.1 | ±2.0 |
| Test Sample Related Uncertainty | | | | | ±9.2 | ±9.2 |
| Phantom and Tissue Parameters | | | | | | |
| Phantom uncertainty | ±4.0 | R | √3 | 1 | ±2.3 | ±2.3 |
| Liquid conductivity (meas) | -5/-3.6 | R | √3 | 0.6 | ±1.7 | ±1.2 |
| Liquid conductivity (target) | ±5.0 | R | √3 | 0.6 | ±1.7 | ±1.7 |
| Liquid Permittivity (meas) | +5/+2.6 | R | √3 | 0.6 | ±1.7 | ±0.9 |
| Liquid Permittivity (target) | ±5.0 | R | √3 | 0.6 | ±1.7 | ±1.7 |
| Phantom and Tissue Parameters Uncertainty | | | | | ±3.4 | ±2.7 |
| Combined standard uncertainty | | | | | ±12.45 | ±12.3 |
| Extended standard uncertainty (k=2) | | | | | ±24.9 | ±24.6 |



Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

Reference

050905

B

File

8 Test results

The measured 1-gram and averaged SAR values of the device against the head are provided in Tables 1 and body are provided in Tables 2. The ambient humidity and temperature of test facility were 40% - 50% and 22.0 °C – 23.0 °C respectively. The depth of the head tissue simulating liquid was 15.2cm. A base station simulator was used to control the device during the SAR measurement. The phone was supplied with full-charged battery for each measurement.

For head measurement, the device was tested on the right-hand phantom (corresponding to the right side of the head) and the left-hand phantom in two phone position, cheek (touch) and tilt (cheek + 15deg).

For body measurement phone was tested on the antenna to the phantom and back to the phantom in GPRS 2 Slots mode on 15mm distance between phone and phantom. For speech mode phone was antenna to phantom in position with 15mm distance and with connected portable hands free accessory HPM-20. For all modes, the device was tested at the lowest, middle and highest frequencies in the transmit band. For Blue Tooth mode, phone was paired with Sony Ericsson HBH-200 Blue Tooth head sets and measured on worst case speech mode body position.

| Mode | Channel | Peak Output Power(dBm) | Phone Position | Liquid temp(°C) | SAR (W/kg) in 1g mass | | | |
|---------------|---------|------------------------|-------------------|-----------------|-----------------------|----------------------|---------------------|----------------------|
| | | | | | Right-hand | | Left-hand | |
| | | | | | Phone in Open state | Phone in Close state | Phone in Open state | Phone in Close state |
| GSM 1900 Head | 512 | 30.4 | Cheek | 22-22,5 | 0,31 | 0,40 | 0,35 | 0,43 |
| | | | Tilt | 22-22,5 | 0,29 | 0,28 | 0,24 | 0,26 |
| | | | Cheek(blue tooth) | 22-22,5 | - | - | - | 0,43 |
| | 661 | 30.3 | Cheek | 22-22,5 | 0,31 | 0,36 | 0,39 | 0,34 |
| | | | Tilt | 22-22,5 | 0,25 | 0,23 | 0,24 | 0,21 |
| | 810 | 30.1 | Cheek | 22-22,5 | 0,33 | 0,29 | 0,37 | 0,29 |
| Tilt | | | 22-22,5 | 0,25 | 0,20 | 0,19 | 0,19 | |

Table1: SAR measurement result for Sony Ericsson PY7AD022011 (W900i) telephone at highest possible output power. The phone has measured against the head in open and close state.

| Mode | Channel | Power (dBm) | Phone Position | Liquid t (°C) | SAR (W/kg) in 1 g mass |
|---------------|---------|-------------|----------------------------------|---------------|------------------------|
| GSM 1900 Body | 512 | 30.4 | Antenna to phantom, GPRS 2 Slots | 22-22,5 | 0,45 |
| | | | Front to phantom, GPRS 2 Slots | 22-22,5 | 0,14 |
| | | | Antenna to phantom, Speech | 22-22,5 | 0,23 |
| | | | Antenna to phantom +BT, Speech | 22-22,5 | 0,44 |
| | 661 | 30.3 | Antenna to phantom, GPRS 2 Slots | 22-22,5 | 0,36 |
| | | | Antenna to phantom, Speech | 22-22,5 | 0,22 |
| | 810 | 30.1 | Antenna to phantom, GPRS 2 Slots | 22-22,5 | 0,34 |
| | | | Antenna to phantom, Speech | 22-22,5 | 0,18 |

Table2: SAR measurement result for Sony Ericsson PY7AD022011 (W900i) telephone at highest possible output power. The phone has measured against the head only in close state.



Company Internal
REPORT

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

Reference

050905

B

File

9 References

[1] R.Plicanic, "SAR Measurement Specification of Wireless Handsets", Sony Ericsson SAR Test Laboratory internal document GUG/N 03:141

[2] Basic standard for the Measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz-3GHz), European Standard EN 50361, July 2001

[3] FCC, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields: Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radio Frequency Emissions," Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01).

[4] IEEE, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques," STD 1528-2003, June, 2003.

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

050905

Reference

File

10 Appendix

10.1 Photographs of the device under test



Close State



Open State

Front & Back sides



Down Connector



Sides



Back side with Battery



Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

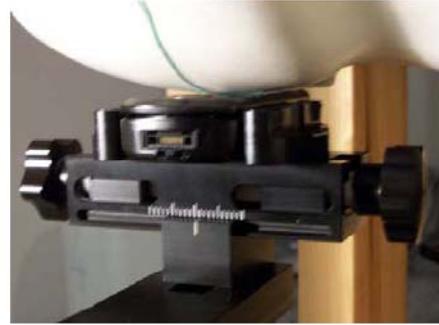
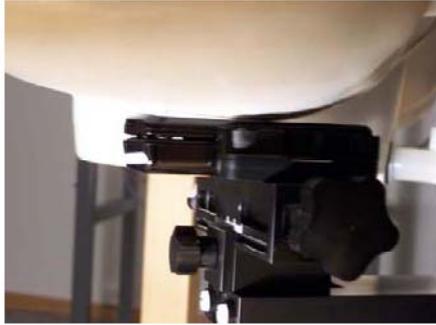
050905

B

Reference

File

10.2 Device position on SAM Twins Phantom



Device position against the head: Cheek (touch) phone position (phone in close state)



Device position against the head: Tilt (cheek+15deg) phone position (phone in close state)



Device position against the head: Cheek (touch) phone position (phone in open state)

Company Internal
REPORT

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

Reference

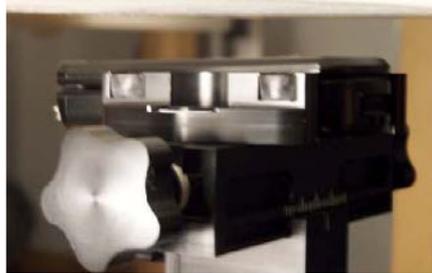
050905

B

File



Device position against the head: Tilt (cheek+15deg) phone position (phone in open state)



Device position against the body: phone in close state



Sony Ericsson

12 (12)

Company Internal
REPORT

Prepared (also subject responsible if other)

LD/SEMC/BGGIN/NM *Hamid Kami Shirazi*

Approved

Checked

LD/SEMC/BGGIN/NM *Ramadan Plicanic* 050905

No.

BGGIN05:262

Date

Rev

050905

B

Reference

File

10.3 Attachment

- Probe & Dipole Calibration
- Measurement plots and system validation

DASY4 Validation Report for Head TSL

Date/Time: 09.03.2005 15:20:45

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d002

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

Medium: HSL 1900 MHz;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.46$ mho/m; $\epsilon_r = 39.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(4.96, 4.96, 4.96); Calibrated: 26.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.01.2005
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 11.4 mW/g

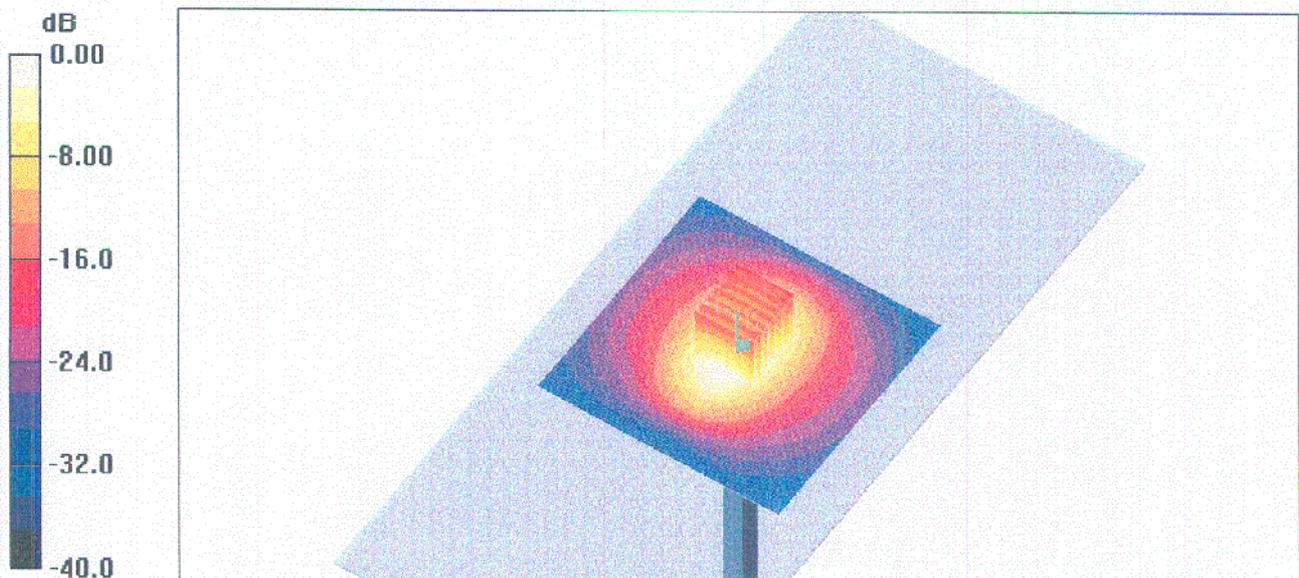
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.4 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 9.81 mW/g; SAR(10 g) = 5.15 mW/g

Maximum value of SAR (measured) = 11.0 mW/g



0 dB = 11.0mW/g

DASY4 Validation Report for Body TSL

Date/Time: 15.03.2005 15:20:32

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d002

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

Medium: MSL 1900 MHz;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.57$ mho/m; $\epsilon_r = 52.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(4.43, 4.43, 4.43); Calibrated: 26.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.01.2005
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 11.4 mW/g

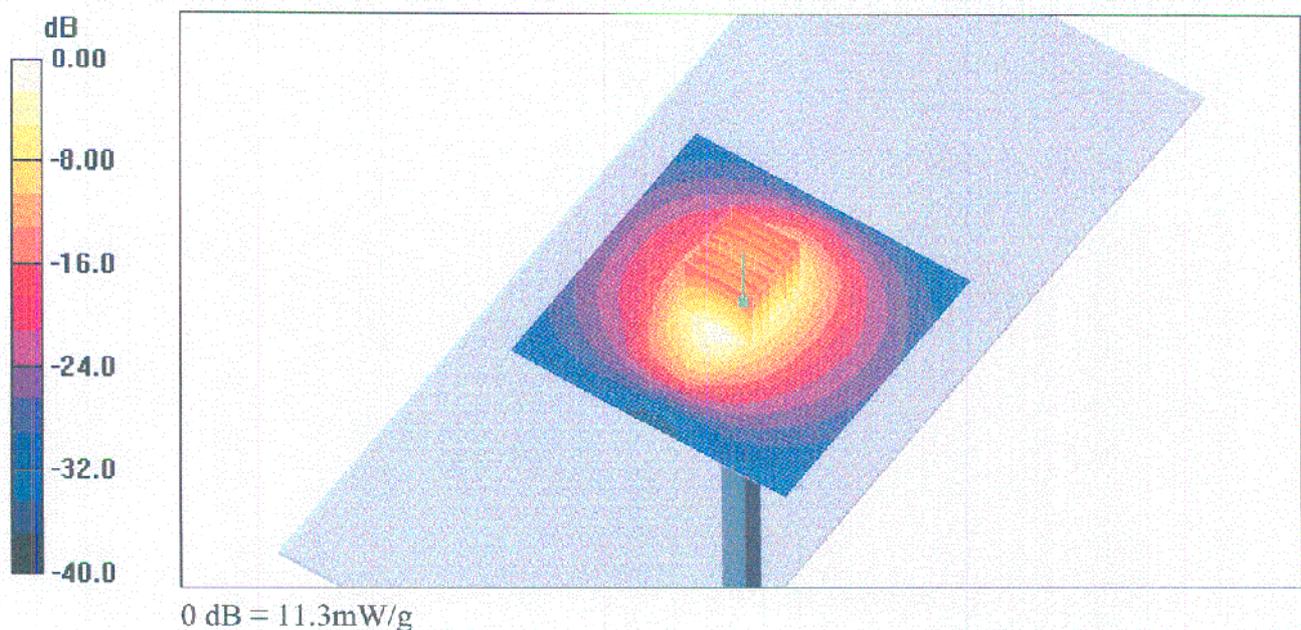
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.3 V/m; Power Drift = 0.061 dB

Peak SAR (extrapolated) = 16.8 W/kg

SAR(1 g) = 9.91 mW/g; SAR(10 g) = 5.23 mW/g

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





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 **Sony Ericsson Lund**

Certificate No: **ET3-1585_Mar05**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1585**

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

Calibration date: **March 16, 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 $(22 \pm 3)^\circ\text{C}$ 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-May-04 (METAS, No. 251-00388) | May-05 |
| Power sensor E4412A | MY41495277 | 5-May-04 (METAS, No. 251-00388) | May-05 |
| 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-04 (METAS, No. 251-00389) | May-05 |
| 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: 617 | 19-Jan-05 (SPEAG, No. DAE4-617_Jan05) | Jan-06 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|--------------|--|------------------------|
| Power sensor HP 8481A | MY41092180 | 18-Sep-02 (SPEAG, in house check Oct-03) | In house check: Oct 05 |
| 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: March 16, 2005

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



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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ET3DV6

SN:1585

| | |
|------------------|----------------|
| Manufactured: | May 7, 2001 |
| Last calibrated: | March 18, 2004 |
| Recalibrated: | March 16, 2005 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1585

Sensitivity in Free Space^A

| | | |
|-------|--------------|-------------------------------------|
| NormX | 1.85 ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | 1.72 ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | 1.90 ± 10.1% | $\mu\text{V}/(\text{V}/\text{m})^2$ |

Diode Compression^B

| | |
|-------|-------|
| DCP X | 93 mV |
| DCP Y | 93 mV |
| DCP Z | 93 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 | | 3.7 mm | 4.7 mm |
| SAR _{be} [%] | Without Correction Algorithm | 7.8 | 4.0 |
| SAR _{be} [%] | With Correction Algorithm | 0.4 | 0.1 |

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

| | | | |
|---|------------------------------|---------------|---------------|
| Sensor Center to Phantom Surface Distance | | 3.7 mm | 4.7 mm |
| SAR _{be} [%] | Without Correction Algorithm | 12.7 | 8.7 |
| SAR _{be} [%] | With Correction Algorithm | 0.4 | 0.3 |

Sensor Offset

Probe Tip to Sensor Center **2.7 mm**

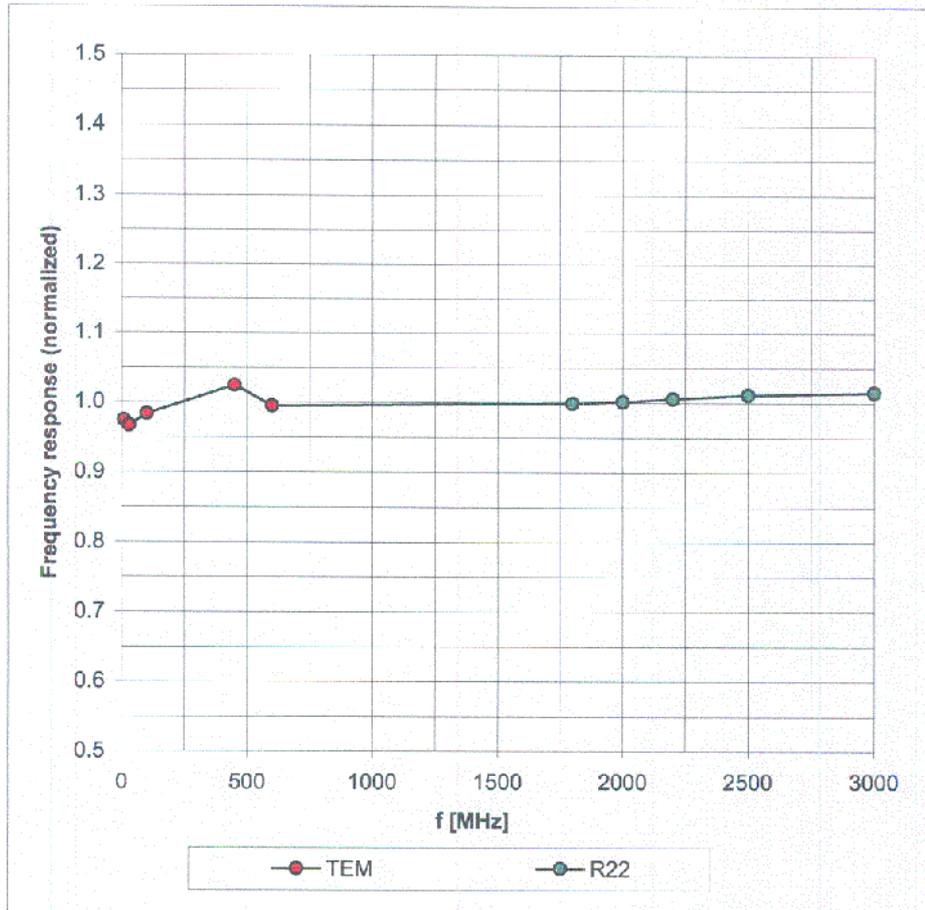
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

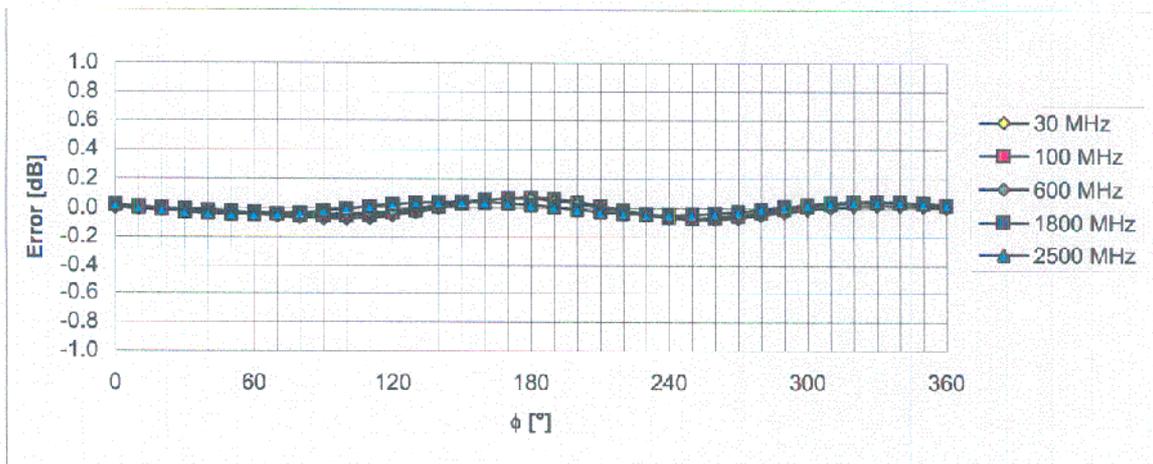
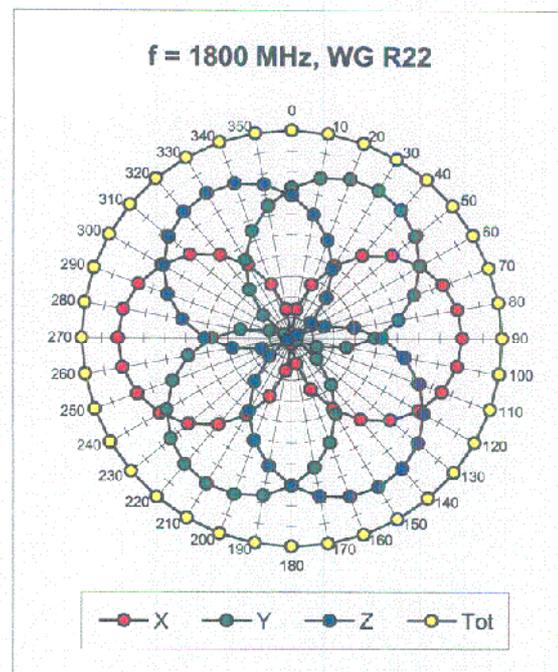
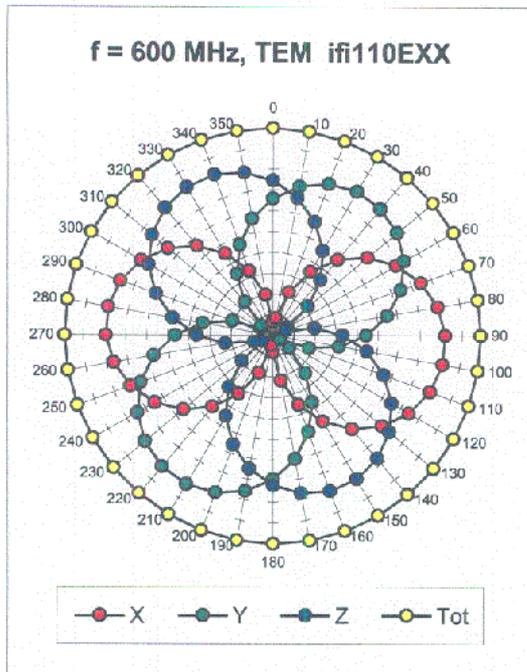
Frequency Response of E-Field

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



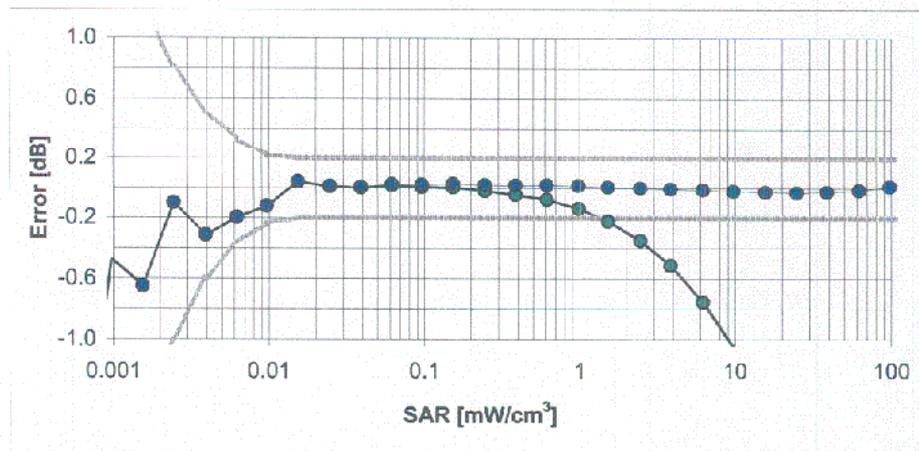
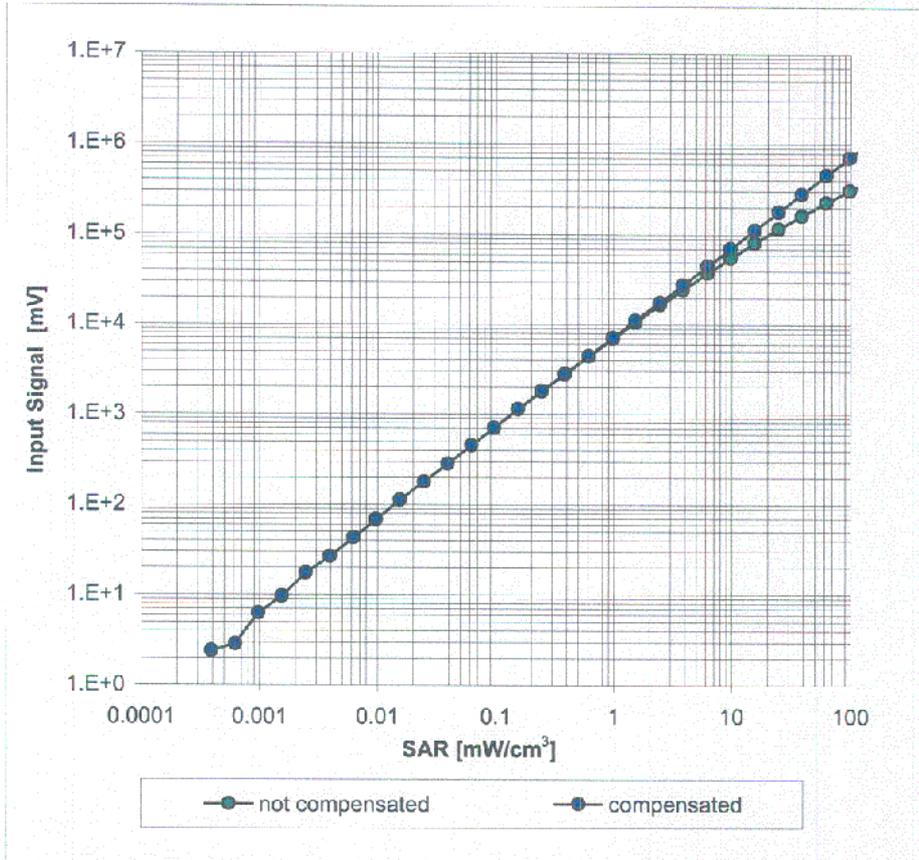
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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



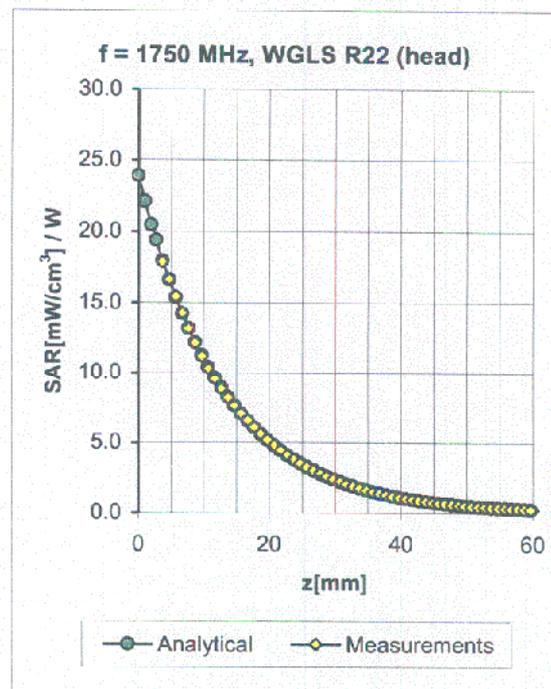
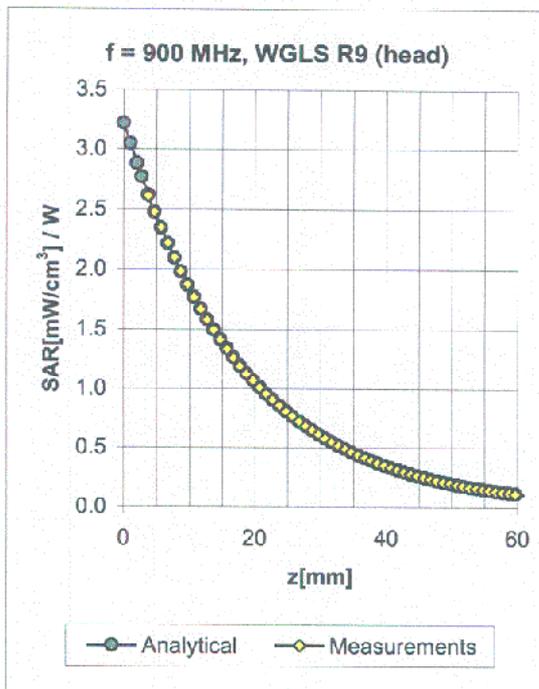
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



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

Conversion Factor Assessment

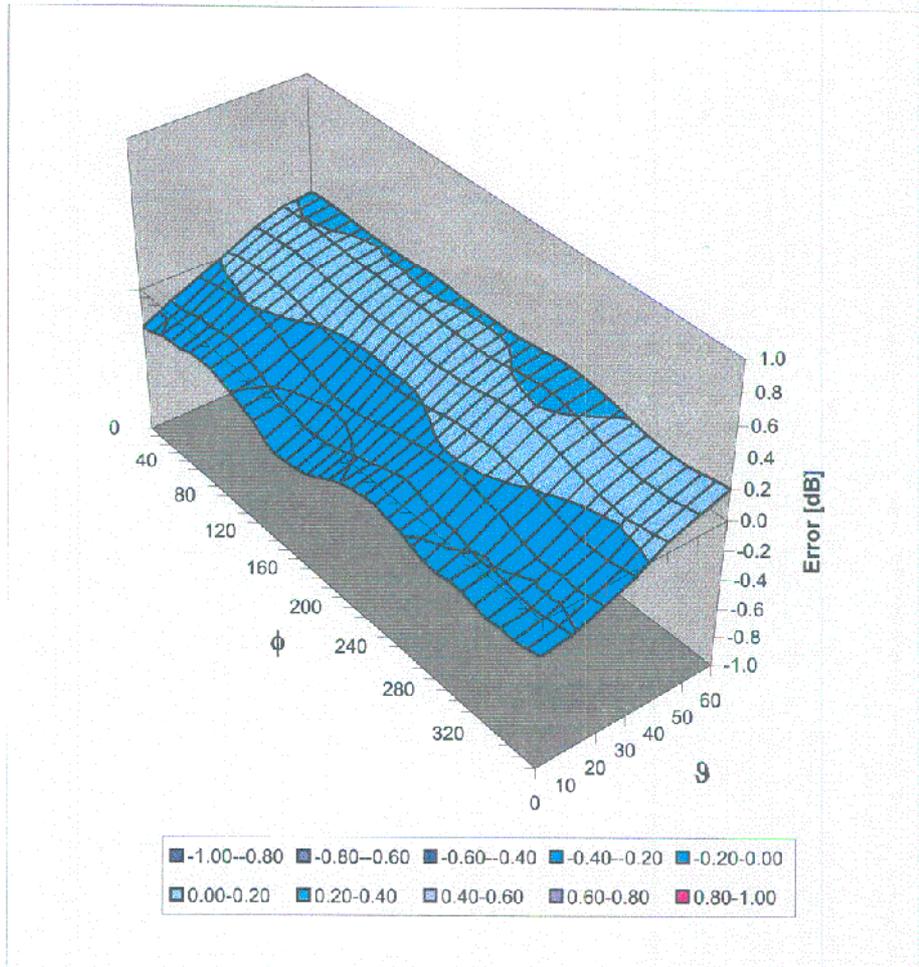


| f [MHz] | Validity [MHz] ^c | TSL | Permittivity | Conductivity | Alpha | Depth | ConvF Uncertainty |
|---------|-----------------------------|------|--------------|--------------|-------|-------|--------------------|
| 835 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.90 ± 5% | 0.99 | 1.46 | 6.95 ± 11.0% (k=2) |
| 900 | ± 50 / ± 100 | Head | 41.5 ± 5% | 0.97 ± 5% | 0.91 | 1.49 | 6.73 ± 11.0% (k=2) |
| 1750 | ± 50 / ± 100 | Head | 40.1 ± 5% | 1.37 ± 5% | 0.53 | 2.45 | 5.30 ± 11.0% (k=2) |
| 1900 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.51 | 2.64 | 5.03 ± 11.0% (k=2) |
| 2000 | ± 50 / ± 100 | Head | 40.0 ± 5% | 1.40 ± 5% | 0.51 | 2.70 | 4.87 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Head | 39.2 ± 5% | 1.80 ± 5% | 0.59 | 2.38 | 4.60 ± 11.8% (k=2) |
| 835 | ± 50 / ± 100 | Body | 55.2 ± 5% | 0.97 ± 5% | 0.96 | 1.54 | 6.65 ± 11.0% (k=2) |
| 1900 | ± 50 / ± 100 | Body | 53.3 ± 5% | 1.52 ± 5% | 0.50 | 2.96 | 4.62 ± 11.0% (k=2) |
| 2450 | ± 50 / ± 100 | Body | 52.7 ± 5% | 1.95 ± 5% | 0.58 | 2.20 | 4.16 ± 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: $\pm 2.6\%$ (k=2)