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APPENDIX D: SAR DISTRIBUTION PLOTS FOR PUSH-TO-TALK MODE CONFIGURATION

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Date/Time: 07/27/04 09:49:05

Test Laboratory: Research In Motion Limited

Push-To-Talk operation; 25 mm distance; Mid frequency (815.50 MHz); Retracted antenna; Sanyo battery; Ambient temp. 24.2; Liquid temp. 23.3 deg.cel

DUT: BlackBerry 7520 Wireless Handheld; Type: Sample (Retracted Ant.)

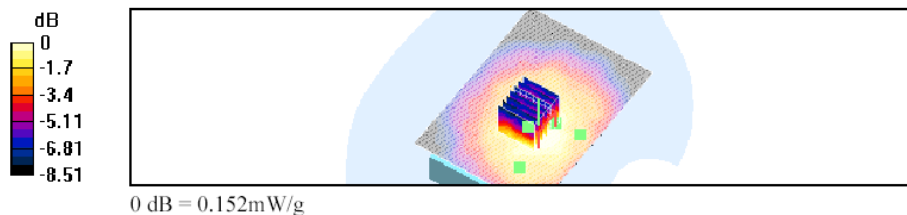
Communication System: IDEN ; Frequency: 815.5 MHz; Duty Cycle: 1:6
Medium: 835 MHz Head Medium parameters used: $f = 815.5 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 41.6$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:


- Probe: ET3DV6 - SN1643; ConvF(6.5, 6.5, 6.5); Calibrated: 09/10/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn473;
- Phantom: SAM I; Type: SAM 4.0; Serial: 1076
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

Unnamed procedure/Area Scan (101x141x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$
Reference Value = 12.3 V/m; Power Drift = 0.7 dB
Maximum value of SAR (interpolated) = 0.156 mW/g

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
Reference Value = 12.3 V/m; Power Drift = 0.7 dB
Maximum value of SAR (measured) = 0.152 mW/g
Peak SAR (extrapolated) = 0.191 W/kg
SAR(1 g) = 0.138 mW/g; SAR(10 g) = 0.100 mW/g



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Date/Time: 07/27/04 10:32:06

Test Laboratory: Research In Motion Limited

Push-To-Talk operation; 25 mm distance; Mid frequency (815.50 MHz); Extended antenna; GS-Mecotec battery; Ambient temp. 24.1; Liquid temp. 23.2 deg.cel

DUT: BlackBerry 7520 Wireless Handheld Ext; Type: Sample (Extended Ant.)

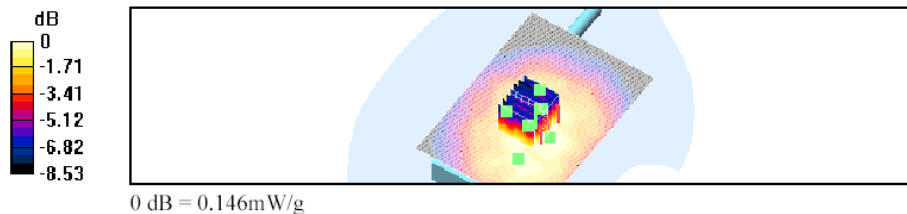
Communication System: IDEN ; Frequency: 815.5 MHz; Duty Cycle: 1:6
Medium: 835 MHz Head Medium parameters used: $f = 815.5 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 41.6$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:


- Probe: ET3DV6 - SN1643; ConvF(6.5, 6.5, 6.5); Calibrated: 09/10/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn473;
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1076
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

Unnamed procedure/Area Scan (101x141x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$
Reference Value = 13.1 V/m; Power Drift = -0.8 dB
Maximum value of SAR (interpolated) = 0.145 mW/g

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
Reference Value = 13.1 V/m; Power Drift = -0.8 dB
Maximum value of SAR (measured) = 0.146 mW/g
Peak SAR (extrapolated) = 0.188 W/kg
SAR(1 g) = 0.137 mW/g; SAR(10 g) = 0.097 mW/g



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Date/Time: 07/27/04 11:13:34

Test Laboratory: Research In Motion Limited

**Push-To-Talk operation; 25 mm distance; Mid frequency (815.50 MHz) with BT ON;
Retracted antenna; Sanyo battery; Ambient temp. 24.6; Liquid temp. 23.4 deg.cel**

DUT: BlackBerry 7520 Wireless Handheld; Type: Sample (Retracted Ant.)

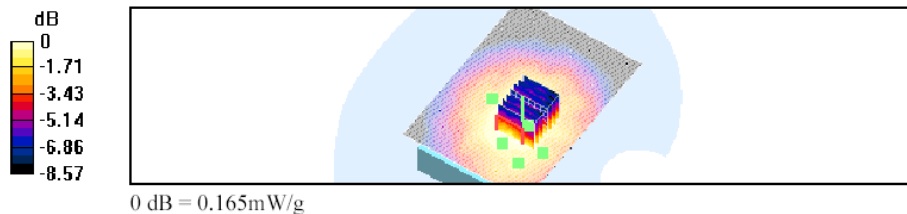
Communication System: IDEN ; Frequency: 815.5 MHz; Duty Cycle: 1:6
Medium: 835 MHz Head Medium parameters used: $f = 815.5 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 41.6$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:


- Probe: ET3DV6 - SN1643; ConvF(6.5, 6.5, 6.5); Calibrated: 09/10/2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn473;
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1076
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

Unnamed procedure/Area Scan (101x141x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$
Reference Value = 13.8 V/m; Power Drift = -0.0 dB
Maximum value of SAR (interpolated) = 0.165 mW/g

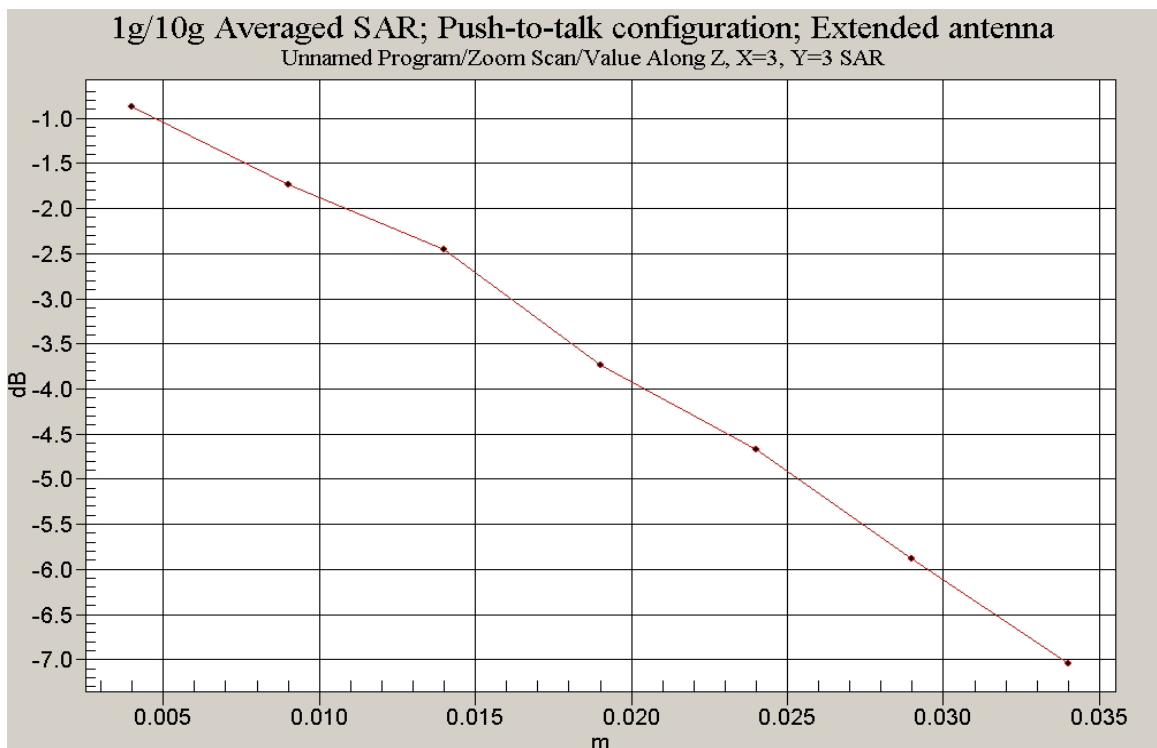
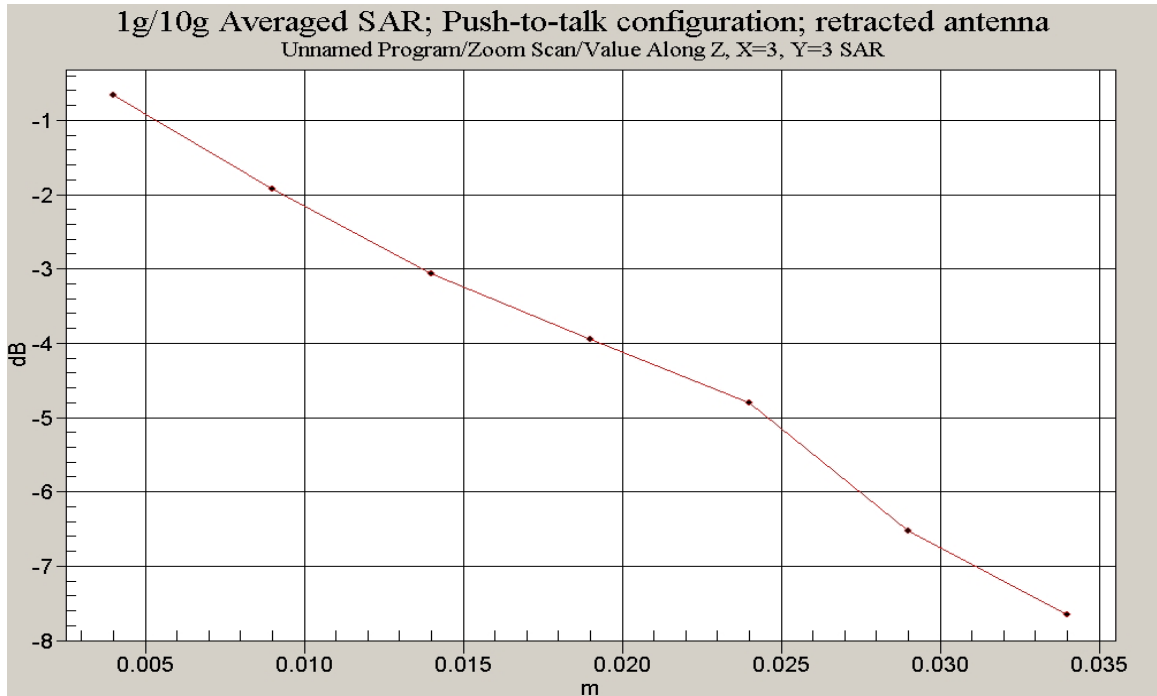
Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
Reference Value = 13.8 V/m; Power Drift = -0.0 dB
Maximum value of SAR (measured) = 0.165 mW/g
Peak SAR (extrapolated) = 0.195 W/kg
SAR(1 g) = 0.148 mW/g; SAR(10 g) = 0.109 mW/g




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Z-Axis plots for the worst case Push-to-talk mode:



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APPENDIX E: PROBES AND VALIDATION DIPOLE CALIBRATION



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

Client

RIM

CALIBRATION CERTIFICATE																																			
Object(s)	ET3DV6 - SN:1643																																		
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes																																		
Calibration date:	October 9, 2003																																		
Condition of the calibrated item	In Tolerance (according to the specific calibration document)																																		
<p>This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Model Type</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter EPM E4419B</td> <td>GB41293874</td> <td>2-Apr-03 (METAS, No 252-0250)</td> <td>Apr-04</td> </tr> <tr> <td>Power sensor E4412A</td> <td>MY41495277</td> <td>2-Apr-03 (METAS, No 252-0250)</td> <td>Apr-04</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: 5086 (20b)</td> <td>3-Apr-03 (METAS No. 251-0340)</td> <td>Apr-04</td> </tr> <tr> <td>Fluke Process Calibrator Type 702</td> <td>SN: 6295803</td> <td>8-Sep-03 (Sintrel SCS No. E-030020)</td> <td>Sep-04</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>MY41092180</td> <td>18-Sep-02 (Agilent, No. 20020918)</td> <td>In house check: Oct 03</td> </tr> <tr> <td>RF generator HP 8684C</td> <td>US3642U01700</td> <td>4-Aug-99 (SPEAG, in house check Aug-02)</td> <td>In house check: Aug-05</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585</td> <td>18-Oct-01 (Agilent, No. 24BR1033101)</td> <td>In house check: Oct 03</td> </tr> </tbody> </table>				Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04	Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04	Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS No. 251-0340)	Apr-04	Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04	Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	In house check: Oct 03	RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05	Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
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Calibrated by:	Name Nico Vetterli	Function Technician	Signature 																																
Approved by:	Name Katja Pokovic	Function Laboratory Director	Signature 																																
Date issued: October 9, 2003																																			
This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.																																			

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Schmid & Partner Engineering AG

s p e a g

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, <http://www.speag.com>


Probe ET3DV6

SN:1643

Manufactured: November 7, 2001
Last calibration: September 24, 2002
Recalibrated: October 9, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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ET3DV6 SN:1643

October 9, 2003

DASY - Parameters of Probe: ET3DV6 SN:1643

Sensitivity in Free Space

Diode Compression

NormX	1.73 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	96	mV
NormY	1.88 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	96	mV
NormZ	1.81 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	96	mV

Sensitivity in Tissue Simulating Liquid

Head 900 MHz $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha	0.37
ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth	2.72

Head 1800 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha	0.47
ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth	2.87

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm


Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	10.8	6.3
SAR _{be} [%]	With Correction Algorithm	0.4	0.6

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	14.5	10.1
SAR _{be} [%]	With Correction Algorithm	0.2	0.1

Sensor Offset

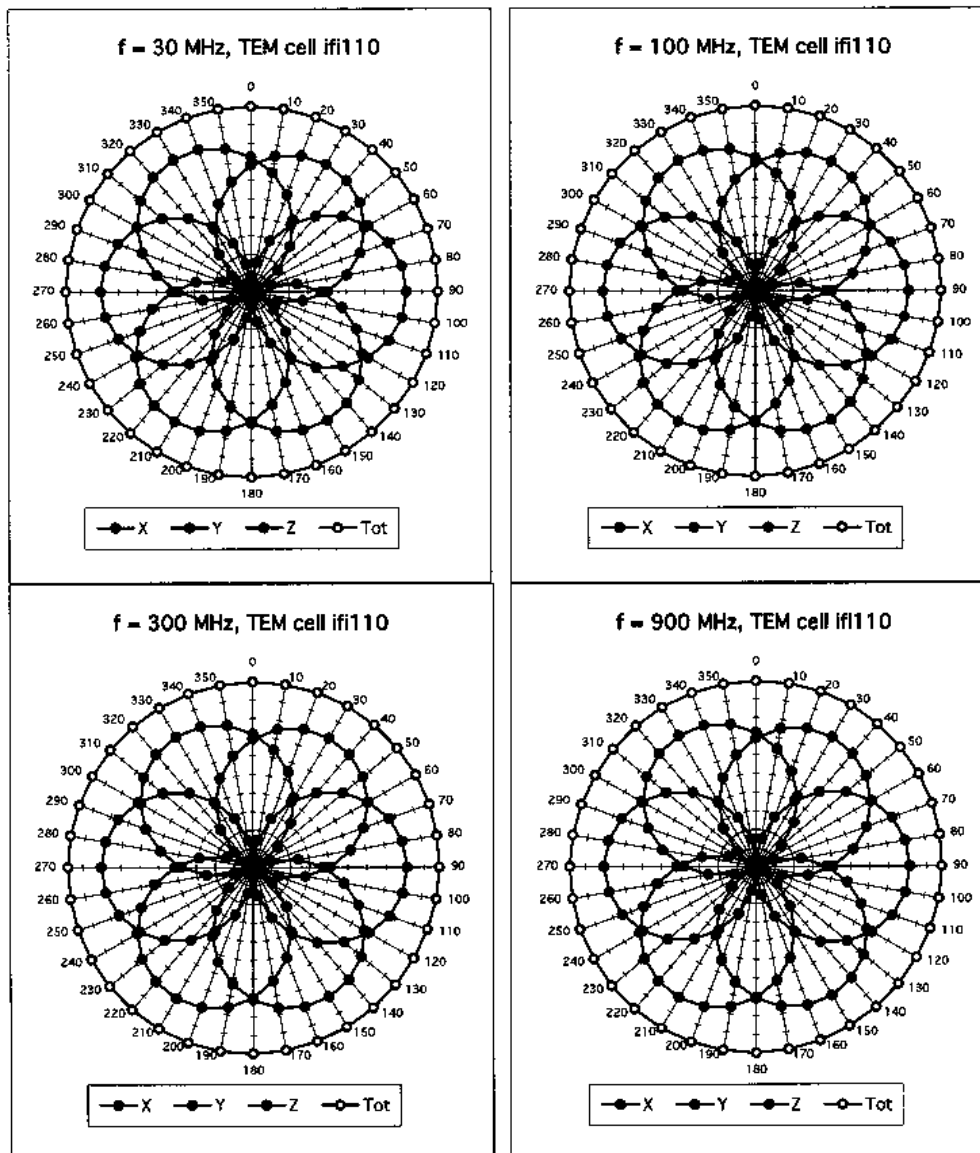
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.4 \pm 0.2	mm


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ET3DV6 SN:1643

October 9, 2003

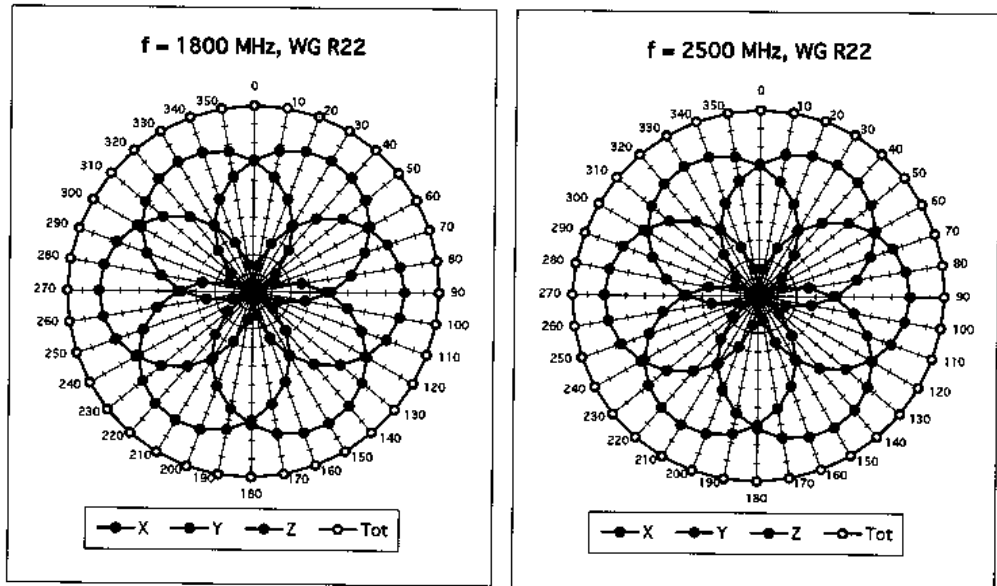
Receiving Pattern (ϕ), $\theta = 0^\circ$



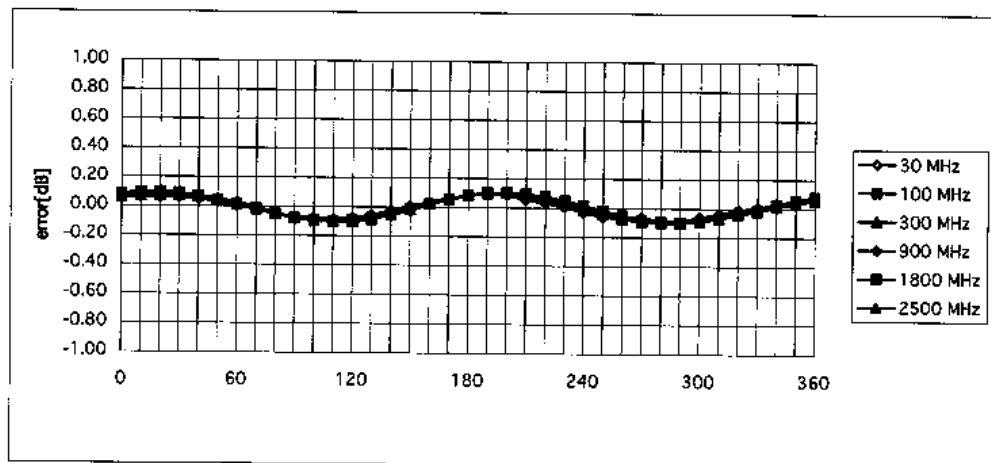
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Isotropy Error (ϕ), $\theta = 0^\circ$



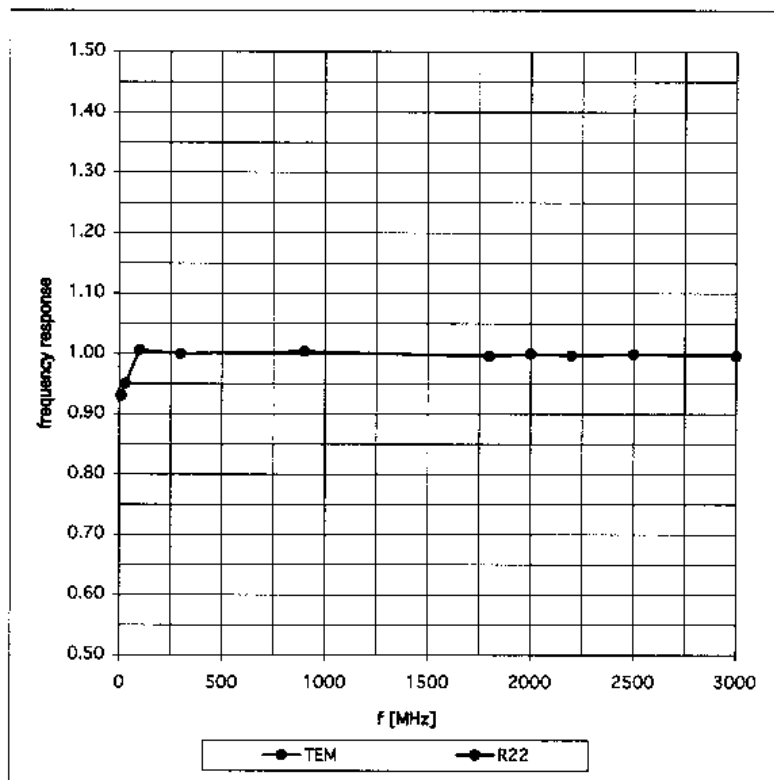
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ET3DV6 SN:1643

October 9, 2003

Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)

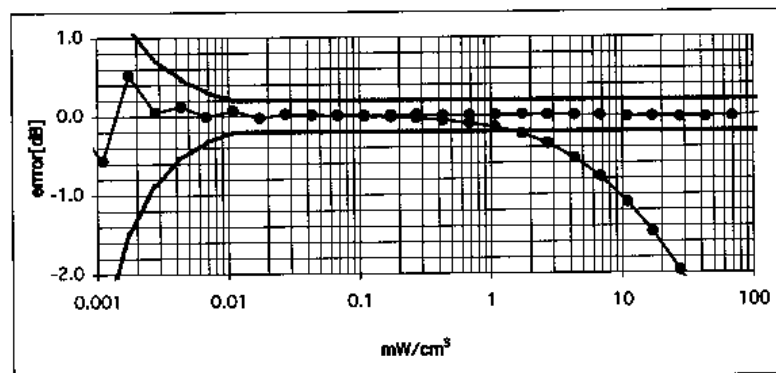
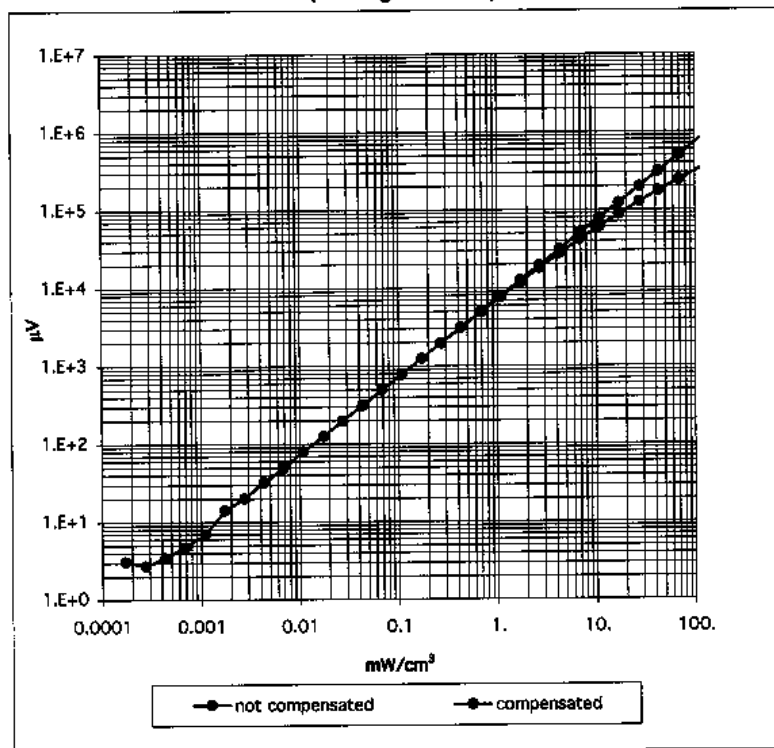



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Dynamic Range f(SARhead) (Waveguide R22)

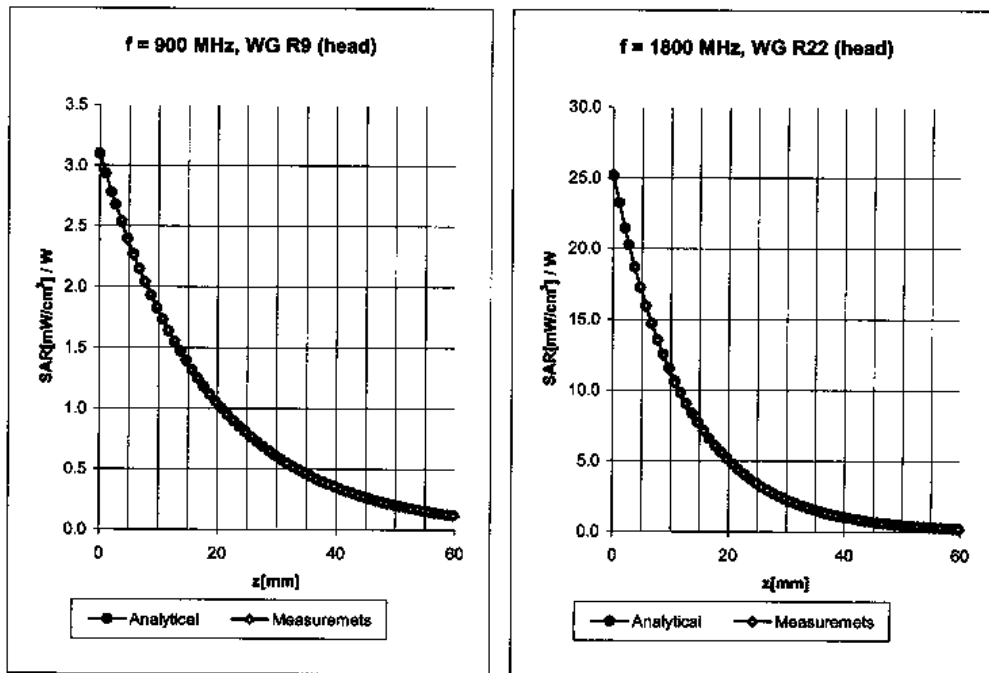


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Conversion Factor Assessment



Head 900 MHz $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ mho/m


Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha
ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth
		0.37
		2.72

Head 1800 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

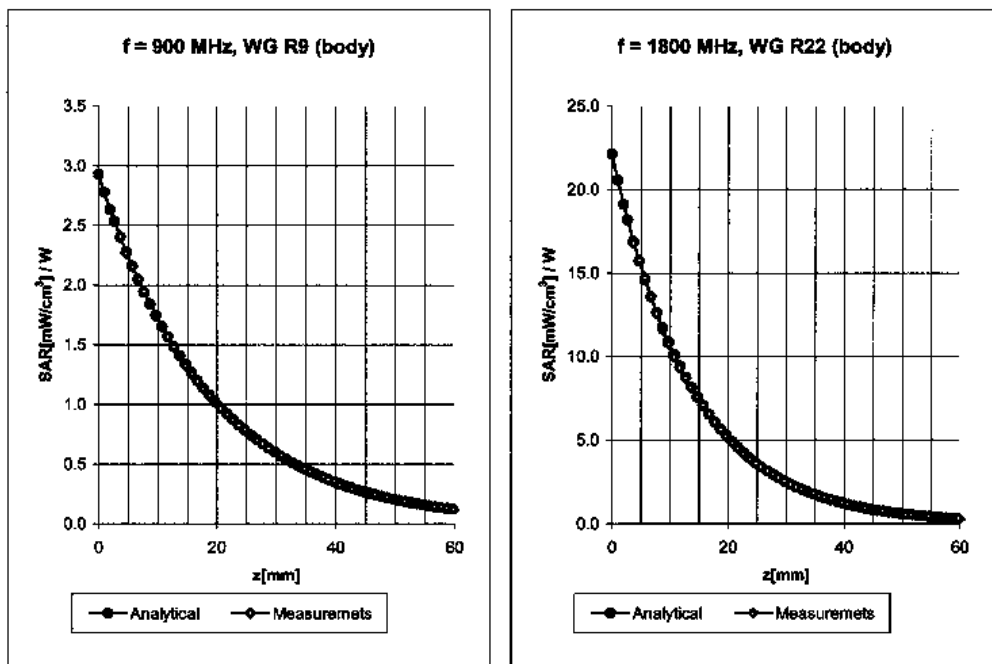
ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha
ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth
		0.47
		2.87

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October 9, 2003

Conversion Factor Assessment



Body 900 MHz $\epsilon_r = 55.0 \pm 5\%$ $\sigma = 1.05 \pm 5\%$ mho/m


Valid for f=800-1000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	6.3 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.3 $\pm 9.5\%$ (k=2)	Alpha	0.43
ConvF Z	6.3 $\pm 9.5\%$ (k=2)	Depth	2.49

Body 1800 MHz $\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ mho/m

Valid for f=1710-1910 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.8 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.8 $\pm 9.5\%$ (k=2)	Alpha	0.57
ConvF Z	4.8 $\pm 9.5\%$ (k=2)	Depth	2.74

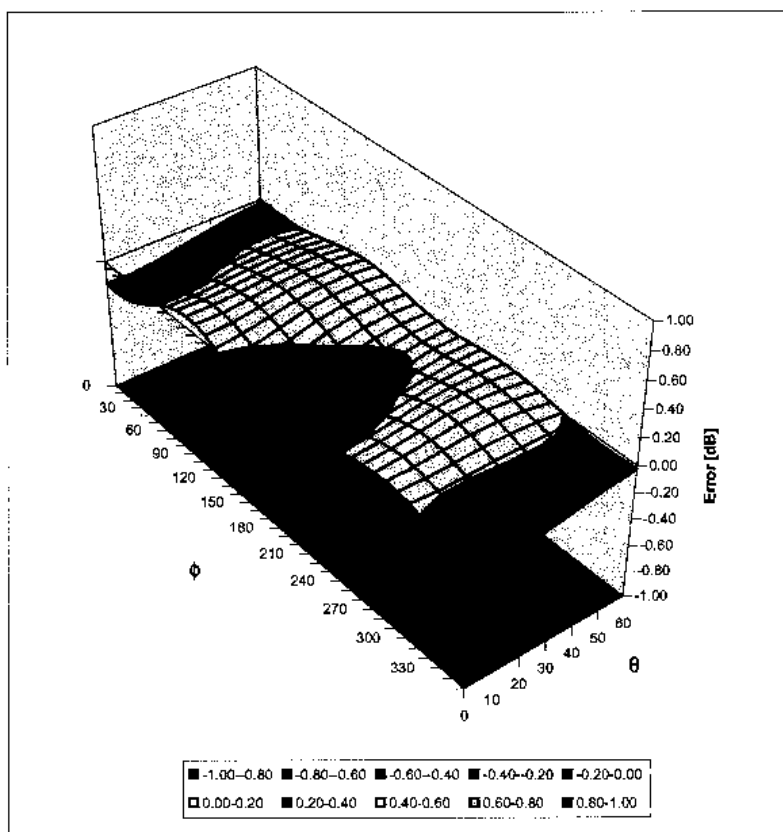
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Deviation from Isotropy in HSL

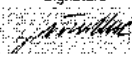
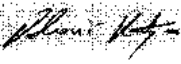
Error (θ, ϕ), $f = 900$ MHz




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

Client **RIM**

CALIBRATION CERTIFICATE																											
Object(s)	D835V2 - SN.446																										
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits																										
Calibration date:	August 21, 2003																										
Condition of the calibrated item	In Tolerance (according to the specific calibration document)																										
<p>This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.</p> <p>All calibrations have been conducted in the closed laboratory facility; environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Model Type</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>RF generator R&S SML-03</td> <td>100698</td> <td>27-Mar-2002 (R&S, No. 20-82388)</td> <td>In house check: Mar-05</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>MY41092317</td> <td>18-Oct-02 (Agilent, No. 20021018)</td> <td>Oct-04</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>US37292783</td> <td>30-Oct-02 (METAS, No. 252-0236)</td> <td>Oct-03</td> </tr> <tr> <td>Power meter EPM E442</td> <td>GB37480704</td> <td>30-Oct-02 (METAS, No. 252-0236)</td> <td>Oct-03</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585</td> <td>18-Oct-01 (Agilent, No. 24BR1033101)</td> <td>In house check: Oct 03</td> </tr> </tbody> </table>				Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-82388)	In house check: Mar-05	Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04	Power sensor HP 8481A	US37292783	30-Oct-02 (METAS, No. 252-0236)	Oct-03	Power meter EPM E442	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03	Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
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Calibrated by:	Name Joëth Mueller	Function Technician	Signature 																								
Approved by:	Name Katja Pokovic	Function Laboratory Director	Signature 																								
Date issued: August 22, 2003																											
<p>This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed</p>																											

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Schmid & Partner Engineering AG

s p e a g

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DASY


Dipole Validation Kit

Type: D835V2

Serial: 446

Manufactured: October 24, 2001

Calibrated: August 21, 2003

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1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating solution of the following electrical parameters at 835 MHz:

Relative Dielectricity	43.3	$\pm 5\%$
Conductivity	0.91 mho/m	$\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.7 at 835 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.


The dipole input power (forward power) was 250 mW $\pm 3\%$. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm ³ (1 g) of tissue:	9.60 mW/g $\pm 16.8\%$ (k=2)¹
averaged over 10 cm ³ (10 g) of tissue:	6.24 mW/g $\pm 16.2\%$ (k=2)¹

¹ validation uncertainty

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3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay: **1.395 ns** (one direction)
Transmission factor: **0.983** (voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 835 MHz: $\text{Re}\{Z\} = 48.9 \Omega$
 $\text{Im}\{Z\} = -5.5 \Omega$
Return Loss at 835 MHz: **-24.9 dB**

4. Handling


Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

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.

6. Power Test

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

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Date/Time: 08/21/03 10:03:51

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN446_SN1507_HSL835_210803.da4

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN446
Program: Dipole Calibration

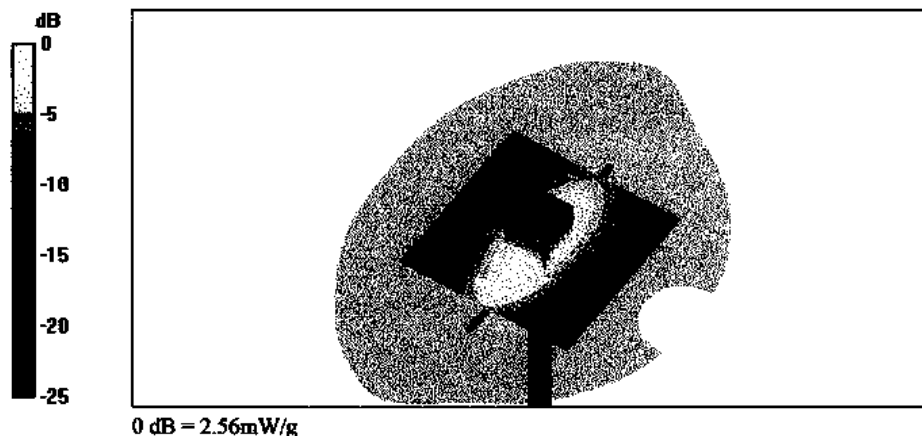
Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL 835 MHz ($\sigma = 0.91$ mho/m, $\epsilon_r = 43.28$, $\rho = 1000$ kg/m³)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)


DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.7, 6.7, 6.7); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

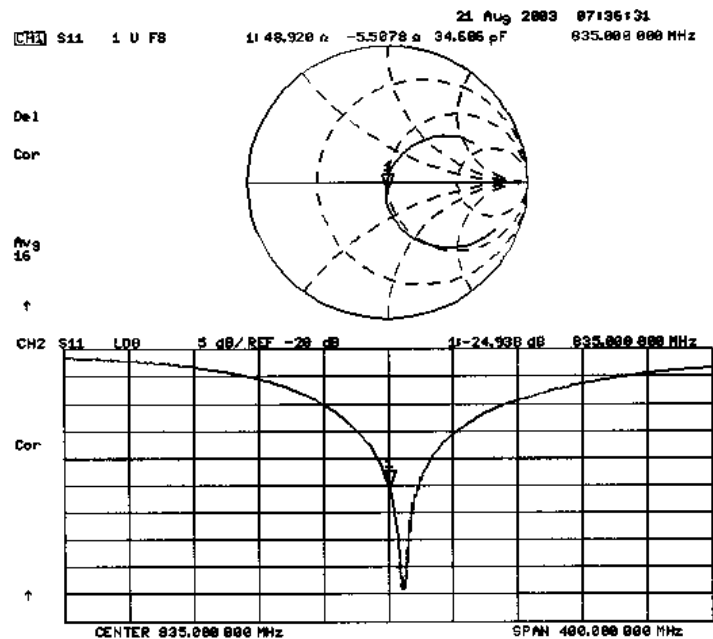
Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 55.3 V/m
Power Drift = -0.02 dB
Maximum value of SAR = 2.55 mW/g


Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 3.52 W/kg
SAR(1 g) = 2.4 mW/g; SAR(10 g) = 1.56 mW/g
Reference Value = 55.3 V/m
Power Drift = -0.02 dB
Maximum value of SAR = 2.56 mW/g



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APPENDIX F: SAR SET UP PHOTOS


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Figure E1. Left ear touch configuration



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Figure E2. Left ear tilted configuration

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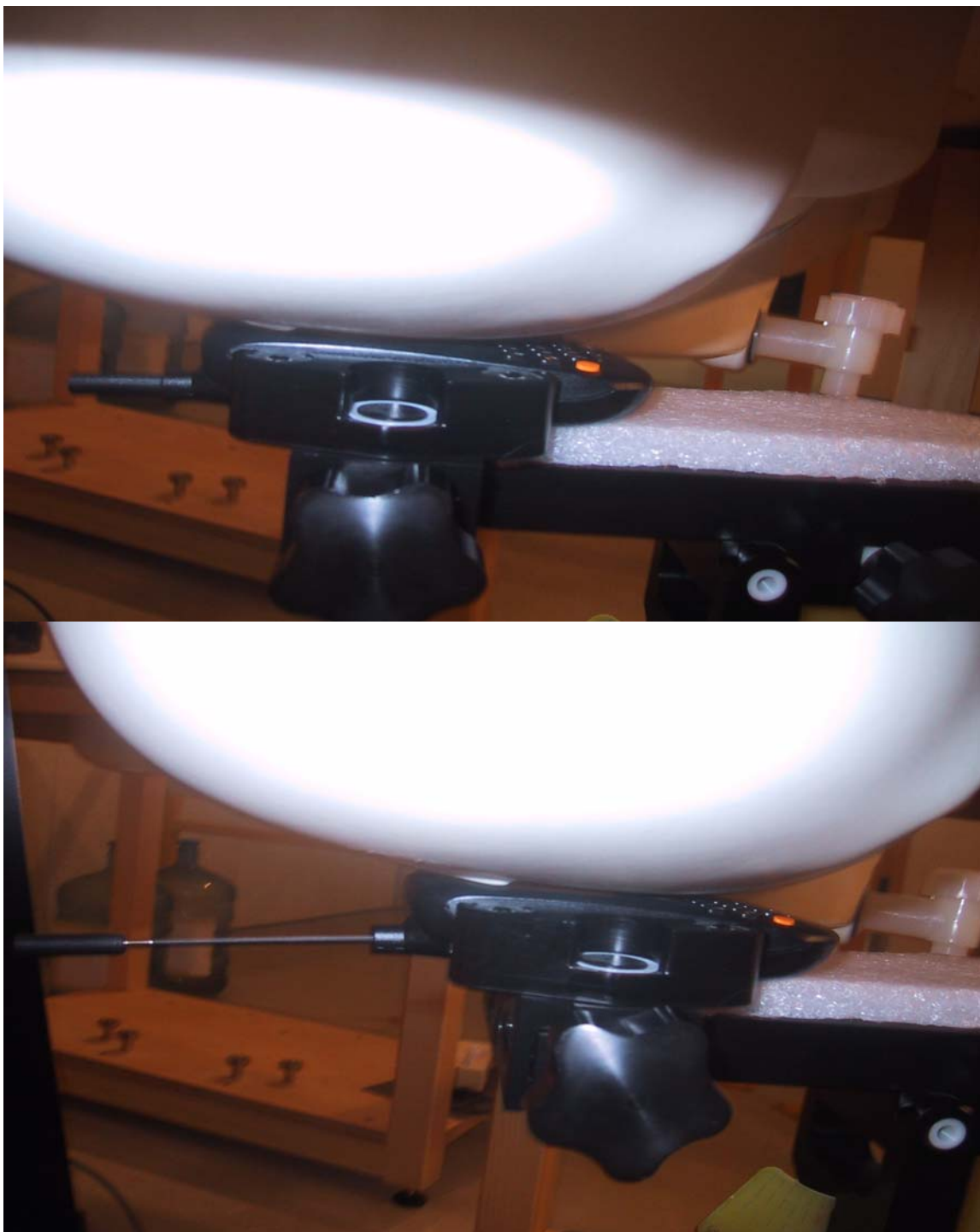


Figure E3. Right ear touch configuration



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Figure E4. Right ear tilted configuration

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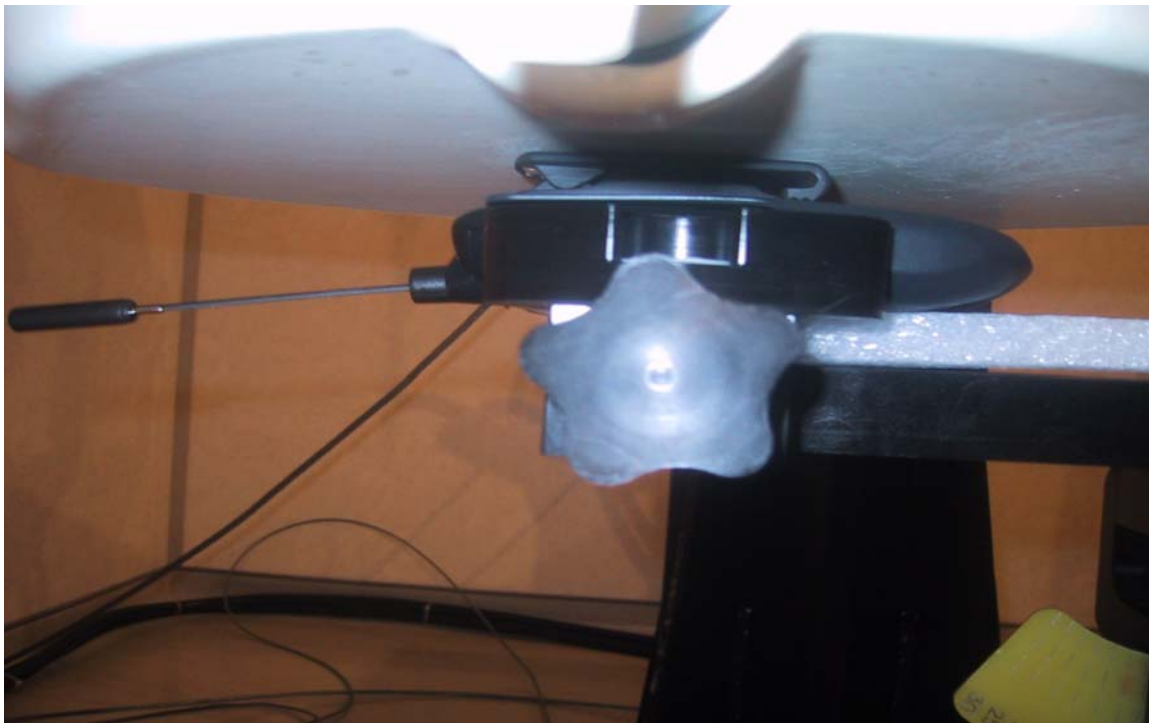


Figure E6. Body worn configuration extended antenna with holster


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Figure E7. Body worn configuration with Leather Swivel Holster


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Figure E8. Body worn configuration with Vertical Foam Holster


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Figure E9. Body worn configuration with Horizontal Foam Holster


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Figure E10. Push-To-Talk mode configuration with 2.5 cm separation distance