SAR Compliance Test Report

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Statement of Compliance: Research In Motion Limited, declares under its sole responsibility that the product 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)

Device Category: This wireless handheld is a portable device, designed to be used in direct contact with the user's head, hand and to be carried in approved accessories when carried on the user's body.

RF exposure environment: This wireless portable device has been shown to be in compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in OET Bulletin 65 Supplement C (Edition 01-01), FCC 96-326-August 1, 1996, IEEE Std. C95.1-1999, Health Canada's Safety Code 6-1999, and reproduced in RSS-102-Issue 1-September 25, 1999 and had been tested in accordance with the measurement procedures specified in OET Bulletin 65 Supplement C (Edition 01-01), ANSI/IEEE Std. C95.3-1991, IEEE 1528-2003 and Health Canada's Safety Code 6-1999.

Approved by:	**Signatures**	**Date**
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1.0 OPERATING CONFIGURATIONS AND TEST CONDITIONS

1.1 Picture of Handheld

Figure 1. BlackBerry Wireless Handheld

1.2 Antenna description

Type	Internal fixed antenna
Location	Back lower centre section
Configuration	Internal fixed antenna

Table 1. Antenna description

1.3 Handheld description

Handheld Model	RAQ40GW				
FCC ID	L6ARAQ40GW				
PIN Number	20134D4B				
Prototype or Production Unit	Pre-production				
Mode(s) of Operation	GSM 850	GSM 900	DCS 1800	PCS 1900	Bluetooth
Maximum conducted RF Output Power	33.00 dBm	33.00 dBm	30.00 dBm	30.00 dBm	3.5 dBm
Tolerance in Power Setting on center channel	32.7 ± 0.3 dB	32.7 ± 0.3 dB	29.7 ± 0.3 dB	29.7 ± 0.3 dB	N/A
Duty Cycle	1:8	1:8	1:8	1:8	N/A
Transmitting Frequency Range (MHz)	824.20-848.80	880.20-814.80	1710.20-1784.80	1850.20-1909.80	2402-2483

Table 2. Test device description

Note: GSM 900 & DCS 1800 bands are not operational in the North America, therefore there are no SAR results presented in this report for FCC/IC submission. A separate report has been generated for these bands. The test report only demonstrates body-worn SAR compliance with two new after market holsters.

1.3 Body worn accessories

Holsters

In addition to the Black Fabric Holster P/N: HDW-08104-001 that was tested and submitted under RIM test report number RIM-0094-0407-03, the BlackBerry Wireless Handheld has been tested with the following additional two holsters which all contain metal components. The worst case SAR has been determined to be with the handheld's back side towards the user's body. The separation distance between the handheld and the user's body for each type of holster is listed in the table below:

Holster Type	Model / Part Number	Separation (mm)
Black Fabric Holster	HDW-08104-001	15
Black Leather Holster	HDW-08360-xxx	15
Fabric Holster with key chain	HDW-08361-xxx	10

Figure 2. Body-worn holsters

1.5 Headsets

The BlackBerry Wireless Handheld was tested with and without headset model number HDW-03458-001. The SAR values are shown in the Table 16.

1.6 Batteries

The Blackberry Wireless Handheld can operate and was tested with the following Lithium Ion Batteries:

- Sanyo battery pack, RIM part number: BAT-06860-001
- Sanyo GS battery pack, RIM part number: BAT-06860-001
- Sanyo GS higher capacity battery pack, RIM part number: BAT-06985-001

1.7 Procedure used to establish the test signal

The Handheld was put into test mode for the SAR measurements by enabling a call via a Rohde & Schwartz CMU 200 Base Station Simulator test instrument. A SIM card was placed in the Handheld to enable the interaction between the BSS communications test instrument and the Handheld. The CMU 200 communications test instrument then sent out a command for the Handheld to transmit at full power at the specified frequency.

A second CMU 200 was used to connect to the Bluetooth band and set to transmit at maximum power. Worst case SAR was measured with GSM and Bluetooth bands ON simultaneously.

2.0 DESCRIPTION OF THE TEST EQUIPMENT

2.1 SAR measurement system

SAR measurements were performed using a Dosimetric Assessment System (DASY 4), an automated SAR measurement system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich, Switzerland.

The DASY 4 system for performing compliance tests consists of the following items:

· A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
· An arm extension for accommodating the data acquisition electronics (DAE).
· A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
· A DAE module which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the Electro-optical coupler (EOC).
· A unit to operate the optical surface detector which is connected to the EOC.
· The EOC performs the conversion from an optical signal into the digital electric signal of the DAE. The EOC is connected to the PC plug-in card.
· The functions of the PC plug-in card based on a DSP is to perform the time critical tasks such as signal filtering, surveillance of the robot operation fast movement interrupts.
· A computer operating Windows 2000.
· DASY 4 software version 4.3 .
· Remote control with teach pendant and additional circuitry for robot safety such as

warning lamps, etc.
· The SAM Twin Phantom enabling testing left-hand and right-hand usage.
· The device holder for handheld mobile phones.
· Tissue simulating liquid mixed according to the given recipes (see Application Note).
· System validation dipoles allowing for the validation of proper functioning of the system.

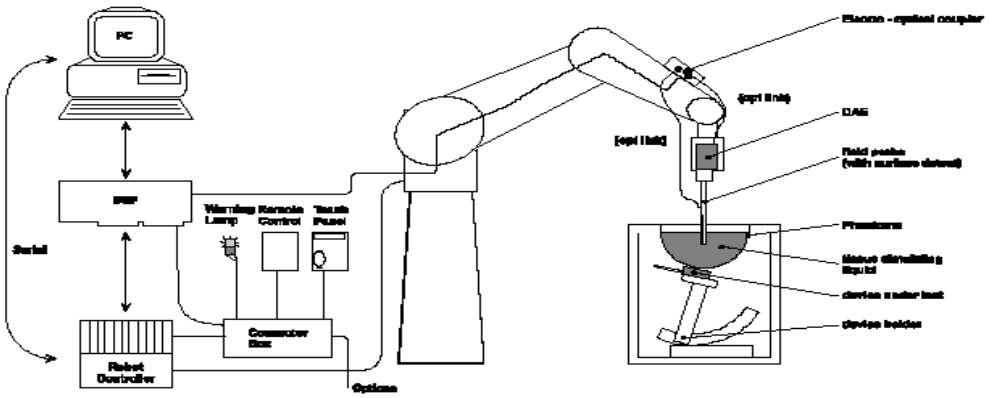


Figure 3: System Description

2.1.1 Equipment List

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date
SCHMID & Partner Engineering AG	E-field probe	ET3DV6	1644	21/04/2005
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3 V1	472	27/08/2005
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	446	21/08/2005
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	545	22/08/2005
Agilent Technologies	Signal generator	HP 8648C	4037U03155	01/08/2005
Agilent Technologies	Power meter	E4419B	GB40202821	21/07/2005
Agilent Technologies	Power sensor	8482A	US37295126	05/08/2005
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	27/07/2005
Rohde & Schwarz	Base Station Simulator	CMU 200	100251	21/04/2005

Table 3. Equipment list

2.2 Description of the test setup

Before a SAR test is conducted the Handheld and the DASY equipment are setup as follows:

2.2.1 Handheld and base station simulator setup

• Insert SIM card into the Handheld's SIM card slot and power it up.
• Turn on the CMU 200 test set and set the carrier frequency and power to the appropriate values.
• Connect an antenna to the RF IN/OUT of the communication test set and place it close to the Handheld.

2.2.2 DASY setup

• Turn the computer on and log on to Windows 200.
• Start DASY 4 software by clicking on the icon located on the Windows desktop. Once the software loads, click on the Change to Robot toolbar button to open the State and Robot Monitoring Windows.
• Once the DASY State dialog opens you can ignore all errors and click OK to open the Robot Monitoring window.
• Mount the DAE unit and the probe. Turn on the DAE unit.
• Turn the Robot Controller on by turning the main power switch to the horizontal position
• Align the probe and click the align probe in the light beam button to correct the probe offset.
• Open a program and configure it to the proper parameters
• Establish a connection between the Handheld and the communications test instrument. Place the Handheld on the stand and adjust it under the phantom.
• Start SAR measurements.

3.0 ELECTRIC FIELD PROBE CALIBRATION

3.1 Probe Specification

SAR measurements were conducted using the dosimetric probe ET3DV6, designed by Schmid & Partner Engineering AG for the measurement of SAR. The probe is constructed using the thin film technique, with printed resistive lines on ceramic substrates. It has a symmetrical design with triangular core, built-in optical fiber for the surface detection system and built-in shielding against static discharge. The probe is sensitive to E-fields and thus incorporates three small dipoles arranged so that the overall response is close to isotropic. The table below summarizes the technical data for the probe.

Property	Data
Frequency range	30 MHz – 3 GHz
Linearity	±0.1 dB
Directivity (rotation around probe axis)	≤ ±0.2 dB
Directivity (rotation normal to probe axis)	±0.4 dB
Dynamic Range	5 mW/kg – 100 W/kg
Probe positioning repeatability	±0.2 mm
Spatial resolution	< 0.125 mm ³

Table 4. Probe specification

3.2 Probe calibration and measurement errors

The probe was calibrated on 09/10/2003 with an accuracy better than ±10%. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe were tested. The probe calibration parameters are shown on Appendix D.

4.0 SAR MEASUREMENT SYSTEM VERIFICATION

Prior to conducting SAR evaluation, the measurements were validated using the dipole validation kit and a flat phantom. A power level of 1.0 W was applied to the dipole antenna. The verification results are in the table below with a comparison to reference values. Printouts are shown in Appendix A. All the measured parameters are satisfactory.

4.1 System accuracy verification for Head Adjacent use

f (MHz)	Limits / Measured	SAR (W/kg) 1 g/ 10 g	Dielectric Parameters		Liquid Temp (°C)
			ε_r	σ [S/m]	
835	Measured	10.4 / 6.7	44.4	0.95	22.5
	Recommended Limits	9.6 / 6.2	43.3	0.91	N/A
1900	Measured	41.3 / 21.4	39.5	1.45	22.5
	Recommended Limits	41.2 / 21.3	40.2	1.46	N/A

Table 5. System accuracy (Validation for Head Adjacent use)

5.0 PHANTOM DESCRIPTION

The SAM Twin Phantom, manufactured by SPEAG, was used during the SAR measurements. The phantom is made of a fiberglass shell integrated with a wooden table.

The SAM Twin Phantom is a fiberglass shell phantom with 2 mm shell thickness. It has three measurement areas:
Left hand
Right hand
Flat phantom

The phantom table dimensions are: 100x50x85 cm (LxWxH). The table is intended for use with free standing robots.

The bottom shelf contains three pair of bolts for locking the device holder in place. 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).

A white cover is provided to top the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible; however the optical surface detector does not work properly at the cover surface. Place a sheet of white paper on the cover when using optical surface detection.

Liquid depth of ≥ 15 cm is maintained in the phantom for all the measurement.

Figure 4
SAM Twin Phantom

6.0 TISSUE DIELECTRIC PROPERTY

6.1 Composition of tissue simulant

The composition of the brain and muscle simulating liquids for 800-900 MHz and 1800-1900 MHz are shown in the table below.

INGREDIENT	MIXTURE 800–900MHz		MIXTURE 1800–1900MHz	
	Brain %	Muscle %	Brain %	Muscle %
Water	51.07	65.45	54.88	69.91
Sugar	47.31	34.31	0	0
Salt	1.15	0.62	0.21	0.13
HEC	0.23	0	0	0
Bactericide	0.24	0.10	0	0
DGBE	0	0	44.91	29.96

Table 6. Tissue simulant recipe

6.1.1 Equipment

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date
Pyrex, England	Graduated Cylinder	N/A	N/A	N/A
Pyrex, USA	Beaker	N/A	N/A	N/A
Acculab	Weight Scale	V1-1200	018WB2003	N/A
Hart Scientific	Digital Thermometer	61161-302	21352860	09/10/2005
IKA Works Inc.	Hot Plate	RC Basic	3.107433	N/A

Table 7. Tissue simulant preparation equipment

6.1.2 Preparation procedure

800-900 MHz liquids

• Fill the container with **water**. Begin heating and stirring.
• Add the **Cellulose,** the **preservative substance** and the **salt**. After several hours, the liquid will become more transparent again. The container must be covered to prevent evaporation.
• Add **Sugar**. Stir it well until the sugar is sufficiently dissolved.
• Keep the liquid hot but below the boiling point for at least an hour. The container must be covered to prevent evaporation.
• Remove the container from, and turn the hotplate off and allow the liquid to cool off to room temperature prior to performing dielectric measurements.

1800-1900 MHz liquid

- Fill the container with **water**. Begin heating and stirring.
- Add the **salt** and **Glycol**. The container must be covered to prevent evaporation.
- Keep the liquid hot but below the boiling point for at least an hour. The container must be covered to prevent evaporation.
- Remove the container from, and turn the hotplate off and allow the liquid to cool off to room temperature prior to performing dielectric measurements.

6.2 Electrical parameters of the tissue simulating liquid

The tissue dielectric parameters shall be measured before a batch can be used for SAR measurements to ensure that the simulated tissue was properly made and will simulate the desired human characteristic. Limits and measured electrical parameters are show in the table below.
Recommended limits are adopted from IEEE 1528-2003:
" Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", SPEAG dipole calibration certificates and from FCC Tissue Dielectric Properties web page at http://www.fcc.gov/fcc-bin/dielec.sh

f (MHz)	Tissue Type	Limits / Measured	Dielectric Parameters		Liquid Temp (°C)
			ε_r	σ [S/m]	
835	Head	Measured	44.4	0.95	22.5
		Recommended Limits	43.3	0.91	N/A
	Muscle	Measured	53.2	0. 98	22.2
		Recommended Limits	55.2	0.97	N/A
1900	Head	Measured	39.5	1.45	22.5
		Recommended Limits	40.0	1.46	N/A
	Muscle	Measured	51.1	1.56	22.4
		Recommended Limits	53.3	1.52	N/A

Table 8. Electrical parameters of tissue simulating liquid

6.2.1 Equipment

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date
Agilent Technologies	Network Analyzer	8753ES	US39174857	27/07/2005
Agilent Technologies	Dielectric probe kit	HP 85070C	US9936135	CNR
Dell	PC using GPIB card	GX110	347	N/A
Hart Scientific	Digital Thermometer	61161-302	21352860	09/10/2005

Table 9. Equipment required for electrical parameter measurements

6.2.2 Test Configuration

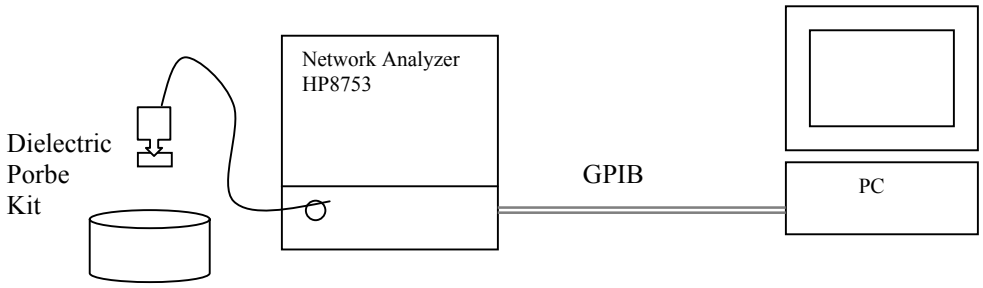


Figure 5: Test configuration

6.2.3 Procedure

1. Turn NWA on and allow at least 30 minutes for warm up.
2. Mount dielectric probe kit so that interconnecting cable to NWA will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature (±1°).
4. Set water temperature in HP-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness ε'=10.0, ε''=0.0). If measured parameters do not fit within tolerance, repeat calibration (±0.2 for ε': ±0.1 for ε'').
7. Relative permittivity $\varepsilon r = \varepsilon'$ and conductivity can be calculated from ε''
   $\sigma = \omega \varepsilon_0 \varepsilon''$
8. Measure liquid shortly after calibration.
9. Stir the liquid to be measured. Take a sample (~50ml) with a syringe from the center of the liquid container.
10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in DASY 4 for the frequencies necessary for the measurements ('Setup Config', select medium (e.g. Brain 900 MHz) and press 'Option'-button.
14. Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 900 MHz).

Sample calculation for 835 MHz head tissue dielectric parameters using data from Table 10.

Relative permittivity $\varepsilon r = \varepsilon'$ = 44.38
Conductivity $\sigma = \omega \varepsilon_0 \varepsilon''$ = 2 x 3.1416 x 835 e+6 x 8.854e-12 x 20.4 = 0.95 S/m

Title
SubTitle
September 23, 2004 10:54 AM

Frequency	e'	e''
800.000000 MHz	44.8707	20.5406
805.000000 MHz	44.8152	20.5397
810.000000 MHz	44.7353	20.5077
815.000000 MHz	44.6725	20.4931
820.000000 MHz	44.5970	20.4501
825.000000 MHz	44.5082	20.4494
830.000000 MHz	44.4508	20.4235
835.000000 MHz	44.3846	20.4008
840.000000 MHz	44.3067	20.3712
845.000000 MHz	44.2553	20.3555
850.000000 MHz	44.1922	20.3330
855.000000 MHz	44.1205	20.3135
860.000000 MHz	44.0833	20.2839
865.000000 MHz	44.0220	20.2412
870.000000 MHz	43.9685	20.2380
875.000000 MHz	43.9102	20.2160
880.000000 MHz	43.8492	20.2155
885.000000 MHz	43.8078	20.2092
890.000000 MHz	43.7785	20.1738
895.000000 MHz	43.7238	20.1367
900.000000 MHz	43.6683	20.1104
905.000000 MHz	43.6131	20.1293
910.000000 MHz	43.5669	20.0956
915.000000 MHz	43.4988	20.0842
920.000000 MHz	43.4482	20.0625
925.000000 MHz	43.3984	20.0409
930.000000 MHz	43.3139	20.0309
935.000000 MHz	43.2539	20.0328
940.000000 MHz	43.1863	19.9790
945.000000 MHz	43.1137	19.9663
950.000000 MHz	43.0766	19.9712

Title
SubTitle
September 23, 2004 11:10 AM

Frequency	e'	e''
800.000000 MHz	53.6000	21.2247
805.000000 MHz	53.5379	21.2064
810.000000 MHz	53.4787	21.1930
815.000000 MHz	53.4333	21.1358
820.000000 MHz	53.3848	21.1305
825.000000 MHz	53.3225	21.1301
830.000000 MHz	53.2621	21.0850
835.000000 MHz	53.2036	21.0729
840.000000 MHz	53.1391	21.0412
845.000000 MHz	53.0793	21.0191
850.000000 MHz	53.0275	21.0162
855.000000 MHz	52.9663	20.9844
860.000000 MHz	52.9256	20.9617
865.000000 MHz	52.8881	20.9165
870.000000 MHz	52.8146	20.9012
875.000000 MHz	52.7934	20.9091
880.000000 MHz	52.7313	20.8900
885.000000 MHz	52.7048	20.8787
890.000000 MHz	52.6568	20.8915
895.000000 MHz	52.6387	20.8562
900.000000 MHz	52.6100	20.8460
905.000000 MHz	52.5559	20.8353
910.000000 MHz	52.4994	20.8154
915.000000 MHz	52.4669	20.8019
920.000000 MHz	52.4299	20.7749
925.000000 MHz	52.3353	20.7810
930.000000 MHz	52.2702	20.7555
935.000000 MHz	52.2044	20.7509
940.000000 MHz	52.1918	20.7254
945.000000 MHz	52.1295	20.6997
950.000000 MHz	52.0536	20.7000

Table 10. 835 MHz head and muscle tissue dielectric parameters

Title

SubTitle

September 27, 2004 02:01 PM

Frequency	e'	e"
1.700000000 GHz	40.3347	13.3357
1.710000000 GHz	40.2977	13.3644
1.720000000 GHz	40.2978	13.3744
1.730000000 GHz	40.2704	13.4099
1.740000000 GHz	40.2604	13.4410
1.750000000 GHz	40.2234	13.4507
1.760000000 GHz	40.1574	13.4718
1.770000000 GHz	40.0993	13.5038
1.780000000 GHz	40.0351	13.5181
1.790000000 GHz	39.9573	13.5533
1.800000000 GHz	39.9094	13.5798
1.810000000 GHz	39.8349	13.5953
1.820000000 GHz	39.8016	13.6164
1.830000000 GHz	39.7614	13.6539
1.840000000 GHz	39.7212	13.6794
1.850000000 GHz	39.6939	13.6848
1.860000000 GHz	39.6502	13.7007
1.870000000 GHz	39.6170	13.7220
1.880000000 GHz	39.5665	13.7425
1.890000000 GHz	39.5154	13.7366
1.900000000 GHz	39.4465	13.7573
1.910000000 GHz	39.3711	13.7797
1.920000000 GHz	39.3221	13.7765

Title

SubTitle

September 27, 2004 03:06 PM

Frequency	e'	e"
1.700000000 GHz	51.7795	14.1346
1.710000000 GHz	51.7519	14.1338
1.720000000 GHz	51.7208	14.1539
1.730000000 GHz	51.6866	14.1765
1.740000000 GHz	51.6382	14.2106
1.750000000 GHz	51.6332	14.2425
1.760000000 GHz	51.5892	14.2770
1.770000000 GHz	51.5772	14.3394
1.780000000 GHz	51.5408	14.3824
1.790000000 GHz	51.5067	14.4343
1.800000000 GHz	51.4744	14.4814
1.810000000 GHz	51.4284	14.5008
1.820000000 GHz	51.3720	14.5185
1.830000000 GHz	51.3321	14.5620
1.840000000 GHz	51.2875	14.5849
1.850000000 GHz	51.2235	14.6246
1.860000000 GHz	51.2029	14.6420
1.870000000 GHz	51.1644	14.6821
1.880000000 GHz	51.1501	14.7192
1.890000000 GHz	51.1141	14.7576
1.900000000 GHz	51.0761	14.7591
1.910000000 GHz	51.0477	14.8020
1.920000000 GHz	51.0110	14.8172

Table 11. 1900 MHz head and muscle tissue dielectric parameters

7.0 SAR SAFETY LIMITS

Standards/Guideline	Localized SAR Limit (W/kg) General public (uncontrolled)	Localized SAR Limits (W/kg) Workers (controlled)
ICNIRP (1998) Standard	2.0 (10g)	10.0 (10g)
IEEE C95.1 (1999) Standard	1.6 (1g)	8.0 (1g)

Table 12. SAR safety limits for Controlled / Uncontrolled environment

Human Exposure	Localized SAR Limits (W/kg) 10g, ICNIRP (1998) Standard	Localized SAR Limits (W/kg) 1g, IEEE C95.1 (1999) Standard
Spatial Average (averaged over the whole body)	0.08	0.08
Spatial Peak (averaged over any X g of tissue)	2.00	1.60
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.00	4.00 (10g)

Table 13. SAR safety limits

Uncontrolled Environments are defined as locations where there is exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

8.0 DEVICE POSITIONING

8.1 Device holder for SAM Twin Phantom

The Handheld was positioned for all test configurations using the DASY 4 holder. The device holder facilitates the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening. The devices can be easily, accurately and with repeatability positioned according to FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

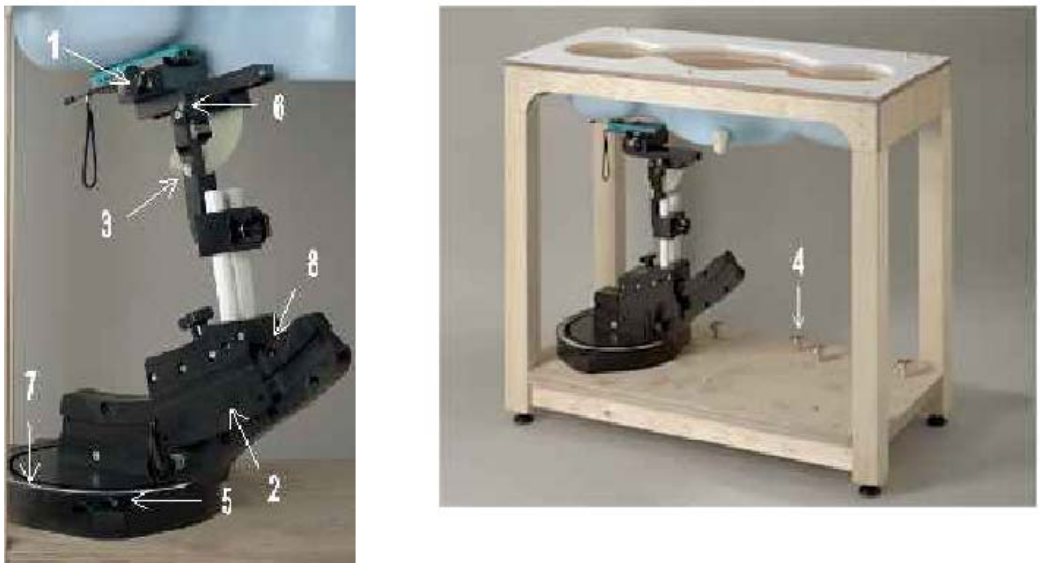


Figure 6
Device Holder

1. Put the phone in the clamp mechanism (1) and hold it straight while tightening. (Curved phones or phones with asymmetrical ear pieces should be positioned so that the ear piece is in the symmetry plane of the clamp).

2. Adjust the sliding carriage (2) to 90°. Then adjust the phone holder angle (3) until the reference line of the phone is horizontal (parallel to the flat phantom bottom). The phone reference line is defined as the front tangential line between the ear piece and the center of the device bottom (or the center of the flip hinge). For devices with parallel front and back sides, the phone holder angle (3) is 0°.

3. Place the device holder at the desired phantom section and move it securely against the positioning pins (4). The screw in front of the turning plate can be applied for correct positioning (5). (Do not tighten it too strongly).

4. Shift the phone clamp (6) so that the ear piece is exactly below the ear marking of the phantom. The phone is now correctly positioned in the holder for all standard phantom measurements, even after changing the phantom or phantom section.

5. Adjust the device position angles to the desired measurement position.

6. After fixing the device angles, move the phone fixture up until the phone touches the ear marking. (The point of contact depends on the design of the device and the positioning angle).

8.2 Description of the test positioning

8.2.1 Test Positions of Device Relative to Head

The handset was tested in two test positions against the head phantom, the "cheek" position and the "tilted" position, on both left and right sides of the phantom.

The handset was tested in the above positions according to IEEE 1528: 2003 "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques".

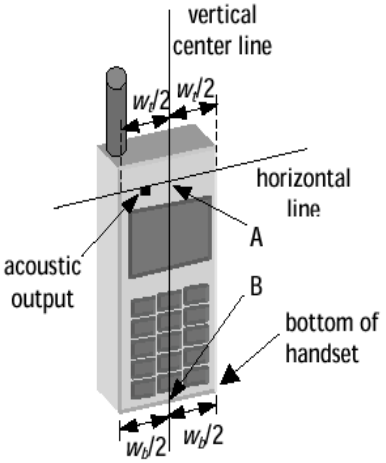


Figure 7a – Handset vertical and horizontal reference lines – fixed case

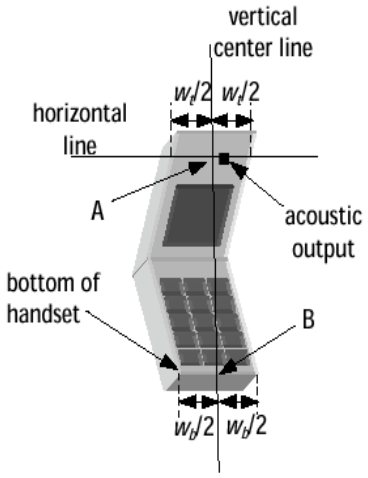


Figure 7b – Handset vertical and horizontal reference lines – "clam-shell"

8.2.1.1 Definition of the "cheek" position

1) Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover.
2) Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width *wt* of the handset at the level of the acoustic output (point A on Figures 7a and 7b), and the midpoint of the width *wb* of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 7a). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 7b), especially for clamshell handsets, handsets with flip pieces, and other irregularly shaped handsets.
3) Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 7), such that the plane defined by the vertical center line and the horizontal center line is in a plane approximately parallel to the sagittal plane of the phantom.
4) Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the ear.
5) While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is the plane normal to MB ("*mouth-back*") - NF ("*neck-front*") including the line MB (reference plane).
6) Rotate the phone around the vertical centerline until the phone (horizontal line) is symmetrical with respect to the line NF.
7) While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the ear (cheek).

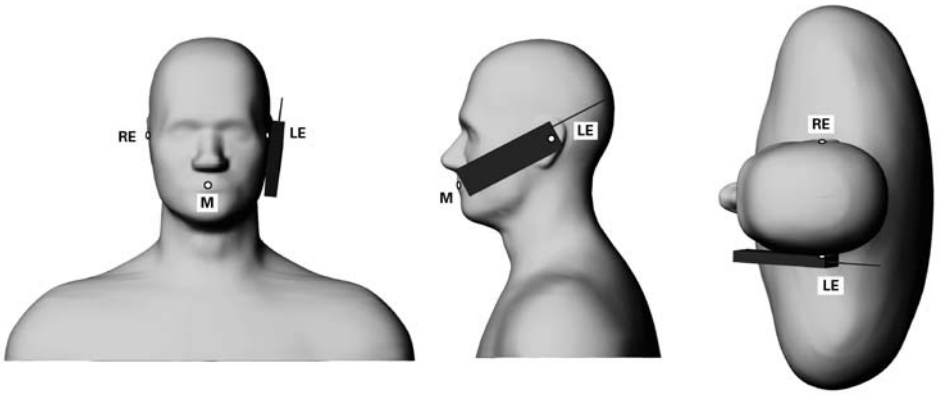


Figure 8 – Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.1.2 Definition of the "Tilted" Position

1) Repeat steps 1 to 7 of 5.4.1 (in this report 8.2.1.1) to replace the device in the "cheek position."
2) While maintaining the device in the reference plane (described above) and pivoting against the ear, move the device outward away from the mouth by an angle of 15 degrees, or until the antenna touches the phantom**.**

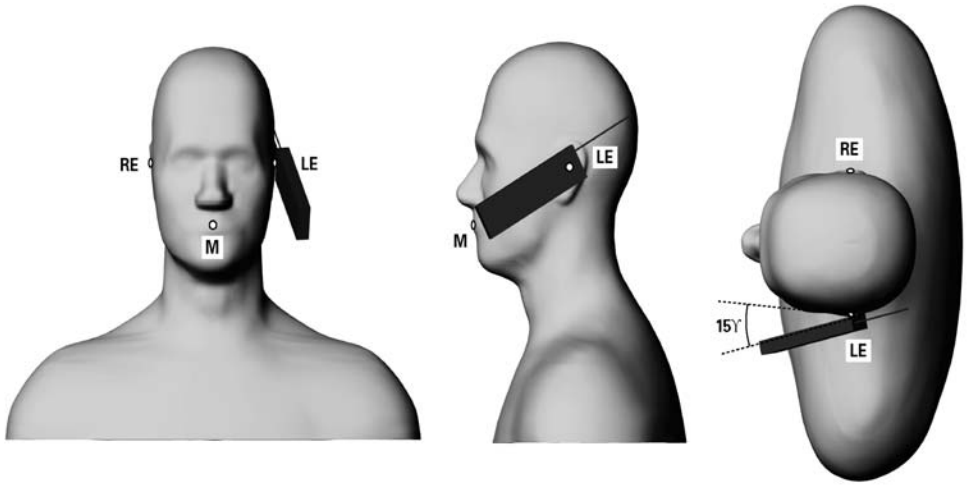


Figure 9 – Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body Holster Configuration

A body worn holster, as shown on Figure 2, was tested with the Wireless Handheld for FCC/IC RF exposure compliance. The EUT was positioned in the holster case and the belt clip was placed against the flat section of the phantom. A headset was then connected to the handheld to simulate hands-free operation in a body worn holster configuration.

9.0 High Level Evaluation

9.1 Maximum search

The maximum search is automatically performed after each coarse scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations.

9.2 Extrapolation

The extrapolation can be used in z-axis scans with automatic surface detection. The SAR values can be extrapolated to the inner phantom surface. The extrapolation distance is the sum of the probe sensor offset, the surface detection distance and the grid offset. The extrapolation is based on fourth order polynomial functions. The extrapolation is only available for SAR values.

9.3 Boundary correction

The correction of the probe boundary effect in the vicinity of the phantom surface is done in the standard (worst case) evaluation; the boundary effect is reduced by different weights for the lowest measured points in the extrapolation routine. The result is a slight overestimation of the extrapolated SAR values (2% to 8%) depending on the SAR distribution and gradient. The advanced evaluation makes a full compensation of the boundary effect before doing the extrapolation. This is only possible for probes with specifications on the boundary effect.

9.4 Peak search for 1g and 10g cube averaged SAR

The 1g and 10g peak evaluations are only available for the predefined cube 5x5x7 scan. The routines are verified and optimized for the grid dimensions used in these cube measurements.
The measure volume of 32x32x35mm mm contains about 35g of tissue. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid (35000 points). In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is then moved around until the highest averaged SAR is found. This last procedure is repeated for a 10 g cube. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

10.0 MEASUREMENT UNCERTAINTIES

DASY4 Uncertainty Budget
According to IEEE P1528 [1]

Error Description	Uncertainty value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±4.8%	N	1	1	1	±4.8%	±4.8%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±1.0%	N	1	1	1	±1.0%	±1.0%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Conditions	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0%	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (meas.)	±2.5%	N	1	0.64	0.43	±1.6%	±1.1%	∞
Liquid Permittivity (target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (meas.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined Std. Uncertainty						±10.3%	±10.0%	330
Expanded STD Uncertainty						**±20.6%**	**±20.1%**	

Table 14. Measurement uncertainty

11.0 TEST RESULTS

11.1 SAR measurement results at highest power measured against the body using holster

Mode	f (MHz)	Cond. Output Power (dBm)	Liquid Temp (°C)	Holster / Battery pack type	SAR, averaged over 1 g (W/kg) Holster
GSM 850	824.20	33.0	22.0	Leather holster with Sanyo GS	1.03
	836.80	33.2	22.3	Leather holster with Sanyo GS	0.98
	848.80	33.0	22.3	Leather holster with Sanyo GS	0.84
	824.20	33.0	21.8	Fabric holster with keychain with Sanyo GS	**1.03**
	836.80	33.0	21.9	Fabric holster with keychain Sanyo GS	1.00
	848.80	33.0	21.8	Fabric holster with keychain Sanyo GS	0.96
GSM 1900	*1880.00	30.2	22.4	Leather holster Sanyo GS	0.53
	1880.00	30.2	22.2	Fabric holster with keychain Sanyo GS	**0.80**

Table 16. SAR results with body-worn holster

* Supplement C: Middle channel testing is sufficient only if SAR < 3dB below limit see PN 02-1438

12.0 REFERENCES

[1] EN 50360: 2001, Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)

[2] EN 50361: 2001, Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz)

[3] ICNIRP, International Commission on Non-Ionizing Radiation Protection (1998), Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

[4] Council Recommendation 1999/519/EC of July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)

[5] IEEE C95.3-1991, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

[6] IEEE C95.1-1999, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[7] OET Bulletin 65 (Edition 97-01) Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

[8] FCC 96-326-August 1, 1996, Guidelines for Evaluating the Environmental Effects of Radio-Frequency Radiation.

[9] DASY 4 DOSIMETRIC ASSESSMENT SYSTEM SOFTWARE MANUAL V4.1 Schmid & Partner Engineering AG, April 2003.

[10] IEEE 1528-2003: Recommended Practice for Determining the Peak Spatial-Average Specific Aborption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

[11] Health Canada, Safety Code 6, 1999: Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency range from 3 kHz to 300 GHz.

[12] RSS-102, issue 1 (Provisional), September 25, 1999: Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields.

APPENDIX A: SAR DISTRIBUTION COMPARISON FOR THE ACCURACY VERIFICATION

Date/Time: 09/23/04 11:24:55

Test Laboratory: Research In Motion Limited

835 MHz dipole validation; Amb. Temp. 24.4 deg. cel.; Liquid Temp. 22.5 deg. cel.

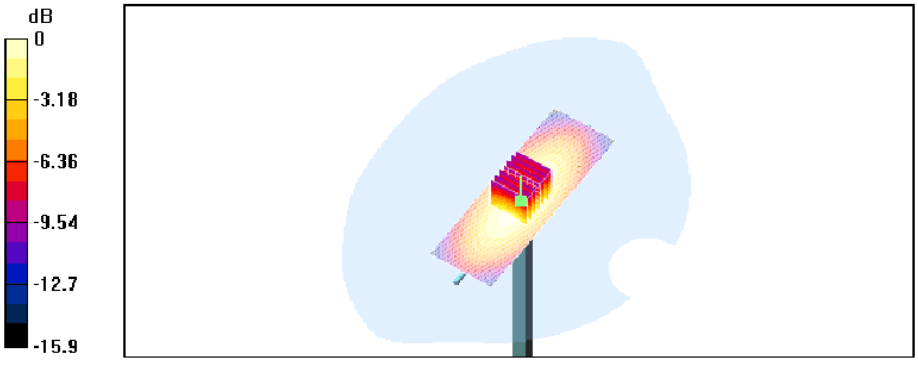
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:446

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 MHz Head Medium parameters used: f = 835 MHz; σ = 0.95 mho/m; ε_r = 44.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1644; ConvF(6.8, 6.8, 6.8); Calibrated: 21/04/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn472; Calibrated: 27/08/2004
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1076
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 112.3 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 15.5 W/kg
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 6.74 mW/g
Maximum value of SAR (measured) = 11.2 mW/g

Unnamed procedure/Area Scan (51x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 11.3 mW/g



0 dB = 11.3mW/g

Date/Time: 09/27/04 14:08:42

Test Laboratory: Research In Motion Limited

1900 MHz dipole validation; Amb. Temp. 23.7 deg. cel.; Liquid Temp. 22.5 deg. cel.

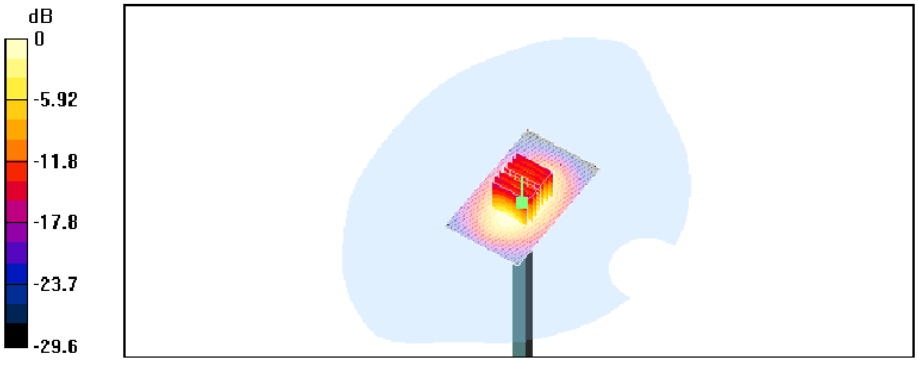
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:545

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL1900 Medium parameters used: f = 1900 MHz; σ = 1.45 mho/m; ε_r = 39.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1644; ConvF(5.4, 5.4, 5.4); Calibrated: 21/04/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn472; Calibrated: 27/08/2004
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1076
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 184.9 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 75 W/kg
SAR(1 g) = 41.3 mW/g; SAR(10 g) = 21.4 mW/g
Maximum value of SAR (measured) = 46.8 mW/g

Unnamed procedure/Area Scan (61x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 47.1 mW/g



0 dB = 47.1mW/g

APPENDIX B: SAR DISTRIBUTION PLOTS FOR BODY-WORN CONFIGURATION

Date/Time: 09/23/04 14:07:46

Test Laboratory: Research In Motion Limited

Body-worn with black leather holster; GSM 850 band; Low Chan; Sanyo GS battery; Amb. Temp. 24.0 deg. cel.; Liquid Temp. 22.0 deg. cel

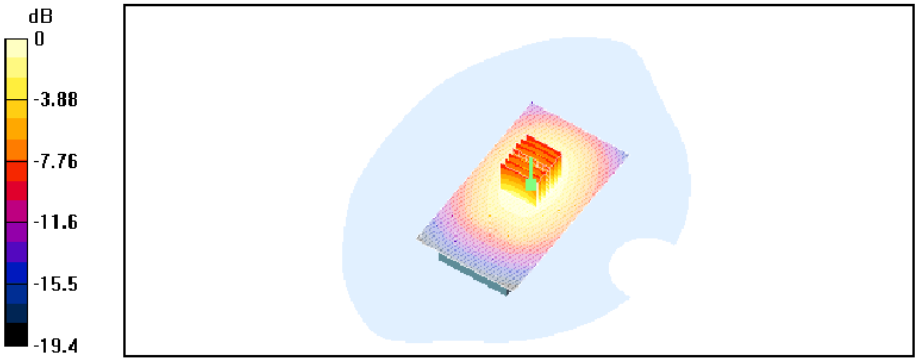
DUT: BlackBerry 7100 Wireless Handheld Model RAQ40GW; Type: Sample

Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium: M 835 Medium parameters used: f = 824.2 MHz; σ = 0.98 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1644; ConvF(6.4, 6.4, 6.4); Calibrated: 21/04/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn472; Calibrated: 27/08/2004
- Phantom: SAM 2; Type: SAM 4.0; Serial: 1080
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 31 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 1.43 W/kg
SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.718 mW/g
Maximum value of SAR (measured) = 1.1 mW/g

Unnamed procedure/Area Scan (81x141x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.13 mW/g



0 dB = 1.13mW/g

Date/Time: 09/23/04 15:19:08

Test Laboratory: Research In Motion Limited

Body-worn with fabric holster and keychain; GSM 850 band; Low Chan; Sanyo GS battery; Amb. Temp. 23.6 deg. cel.; Liquid Temp. 21.8 deg. cel

DUT: BlackBerry 7100 Wireless Handheld Model RAQ40GW; Type: Sample

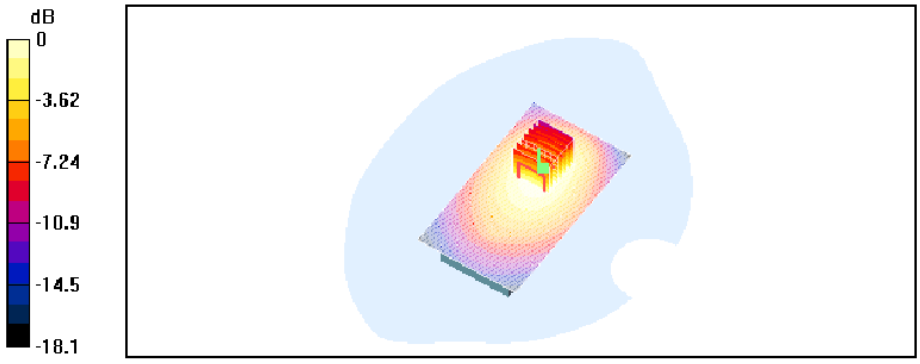
Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium: M 835 Medium parameters used: f = 824.2 MHz; σ = 0.98 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1644; ConvF(6.4, 6.4, 6.4); Calibrated: 21/04/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn472; Calibrated: 27/08/2004
- Phantom: SAM 2; Type: SAM 4.0; Serial: 1080
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.1 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 1.36 W/kg
SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.728 mW/g

Maximum value of SAR (measured) = 1.09 mW/g

Unnamed procedure/Area Scan (81x141x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.11 mW/g



0 dB = 1.11mW/g

Date/Time: 09/27/04 14:55:48

Test Laboratory: Research In Motion Limited

Body worn with leather holster; GSM 1900 MHz; Amb. Temp. 24.2 deg. cel.; Liquid Temp. 22.4 deg. cel.

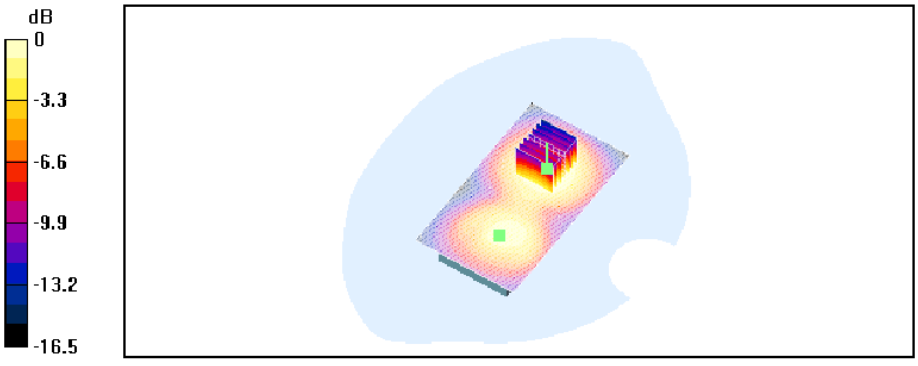
DUT: BlackBerry 7100 Wireless Handheld ; Type: Sample

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: M1900 Medium parameters used: f = 1880 MHz; σ = 1.56 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1644; ConvF(5, 5, 5); Calibrated: 21/04/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn472; Calibrated: 27/08/2004
- Phantom: SAM 2; Type: SAM 4.0; Serial: 1080
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.9 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 0.774 W/kg
SAR(1 g) = 0.528 mW/g; SAR(10 g) = 0.337 mW/g
Maximum value of SAR (measured) = 0.573 mW/g

Unnamed procedure/Area Scan (81x141x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.575 mW/g



0 dB = 0.575mW/g

Date/Time: 09/27/04 15:50:57

Test Laboratory: Research In Motion Limited

Body worn with fabric holster and keychain; GSM 1900 MHz; Amb. Temp. 23.8 deg. cel.; Liquid Temp. 22.2 deg. cel.

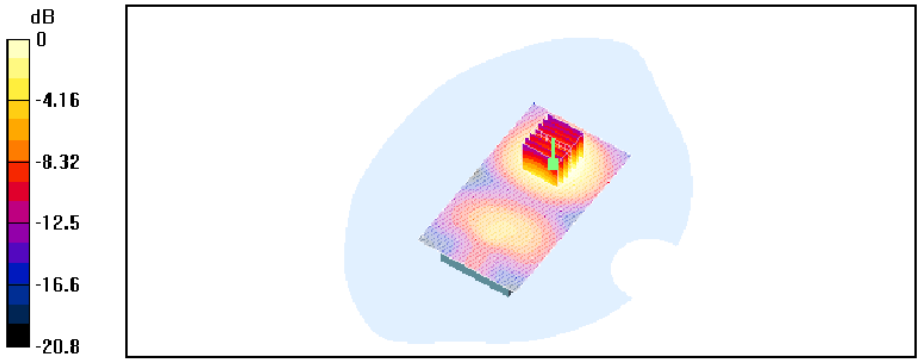
DUT: BlackBerry 7100 Wireless Handheld ; Type: Sample

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: M1900 Medium parameters used: f = 1880 MHz; σ = 1.56 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1644; ConvF(5, 5, 5); Calibrated: 21/04/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn472; Calibrated: 27/08/2004
- Phantom: SAM 2; Type: SAM 4.0; Serial: 1080
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

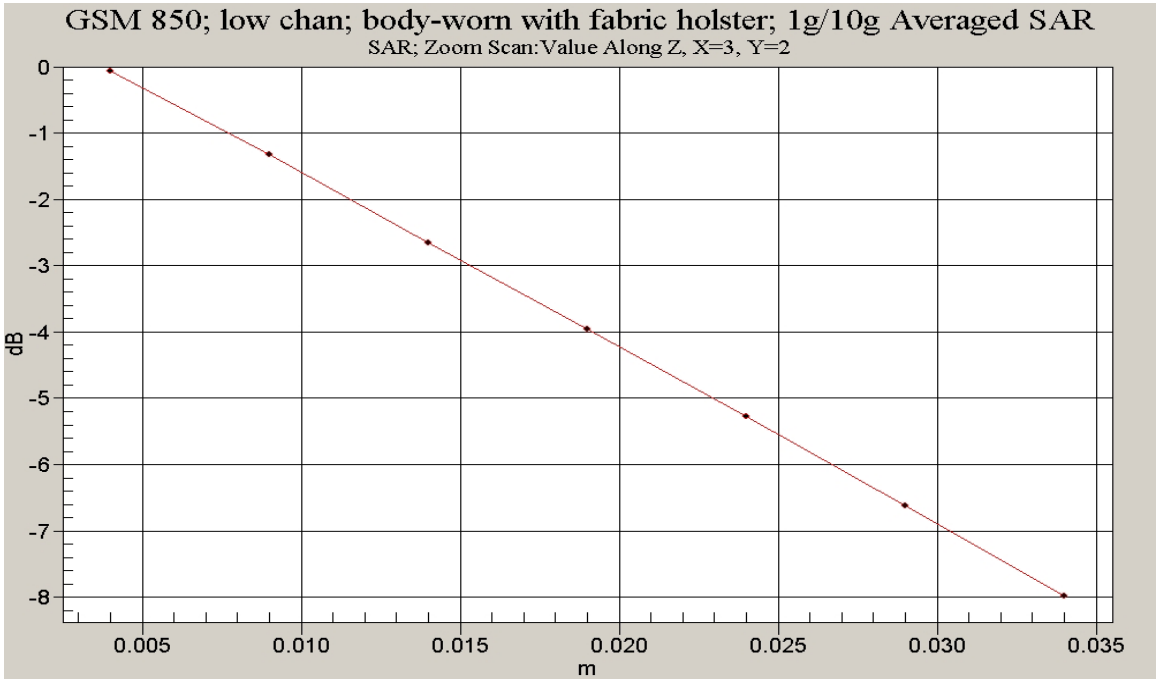
Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.46 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.803 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.865 mW/g

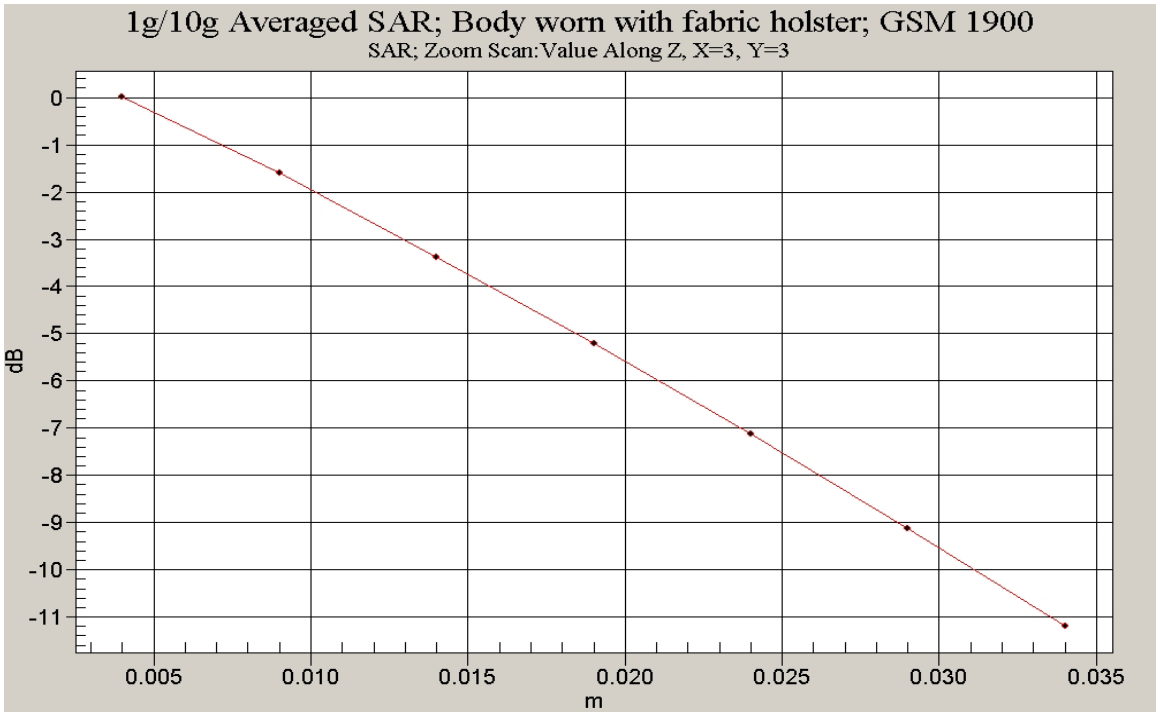
Unnamed procedure/Area Scan (81x141x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.863 mW/g



0 dB = 0.863mW/g

Z-axis plots for worst-case configuration:





APPENDIX D: PROBE & DIPOLE CALIBRATION DATA

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

Client RIM

CALIBRATION CERTIFICATE

Object(s): ET3DV6 - SN:1644

Calibration procedure(s): QA CAL-01.v2 - Calibration procedure for dosimetric E-field probes

Calibration date: November 21, 2003

Condition of the calibrated item: In Tolerance (according to the specific calibration document)

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.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

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 (SPEAG, in house check Oct-03)	In house check: Oct 05
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 (SPEAG, in house check Oct-03)	In house check: Oct 05

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

Date Issued: November 21, 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.

880-KP0301061-A

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Schmid & Partner Engineering AG

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

Probe ET3DV6

SN:1644

Manufactured: November 7, 2001
Last calibration: October 21, 2002
Recalibrated: November 21, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1644 **November 21, 2003**

DASY - Parameters of Probe: ET3DV6 SN:1644

Sensitivity in Free Space

Diode Compression

NormX	**1.71** $\mu V/(V/m)^2$	DCP X	**95**	mV
NormY	**1.86** $\mu V/(V/m)^2$	DCP Y	**95**	mV
NormZ	**1.82** $\mu V/(V/m)^2$	DCP Z	**95**	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m

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

ConvF X	**6.8** ±9.5% (k=2)	Boundary effect:	
ConvF Y	**6.8** ±9.5% (k=2)	Alpha	**0.48**
ConvF Z	**6.8** ±9.5% (k=2)	Depth	**2.08**

Head **1800 MHz** ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

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

ConvF X	**5.4** ±9.5% (k=2)	Boundary effect:	
ConvF Y	**5.4** ±9.5% (k=2)	Alpha	**0.47**
ConvF Z	**5.4** ±9.5% (k=2)	Depth	**2.66**

Boundary Effect

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

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	9.1	4.9
SAR_{be} [%]	With Correction Algorithm	0.0	0.0

Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

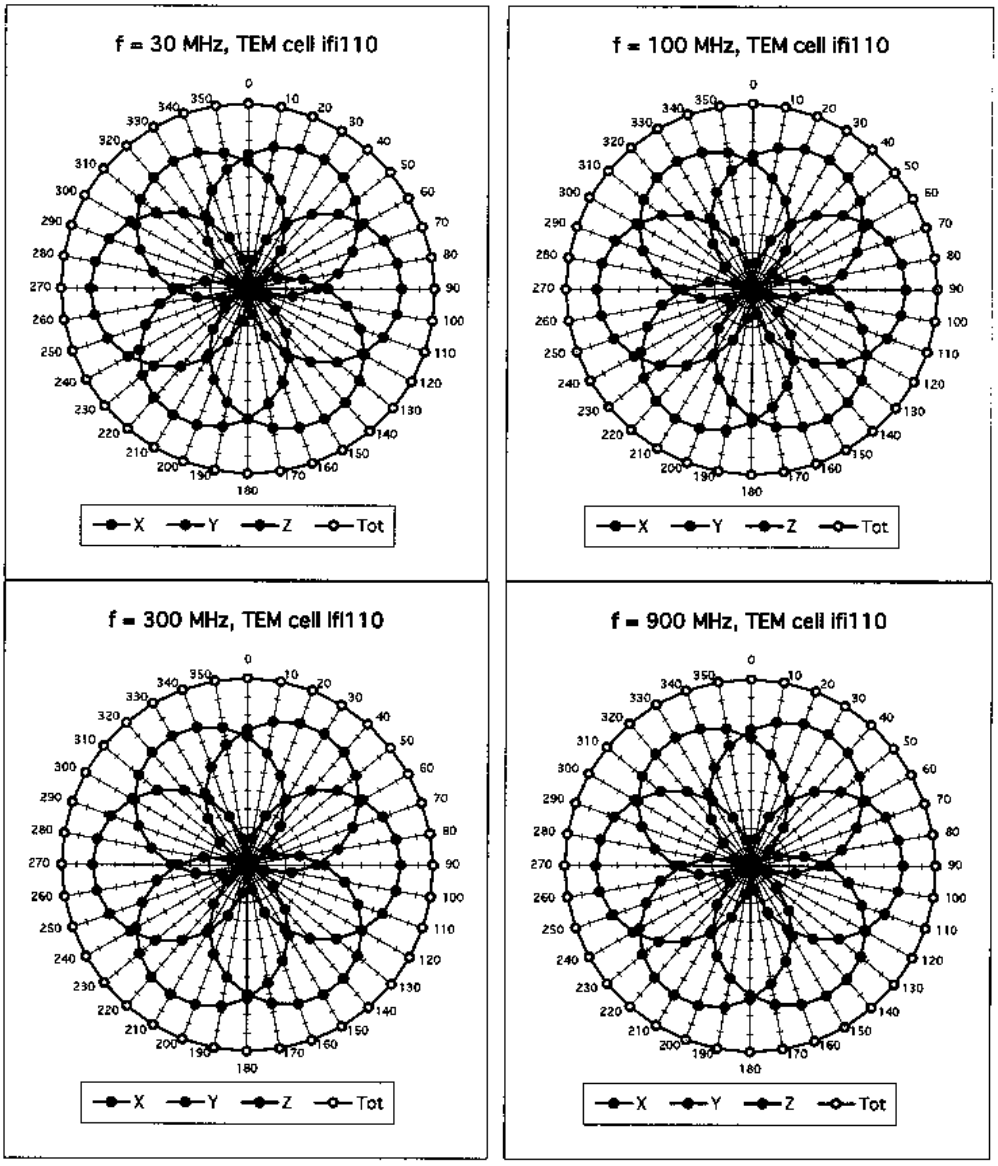
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	13.3	8.9
SAR_{be} [%]	With Correction Algorithm	0.1	0.1

Sensor Offset

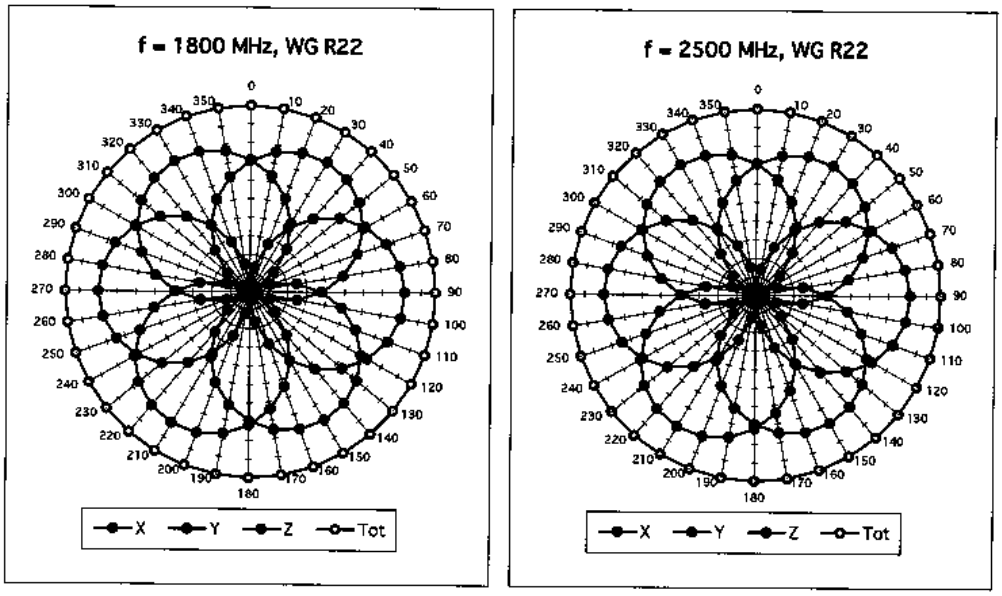
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.4 ± 0.2**	mm

ET3DV6 SN:1644 **November 21, 2003**

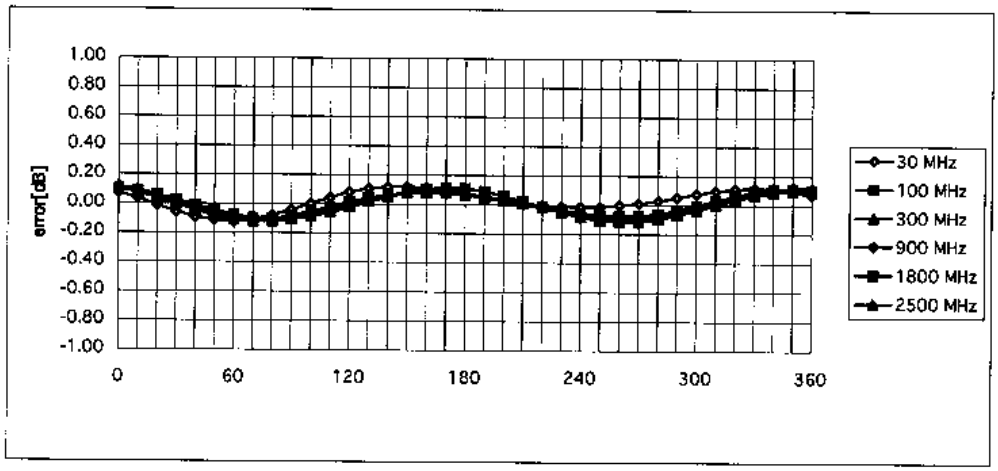
Receiving Pattern (ϕ), θ = 0°



ET3DV6 SN:1644 **November 21, 2003**



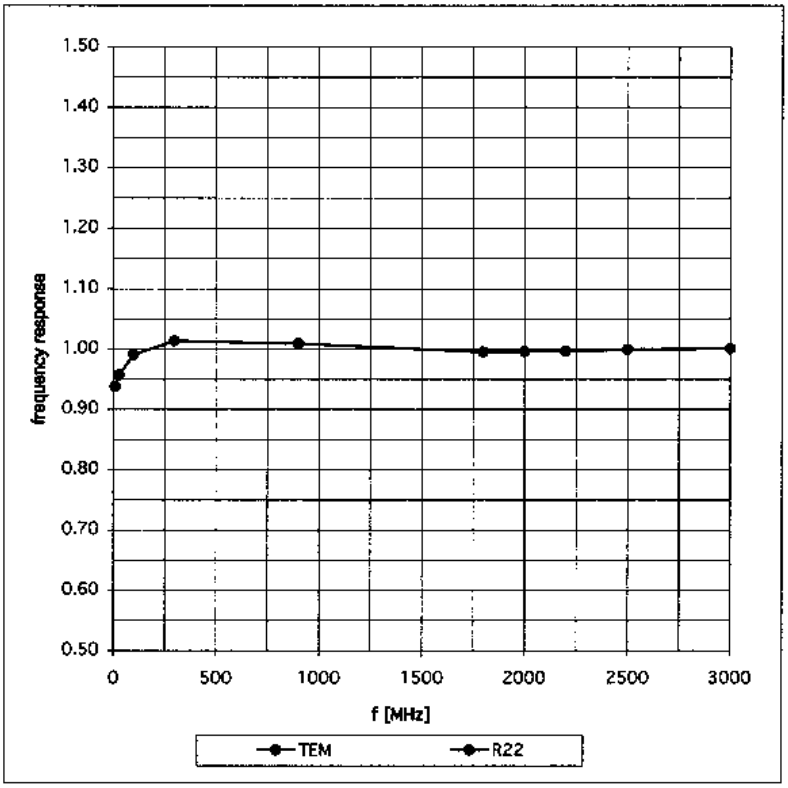
Isotropy Error (ϕ), θ = 0°



ET3DV6 SN:1644 **November 21, 2003**

Frequency Response of E-Field

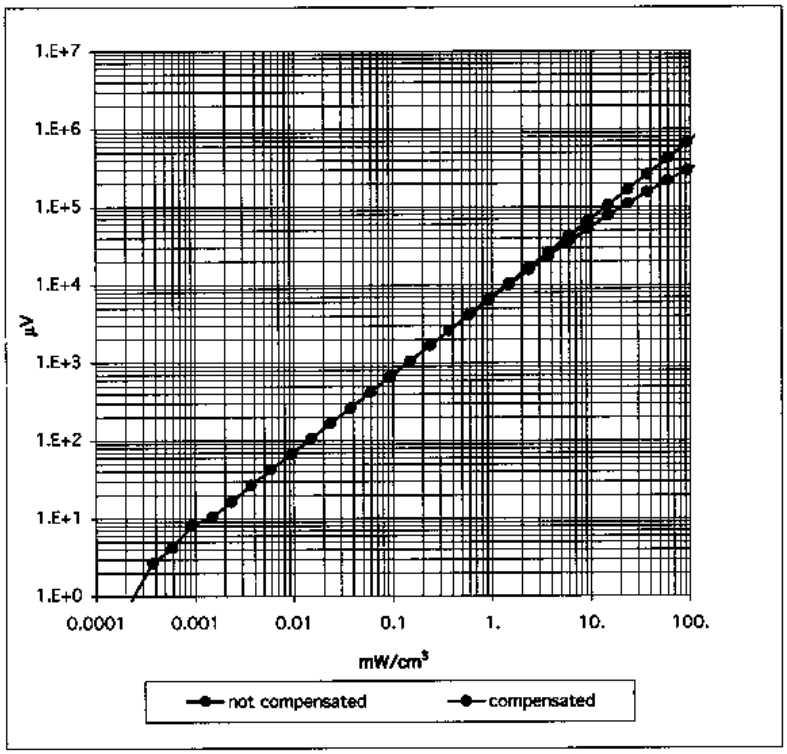
(TEM-Cell:ifi110, Waveguide R22)

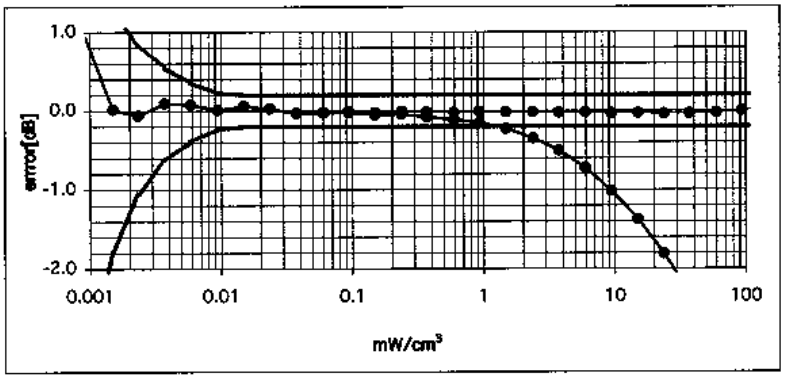


ET3DV6 SN:1644 **November 21, 2003**

Dynamic Range f(SARhead)

(Waveguide R22)





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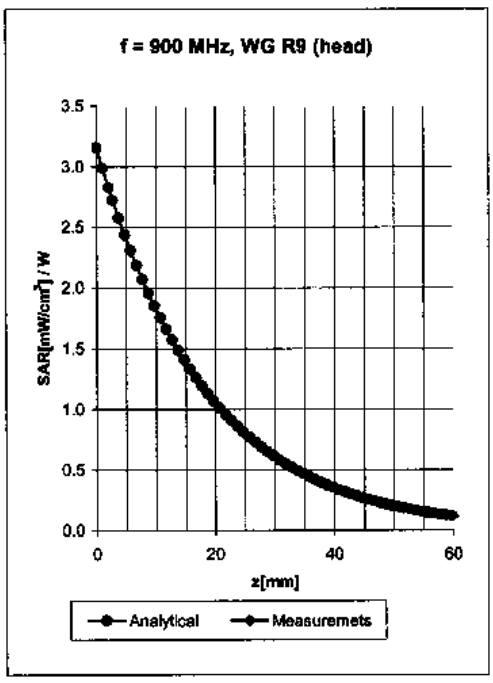
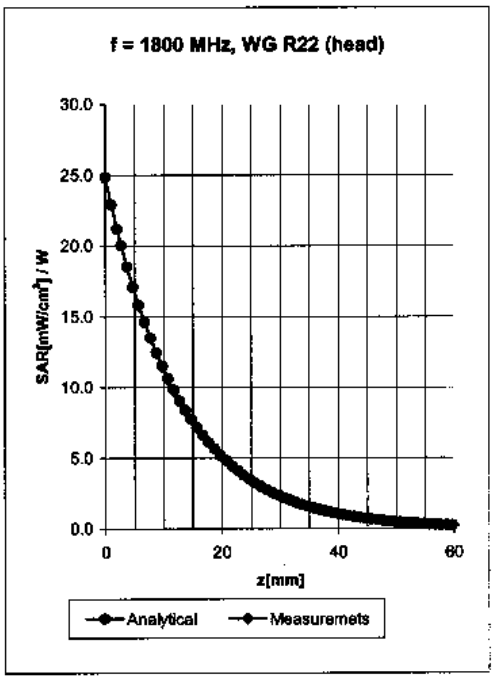
ET3DV6 SN:1644 **November 21, 2003**

Conversion Factor Assessment





Head 900 MHz ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m

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

ConvF X	6.8 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.8 ± 9.5% (k=2)	Alpha	0.48
ConvF Z	6.8 ± 9.5% (k=2)	Depth	2.08

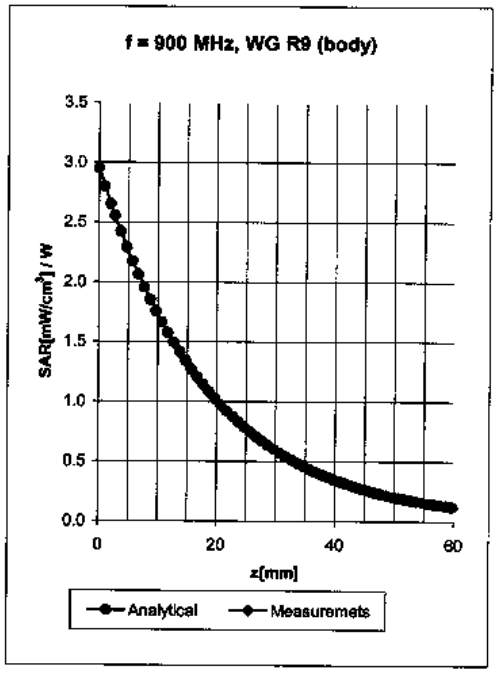
Head 1800 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

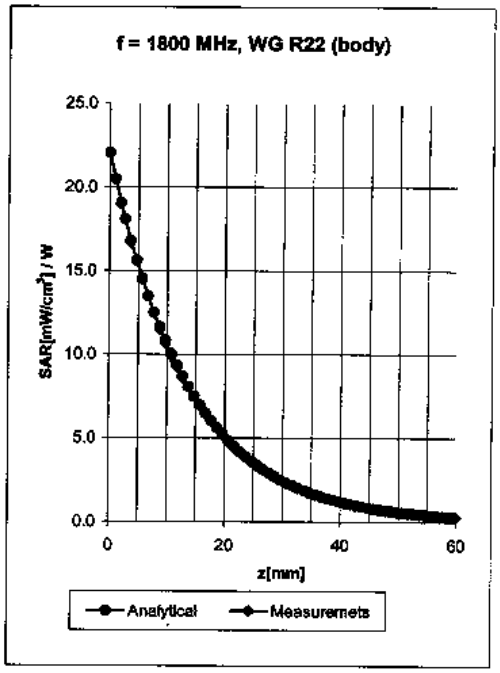
Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.4 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.4 ± 9.5% (k=2)	Alpha	0.47
ConvF Z	5.4 ± 9.5% (k=2)	Depth	2.66

ET3DV6 SN:1644 **November 21, 2003**

Conversion Factor Assessment





Body 900 MHz ε_r = 55.0 ± 5% σ = 1.05 ± 5% mho/m

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

ConvF X	6.4 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.4 ± 9.5% (k=2)	Alpha	0.44
ConvF Z	6.4 ± 9.5% (k=2)	Depth	2.35

Body 1800 MHz ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

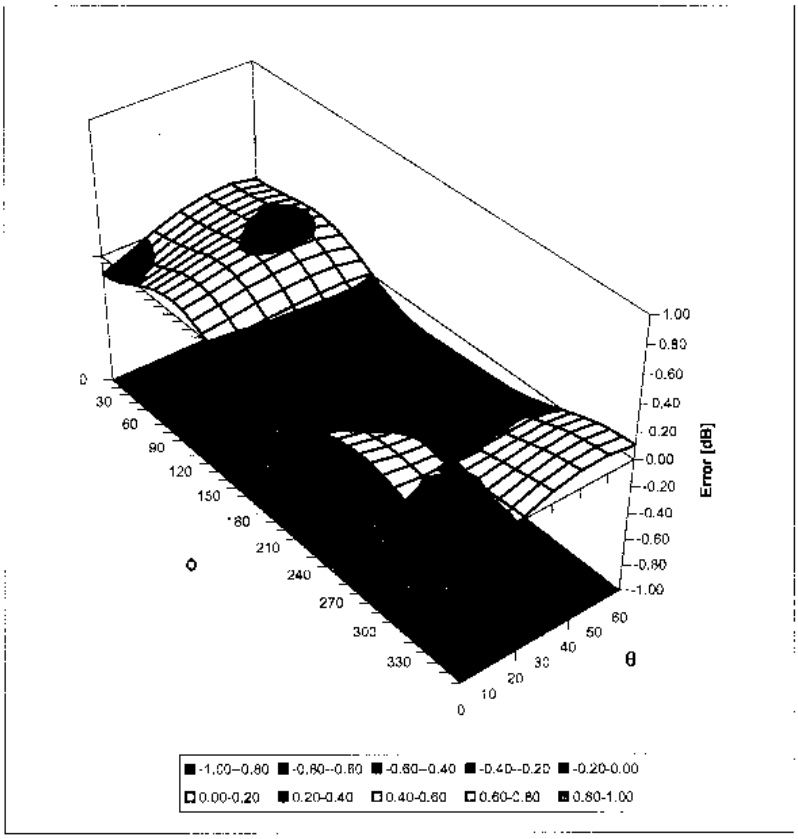
Valid for f=1710-1910 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	5.0 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.0 ± 9.5% (k=2)	Alpha	0.59
ConvF Z	5.0 ± 9.5% (k=2)	Depth	2.61

ET3DV6 SN:1644 **November 21, 2003**

Deviation from Isotropy in HSL

Error (θ,φ), f = 900 MHz



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)

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.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	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

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: August 22, 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

Schmid & Partner Engineering AG

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

DASY

Dipole Validation Kit

Type: D835V2

Serial: 446

Manufactured: October 24, 2001
Calibrated: August 21, 2003

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**	± 5%
Conductivity	**0.91 mho/m**	± 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 ± 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** ± 16.8 % (k=2)[1]

averaged over 10 cm^3 (10 g) of tissue: **6.24 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

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:	Re{Z} = **48.9 Ω**
	Im {Z} = **-5.5 Ω**
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.

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

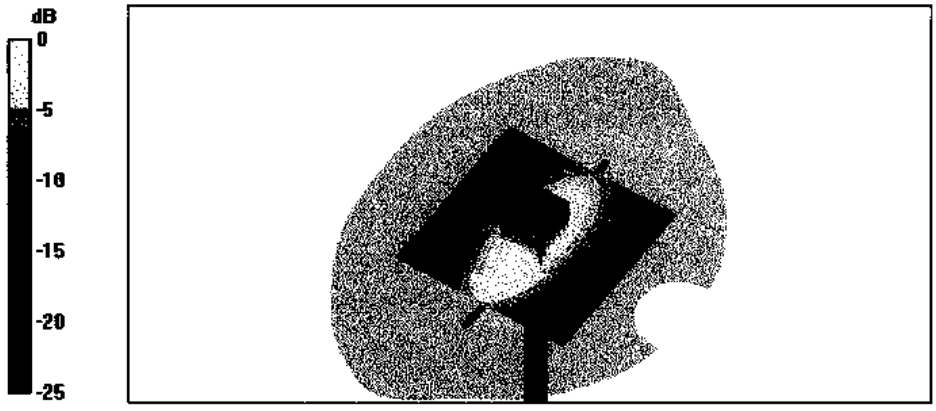
Communication System: CW-835; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL 835 MHz (σ = 0.91 mho/m, ε_r = 43.28, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

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

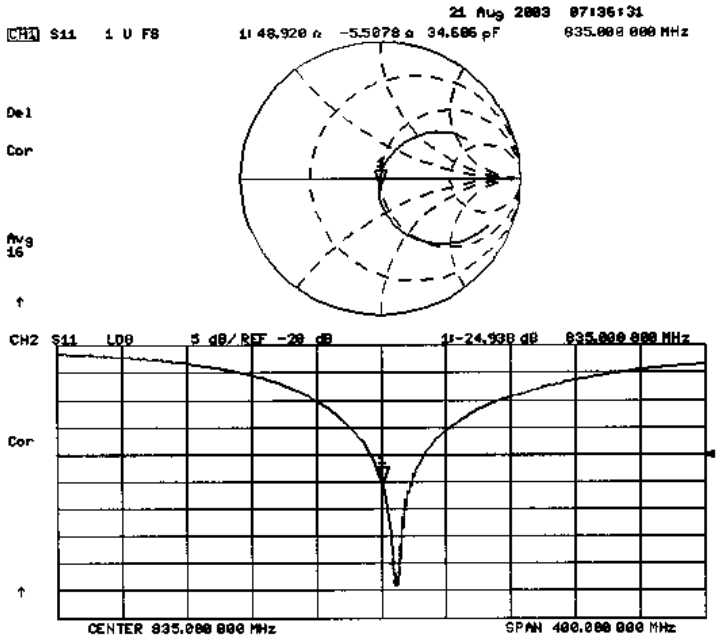
Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): *Measurement grid: dx=15mm, dy=15mm*
Reference Value = 55.3 V/m
Power Drift = -0.02 dB
Maximum value of SAR = 2.55 mW/g

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



0 dB = 2.56mW/g

446



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

Client RIM

CALIBRATION CERTIFICATE

Object(s) D1900V2 - SN:545

Calibration procedure(s) QA CAL-05.v2
Calibration procedure for dipole validation kits

Calibration date: August 22, 2003

Condition of the calibrated item In Tolerance (according to the specific calibration document)

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.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	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

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: August 24, 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.

880-KP0301061-A

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info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D1900V2

Serial: 545

Manufactured: November 15, 2001
Calibrated: August 22, 2003

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 1900 MHz:

Relative Dielectricity	**40.2**	± 5%
Conductivity	**1.46 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.2 at 1900 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 10mm 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 ± 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: **41.2 mW/g ± 16.8 % (k=2)**[1]

averaged over 10 cm^3 (10 g) of tissue: **21.3 mW/g ± 16.2 % (k=2)**[1]

[1] validation uncertainty

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:	**1.198 ns**	(one direction)
Transmission factor:	**0.984**	(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 1900 MHz:	Re{Z} = **49.7 Ω**
	Im {Z} = **0.96 Ω**
Return Loss at 1900 MHz	**-39.9 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.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

6. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 08/22/03 15:40:53

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN545_SN1507_HSL1900_220803.da4

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN545
Program: Dipole Calibration

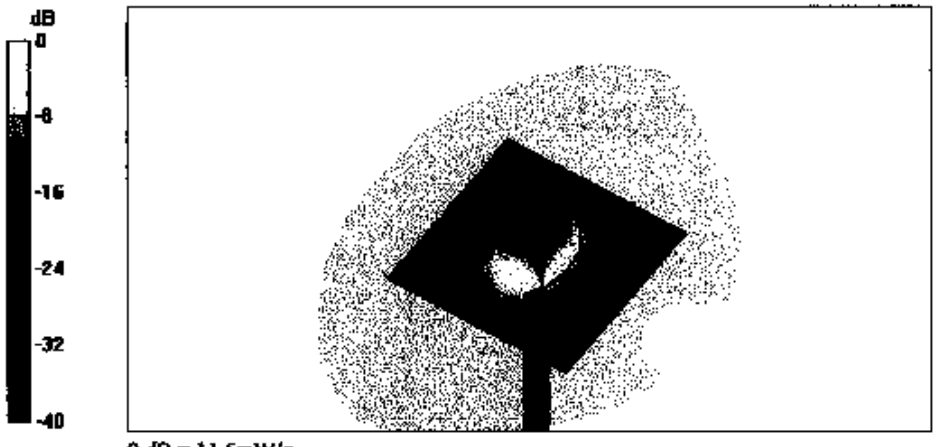
Communication System: CW-1900; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL 1900 MHz (σ = 1.46 mho/m, ϵ_r = 40.17, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(5.2, 5.2, 5.2); 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

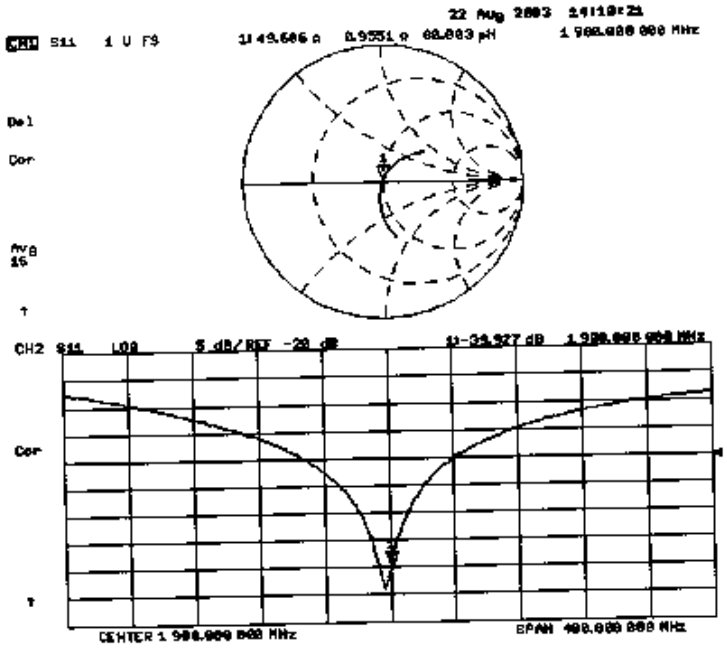
Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 93.6 V/m
Power Drift = 0.05 dB
Maximum value of SAR = 11.5 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.32 mW/g
Reference Value = 93.6 V/m
Power Drift = 0.05 dB
Maximum value of SAR = 11.5 mW/g



0 dB = 11.5mW/g

545



APPENDIX E: SAR SET UP PHOTOS

Figure E1. Body worn configuration with leather holster

Figure E2. Body worn configuration with fabric holster