MOTOROLA

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TESTING CERT # 2518.01

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

Enterprise Mobility Solutions
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Report Revision: A
Report ID: SAR PCII rpt_PMUF1063C_Rev A _101111_ SR8629 & SR8745

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Date/s Tested:	7/14/10~9/8/10
Manufacturer/Location:	Motorola, Penang
Sector/Group/Div.:	EMS
Date submitted for test:	6/17/10 & 6/25/10
DUT Description:	ATS2500/GP540/PRO5750/PRO5650 P XCVR 800M 2.5W POP 1.5PPM, Non-Keypad
Test TX mode(s):	CW (PTT)
Max. Power output:	2.95W (806-825MHz) & 2.40W (851-870MHz)
Nominal Power:	2.5W (806-825MHz) & 2.0W (851-870MHz)
Tx Frequency Bands:	806-825 MHz & 851-870 MHz
Signaling type:	FM
Model(s) Tested:	PMUF1063C
Model(s) Certified:	PMUF1063C
Serial Number(s):	019TES1026
Classification:	Occupational/Controlled
FCC ID:	AZ489FT5837
FCC Rule Part(s):	90 (806-824, 851-869 MHz)
IC ID:	109U-89FT5837
IC standard(s):	RSS-102 (2010)

*** Refer to section 15 of part 1 highest SAR summary results.**

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams results are not applicable to FCC filing.
The test results clearly demonstrate compliance with ICNIRP (1998) Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz), Health Physics 74, 494-522 RF Exposure limits of 10 W/kg averaged over 10grams of contiguous tissue.

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 3.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola EME Laboratory.
I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements. This reporting format is consistent with the suggested guidelines of the TIA TSB-150 December 2004. The results and statements contained in this report pertain only to the device(s) evaluated.

Deanna Zakharia – signature on file
Deanna Zakharia
EMS EME Lab Senior Resource Manager,
Laboratory Director

Approval Date: 12/14/2010

Certification Date: 12/14/2010

Certification No.: 101217AD & 101216AD

Part 1 of 2

1.0 Introduction 4
2.0 Abbreviations / Definitions 4
3.0 Referenced Standards and Guidelines 4
4.0 SAR Limits 5
5.0 SAR Result Scaling Methodology 5
6.0 Description of Device Under Test (DUT) 6
7.0 Optional Accessories and Test Criteria 6
7.1 Antennas 6
7.2 Batteries 6
7.3 Body worn Accessories 7
7.4 Audio Accessories 7
8.0 Description of Test System 7
8.1 Description of Robotics/Probes/Readout Electronics 8
8.2 Description of Phantom(s) 8
8.2.1 Dual Flat Phantom 8
8.2.2 SAM Phantom 8
8.2.3 Elliptical Phantom 8
8.3 Description of Simulated Tissue 8
9.0 Additional Test Equipment 9
10.0 SAR Measurement System Verification 10
10.1 Equivalent Tissue Test Results 10
10.2 System Check Test Results 10
11.0 Environmental Test Conditions 11
12.0 DUT Test Methodology 12
12.1 Measurements 12
12.2 DUT Configuration(s) 12
12.3 DUT Positioning Procedures 12
12.3.1 Body 12
12.3.2 Head 12
12.3.3 Face 12
12.4 DUT Test Plan 12
13.0 DUT Test Data 13
13.1 806-825MHz Test Data 13
13.2 851-870MHz Test Data 13
13.3 Shorten Scan Assessment 14
14.0 Simultaneous Transmission Exclusion 15
15.0 Conclusion 15

Part 1 of 2 Continued

APPENDICES

A Measurement Uncertainty……16
B Probe Calibration Certificates……...19

Part 2 of 2

C Dipole Calibration Certificates…….….2
D Test System Verification Scans……15
E FCC Part 90 (806-824, 851-869)
DUT Scans (Shortened Scan and Highest SAR configurations)……..24
F DUT Supplementary Data (Power Slump)……..31
G DUT Test Position Photos ……..32
H DUT and Body worn Accessory Photos ……..……...36

Report Revision History

Date	Revision	Comments
10/11/05	O	Initial release of model PMUF1063B & PMUF1064B
06/20/07	O	Initial release of model PMUF1063C
09/28/10	A	Release of PCII results with new offered batteries.

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the EMS EME Test Laboratory for model number PMUF1063C FCC ID: AZ489FT5837. The result herein reflect pilot PCII test results.

2.0 Abbreviations / Definitions

CNR: Calibration Not Required
CW: Continues Wave
DUT: Device Under Test
FM: Frequency Modulation
NA: Not Applicable
PTT: Push to Talk
SAR: Specific Absorption Rate

Audio accessories: These accessories allow communication while the DUT is worn on the body.
Body worn accessories: These accessories allow the DUT to be worn on the body of the user.
Maximum Power: Defined as the upper limit of the production line final test station.

3.0 Referenced Standards and Guidelines

This product is designed to comply with the following applicable national and international standards and guidelines.

- IEC62209-1*(2005) Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)
- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 2.1093 sub-part J:1999
- Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- 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
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronics Engineers (IEEE) C95.1-2005
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6 (1999), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2003)
- ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio

frequency range between 9kHz and 300 GHz." and “Attachment to resolution # 303 from July 2, 2002”

- IEC62209-2 Edition 1.0 2010-03, Human Exposure to Radio Frequency Fields from Hand-held and Body-Mounted Wireless Communication Devices – Human models, Instrumentation, and Procedures Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).

* The IEC62209-1 and IEEE 1528 are applicable for hand-held devices used in close proximity to the ear only.

4.0 SAR Limits

TABLE 1

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average - ANSI - (averaged over the whole body)	0.08	0.4
Spatial Peak - ANSI - (averaged over any 1-g of tissue)	1.6	8.0
Spatial Peak – ICNIRP/ANSI - (hands/wrists/feet/ankles averaged over 10-g)	4.0	20.0
Spatial Peak - ICNIRP - (Head and Trunk 10-g)	2.0	10.0

5.0 SAR Result Scaling Methodology:

The calculated 1-gram and 10-gram averaged SAR results indicated as “Max Calc.1g-SAR” and “Max Calc.10g-SAR” in the data tables is determined by scaling the measured SAR to account for power leveling variations and power slump. A table and graph of output power versus time is provided in APPENDIX G. For this device the “Max Calc.1g-SAR” and “Max Calc.10g-SAR” are scaled using the following formula:

$$Max\_Calc = SAR\_meas \cdot 10^{\frac{-(Drift)}{10}} \cdot \frac{P\_\max}{P\_\text{int}} \cdot DC$$

P_max = Maximum Power (W)
P_int = Initial Power (W)
Drift = DASY drift results (dB)
SAR_meas = Measured 1-g or 10-g Avg. SAR (W/kg)
DC = Transmission mode duty cycle in % where applicable
50% duty cycle is applied for PTT operation

Note: for conservative results, the following are applied:
If P_int > P_max, then P_max/P_int = 1.
Drift = 1 for positive drift

Additional SAR scaling was applied using the methodologies outlined in FCC KDB450824 using tissue sensitivity values. SAR was scaled for conditions where the tissue permittivity was measured above the nominal target and for tissue conductivity that was measured below the nominal target.

6.0 Description of Device Under Test (DUT):

FCC ID: AZ489FT5837 is a 800 MHz (806-825 MHz & 851-870 MHz) portable two-way radio that operates using frequency modulation (FM) incorporating traditional simplex two-way radio transmission protocol. This device uses removable antennas that are capable of transmitting within their respective ranges in the 806-825 MHz & 851-870 MHz bands. The nominal output is 2.5W (806-825 MHz & 851-870 MHz), with maximum output powers of 2.95W (806-825 MHz) & 2.40W (851-870 MHz) as defined by the upper limit of the production line final test station. The intended operating positions are " at the face" with the DUT at least 1 inch from the mouth, and at the body" by means of the offered body-worn accessories. Body worn audio and PTT operation is accomplished by means of optional remote accessories that are connected to the radio.

7.0 Optional Accessories and Test Criteria:

FCC ID: AZ489FT5837 is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required. The following sections identify the test criteria and details for each accessory category.

7.1 Antennas:

The offered antennas were tested. The table below lists the offered antennas and its description.

TABLE 2

Antenna Kit	Description	Tested
PMAF4000A	Whip 806-870MHz, ½ wave, -3 dBd	Yes
NAF5037A	Whip 806-870MHz, ½ wave, -3 dBd	Yes

* Refer to APPENDIX G for antenna separation distances.

7.2 Batteries:

The offered batteries were tested. The table below lists the offered batteries and its description.

TABLE 3

Battery Kit	Description	Tested	Comments
PMNN4151AR	Battery Std NiMH1200M1300T (Capacity:1200mAh)	Yes	Height= 123mm
PMNN4156A	Battery IMP Std NiMH2000M2075T (Capacity: 2000mAh)	Yes	Height= 123mm

* Refer to APPENDIX G for antenna separation distances.

7.3 Body worn Accessories:

The offered body worn accessory were tested. The table below lists the offered body worn accessory and its description.

TABLE 4

Body worn Kits	Description	Tested	Comments
HLN9714A	Spring Belt Clip, for 2.5inch belt width	Yes	NA

* Refer to APPENDIX G for antenna separation distances.

7.4 Audio Accessories:

The offered audio accessories were tested. The table below lists the offered audio accessories and its description.

TABLE 5

Audio Acc Kits	Description	Tested	Comments
BDN6768A	Ear MIC, Std noise black	Yes	Tested at the body w/ RMN5117A
RMN5117A	Interface module with PTT and VOX	Yes	Tested at the body w/ BDN6768A
RMN5015A	Racing dual muff headset	Yes	Tested with RKN4091A & HLN9716C
RKN4091A	Racing headset adaptor cable for Pro series	Yes	Tested with RMN5015A & HLN9716C
HLN9716C	Audio accessory adaptor	Yes	Tested with RMN5015A & RKN4091A

8.0 Description of Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

The laboratory utilizes a Dosimetric Assessment System (DASY4™) SAR measurement system Version 4.7 build 80 manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot, DAE4, and ES3DV3 E-field probe. The DASY4™ system is operated per the instructions in the DASY4™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME SAR compliance was calibrated according to ISO/IEC 17025 A2LA guidelines. Section 9.0 presents additional test equipment information. Appendices B and C present the applicable calibration certificates. The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

8.2 Description of Phantom(s)

8.2.1 Dual Flat Phantom

NA

8.2.2 SAM Phantom

NA

8.2.3 Elliptical Flat Phantom

TABLE 6

Phantom ID (s)	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
OVAL 1019 OVAL 1020 OVAL 1021	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190	2mm +/- 0.2mm	Wood	< 0.05

8.3 Description of Simulated Tissue

The simulated tissue used is compliant to that specified in FCC Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01) and IEEE Std 1528 - 2003 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques". The simulated tissue used is also compliant to that specified in IEC62209-1 (2005) and adopted by CENELEC as EN62209-1 (2006).

The sugar based simulate tissue is produced by placing the correct measured amount of De-ionized water into a large container. Each of the dried ingredients are weighed and added to the water carefully to avoid clumping. If the solution has a high sugar concentration the water is pre-heated to aid in dissolving the ingredients. For Diacetin and similar type simulates, sugar and HEC ingredients are not needed. The

solution is mixed thoroughly, covered, and allowed to sit overnight prior to use.

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in the table 7 below for 835 & 900 MHz. During the test duration of this product, this mixture was used to measure the Di-electric parameters daily at 835 & 900 MHz as well as 815.5 MHz and 860.5 MHz frequencies to verify that the Di-electric parameters at these frequencies are within the tolerance of tissue specifications.

Simulated Tissue Composition (by mass)

TABLE 7

% of listed ingredients	835/900MHz	
	Head	Body
Sugar	57.0	44.9
Diacetin	0	0
De ionized -Water	40.45	53.06
Salt	1.45	0.94
HEC	1.0	1.0
Bact.	0.1	0.1

1) Reference section 10.1 for target parameters

9.0 Additional Test Equipment:

The table below lists additional test equipment used during the SAR assessment.

TABLE 8

Equipment Type	Model Number	Serial Number	Calibration Due Date
Power Meter (Agilent)	E4419B	MY45103725	4/19/2011
Power Meter (Agilent)	E4418B	US39251267	2/23/2011
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495730	4/13/2011
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495733	4/13/2011
Bi-Directional Coupler (NARDA)	3020A	40295	6/3/2012
AMP (Amplifier Research)	1W1000	16625	CNR
Signal Generator (Agilent)	E4428C	MY47381119	1/14/2012
Dickson Temperature Recorder	TM125	1195889	2/16/2011
Omega Digital Thermometer with J Type TC Probe	HH202A	18800	11/10/2010
Omega Digital Thermometer with J Type TC Probe	HH202A	18801	4/19/2011
Omega Digital Thermometer with J Type TC Probe	HH202A	18812	3/24/2011
Tissue Station			
Agilent PNA-L Network Analyzer	N5230A	MY45001092	6/10/2011
Dielectric Probe Kit (HP)	85070C	US99360076	CNR
Dipole			
Speag Dipole	D835V2	435	9/22/2010
Speag Dipole	D900V2	084	3/22/2012

10.0 SAR Measurement System Verification:

The SAR measurements were conducted with probes model/serial number ES3DV3/SN3163 and ES3DV3/SN3185. System performance check was conducted daily and within 24 hours prior to testing. DASY output files of the probe/dipole calibration certificates and system performance test results are included in appendices B, C, D respectively.

Dipole validation scans using head tissue equivalent medium are provided in APPENDIX D. The EMS EME lab validated the dipole to the applicable IEEE 1528-2003 system performance targets. Within the same day system validation was performed using FCC body tissue parameters to generate the system performance target values for body at the applicable frequency. The results of the EMS EME system performance validation are provided herein.

10.1 Equivalent Tissue Test Results

Simulated tissue prepared for SAR measurements is measured daily and within 24 hours prior to actual SAR testing to verify that the tissue is within +/- 5% of target parameters at the center of the transmit band. This measurement is done using the applicable equipment indicated in section 9.0. The table below summarizes the measured tissue parameters used for the SAR assessment.

TABLE 9

Frequency (MHz)	Tissue Type	Conductivity Target & Range (S/m)	Dielectric Constant Target & Range	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
835	FCC Body	0.97 (0.92 – 1.01)	55.2 (52.44–57.96)	0.98	55.3	7/14/10
				0.99	56.2	7/21/10
835	IEEE/ IEC Head	0.90 (0.85-0.94)	41.5 (39.43-43.58)	0.91	41.7	8/16/10
900	IEEE/ IEC Head	0.97 (0.92-1.02)	41.5 (39.43-43.58)	0.99	41.2	9/08/10
815.5	FCC Body	0.97 (0.92-1.02)	55.3 (52.54-58.07)	0.94	53.7	8/16/10
				0.94	53.7	8/17/10
				0.94	53.6	8/18/10
815.5	IEEE/ IEC Head	0.90 (0.86-0.95)	41.6 (39.52-43.68)	0.92	42.9	8/13/10
				0.90	42.0	9/08/10
860.5	FCC Body	1.00 (0.95-1.05)	55.1 (52.35-57.86)	1.00	53.3	8/16/10
860.5	IEEE/ IEC Head	0.93 (0.88-0.98)	41.5 (39.43-43.58)	0.96	42.3	8/13/10
				0.96	41.6	9/08/10

10.2 System Check Test Results:

System performance checks were conducted each day during the SAR assessment. The results are normalized to 1W. APPENDIX D explains how the targets were set and

includes DASY plots for each day during the SAR assessment. The table below summarizes the daily system check results used for the SAR assessment.

TABLE 10

Probe Serial #	Tissue Type	Probe Cal Date	Dipole Kit / Serial #	Reference SAR @ 1W (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3163	FCC Body	4/23/2010	SPEAG D835V2 /435	10.04+/- 10%	9.68	7/14/10
3185	FCC Body	11/23/2009	SPEAG D835V2 /435	10.04+/- 10%	10.80	7/21/10
3185	IEEE/ IEC Head	11/23/2009	SPEAG D835V2 /435	10.04+/- 10%	9.44	8/16/10
3163	IEEE/ IEC Head	4/23/2010	SPEAG D900V2 /084	11.63+/- 10%	11.24	9/08/10

Note: See APPENDIX D for an explanation of the reference SAR targets stated above.

11.0 Environmental Test Conditions:

The EME Laboratory ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/ - 2 ^{o}C of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was at least 15cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the SAR tests reported herein:

TABLE 11

	Target	Measured
Ambient Temperature	18 - 25 ˚C	Range: 20.2-22.3˚C Avg. 21.8˚C
Relative Humidity	30 - 70 %	Range: 49.5-59.6% Avg. 53.6%
Tissue Temperature	NA	Range: 20.2-21.7˚C Avg. 21.0˚C

The EME Lab RF environment uses a Spectrum Analyzer to monitor for extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the SAR scans are repeated.

12.0 DUT Test Methodology

12.1 Measurements

SAR measurements were performed using the DASY system described in section 8.0 using coarse and 5x5x7 zoom scan. Elliptical flat phantoms filled with applicable simulated tissue were used for body and face testing.

12.2 DUT Configuration(s)

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were used to test all possible accessory combinations.

12.3 Device Positioning Procedures

The positioning of the device for each body location is described below and illustrated in APPENDIX H.

12.3.1 Body

The DUT was positioned in intended use configuration against the phantom with the offered body worn accessories. The DUT was positioned with it`s front side separated 2.5cm and the back with DUT or antenna separated 2.5cm from the phantom. Testing at 2.5cm is done to satisfy the conditions noted in the safety section of the manual.

12.3.2 Head

NA

12.3.3 Face

The DUT was positioned with its' front sides separated 2.5cm from the phantom.

12.4 DUT Test Plan:

All modes of operation identified in section 6.0 were considered during the development of the test plan. All accessories listed in section 7.0 of this report were evaluated and identified for testing were used to develop the SAR test plan for this product. The test plan was based on the highest SAR configuration per band at the body and face from the initial FCC filing for this model using additional offered batteries.

13.0 DUT Test Data

13.1 806-825 MHz Test Data

Assessment at the Body (CW mode) – with the offered battery:

TABLE 12

806-825MHz band assessments at the Body (CW mode)												
Run Number/ SN	**Antenna**	**Freq. (MHz)**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
Assessment of offered battery PMNN4156A												
MeC-Ab-100714-02 / 019TES1026	PMAF4000A	806.0125	PMNN4156A	DUT Back - Antenna at 2.5cm	None	BDN6768A tested w/ RMN5117A	3.05	-0.710	9.47	6.82	5.58	4.02
Assessment of offered battery PMNN4151AR												
JsT-Ab-100817-01 / 019TES1026	PMAF4000A	806.0125	PMNN4151AR	DUT Back - Antenna at 2.5cm	None	BDN6768A tested w/ RMN5117A	3.13	-0.699	9.08	6.44	5.33	3.78

Assessment at the Face (CW mode) – with the offered battery:

TABLE 13

806-825MHz band assessments at the Face (CW mode)												
Run Number/ SN	**Antenna**	**Freq. (MHz)**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
Assessment of offered battery PMNN4156A												
CM-Face-100721-12 / 019TES1026	PMAF4000A	815.5000	PMNN4156A	DUT Front at 2.5cm	None	None	3.27	-0.790	2.78	2.06	1.67	1.24
Assessment of offered battery PMNN4151AR												
MeC-Face-100908-04 / 019TES1026	PMAF4000A	815.5000	PMNN4151AR	DUT Front at 2.5cm	None	None	3.08	-0.805	2.62	1.92	1.58	1.16

13.2 851-870 MHz Test Data

Assessment at the Body (CW mode) – with the offered battery:

TABLE 14

851-870MHz band assessments at the Body (CW mode)												
Run Number/ SN	**Antenna**	**Freq. (MHz)**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
Assessment of offered battery PMNN4156A												
MeC-Ab-100908-05 / 019TES1026	PMAF4000A	851.0125	PMNN4156A	Against phantom	HLN9714A 2.5 inch belt clip	RMN5015A tested with RKN4091A w/ HLN9716C	2.47	-0.387	1.19	0.874	0.65	0.48
Assessment of offered battery PMNN4151AR												
MeC-Ab-100908-06 / 019TES1026	PMAF4000A	851.0125	PMNN4151AR	Against phantom	HLN9714A 2.5 inch belt clip	RMN5015A tested with RKN4091A w/ HLN9716C	2.48	-0.378	1.46	1.070	0.80	0.58

Assessment at the Face (CW mode) – with the offered battery:

TABLE 15

851-870MHz band assessments at the Face (CW)												
Run Number/ SN	**Antenna**	**Freq. (MHz)**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
Assessment of offered battery PMNN4156A												
MeC-Face-100908-02/ 019TES1026	NAF5037A	851.0125	PMNN4156A	DUT Front at 2.5cm	None	None	2.46	-0.411	1.49	1.07	0.82	0.59
Assessment of offered battery PMNN4151AR												
MeC-Face-100908-03 / 019TES1026	NAF5037A	851.0125	PMNN4151AR	DUT Front at 2.5cm	None	None	2.52	-0.427	1.63	1.19	0.90	0.66

13.3 Shorten Scan Assessment

Shorten scan assessment of the overall SAR highest configuration (806-825 and 851-870MHz Band Assessment Table 12 pg13); A "shortened" scan was performed, using the test configuration and unit that produced the highest SAR results overall (in bold with *) below, to validate the SAR drift of the full DASY4™ coarse and 5x5x7 zoom scans. Note that the shortened scan represents the zoom scan performance result; this is obtained by first running a coarse scan to find the peak area and then, using a newly charged battery, a 5x5x7 zoom scan only was performed. The results of the shortened cube scan presented in APPENDIX E demonstrate that the scaling methodology used to determine the calculated SAR results presented herein are valid. The shortened scan SAR result from the table below is provided in APPENDIX E Section – Shortened scan results.

TABLE 16

Shorten Scan Assessments												
Run Number/ SN	**Antenna**	**Freq. (MHz)**	**Battery**	**Test position**	**Carry Case**	**Additional attachments**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
(Full scan) MeC-Ab-100714-02 / 019TES1026	PMAF4000A	806.0125	PMNN4156A	DUT Back - Antenna at 2.5cm	None	BDN6768A tested w/ RMN5117A	3.05	-0.710	9.47	6.82	5.58	4.02
(Shorten Scan) CM-Ab-100721-13 / 019TES1026	PMAF4000A	806.0125	PMNN4156A	DUT Back - Antenna at 2.5cm	None	BDN6768A tested w/ RMN5117A	3.22	-0.213	10.53	7.57	5.53	3.98
(Full scan) JsT-Ab-100817-01 / 019TES1026	PMAF4000A	806.0125	PMNN4151AR	DUT Back - Antenna at 2.5cm	None	BDN6768A tested w/ RMN5117A	3.13	-0.699	9.08	6.44	5.33	3.78
Shorten scan JsT-Ab-100817-02 / 019TES1026	PMAF4000A	806.0125	PMNN4151AR	DUT Back - Antenna at 2.5cm	None	BDN6768A tested w/ RMN5117A	3.14	-0.408	9.88	7.00	5.43	3.84

14.0 Simultaneous Transmission Exclusion:
NA

15.0 Conclusion:

15.1 RF Exposure Results for FCC Part 90 (806-824) and (851-869):

The highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing: FCC ID: AZ489FT5837, model PMUF1063C:

TABLE 17

	Max Calc at Body (W/kg)		Max Calc at Face (W/kg)	
Frequency Range (MHz)	**1g-SAR**	**10g-SAR**	**1g-SAR**	**10g-SAR**
806-824	5.58	4.02	1.67	1.24
851-869	0.80	0.58	0.90	0.66

Previously reported compliance results for this FCC ID:

TABLE 18

	Max Calc at Body (W/kg)		Max Calc at Face (W/kg)	
Frequency Range (MHz)	**1g-SAR**	**10g-SAR**	**1g-SAR**	**10g-SAR**
806-824	4.79	3.51	2.40	1.71
851-869	4.42	3.08	1.35	0.96

The previous reported results at the body are hereby replaced with the results presented herein. The previous results at the face reported to the FCC are maintained.

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8.0 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams results are not applicable to this FCC filing.

APPENDIX A
Measurement Uncertainty

The Measurement Uncertainty tables indicated in this APPENDIX are applicable to the DUT ranging from 800 MHz to 3 GHz, and for Dipole test frequency ranging from 800 MHz to 3 GHz. Therefore, the highest tolerance for the probe calibration uncertainty is indicated.

Uncertainty Budget for Device Under Test, for 800 MHz to 3 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11	11	411
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				22	22	

FCD-0558 Uncertainty Budget Rev.8

Uncertainty Budget for System Validation (dipole & flat phantom) for 800 MHz to 3 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				18	17	

FCD-0558 Uncertainty Budget Rev.8

Notes:
a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Appendix B
Probe Calibration Certificates

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

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

Accredited by the Swiss Accreditation Service (SAS)
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 Motorola EME

Certificate No: ES3-3163_Apr10

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3163

Calibration procedure(s): QA CAL-01.v6, QA CAL-12.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes

Calibration date: April 23, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

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

Issued: April 27, 2010

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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3163

Manufactured:	October 8, 2007
Last calibrated:	April 21, 2009
Recalibrated:	April 23, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ES3DV3 SN:3163 April 23, 2010

DASY - Parameters of Probe: ES3DV3 SN:3163

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.33	1.16	1.06	± 10.1%
DCP (mV)[B]	93.5	93.1	93.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY - Parameters of Probe: ES3DV3 SN:3163

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	6.37	6.37	6.37	0.14	1.57	± 13.3%
750	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.30	6.30	6.30	0.99	1.03	± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	5.93	5.93	5.93	0.90	1.08	± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.01	5.01	5.01	0.46	1.54	± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.83	4.83	4.83	0.36	1.76	± 11.0%
2300	± 50 / ± 100	39.5 ± 5%	1.67 ± 5%	4.65	4.65	4.65	0.45	1.89	± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.38	4.38	4.38	0.39	1.88	± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	4.29	4.29	4.29	0.47	1.72	± 11.0%
3500	± 50 / ± 100	37.9 ± 5%	2.91 ± 5%	4.00	4.00	4.00	0.90	1.19	± 13.1%
3700	± 50 / ± 100	37.7 ± 5%	3.12 ± 5%	3.58	3.58	3.58	0.90	1.50	± 13.1%

[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.

DASY - Parameters of Probe: ES3DV3 SN:3163

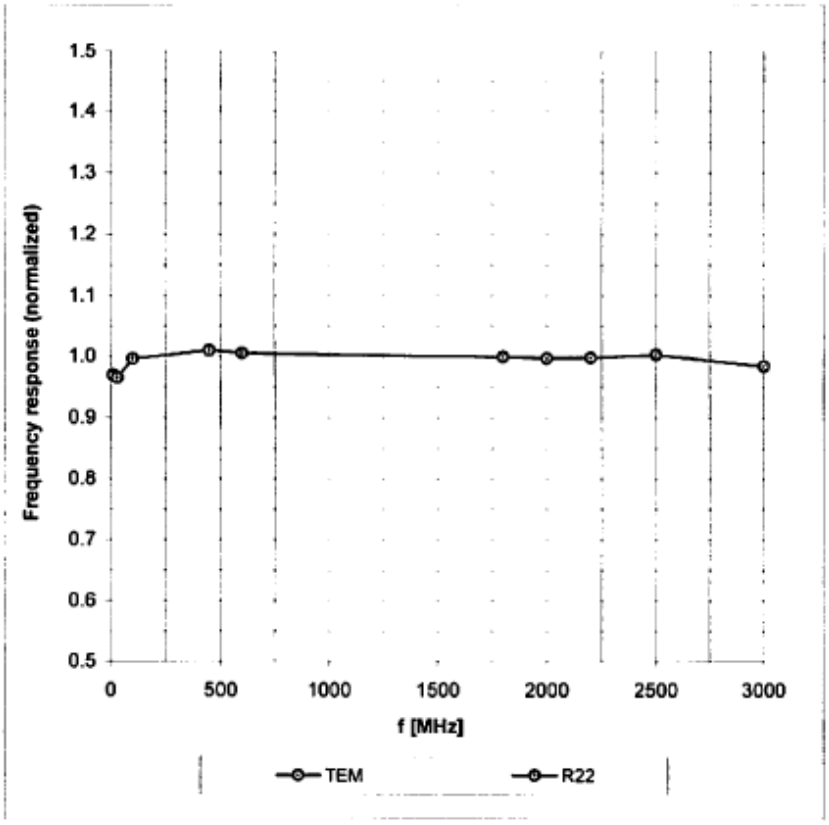
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	6.96	6.96	6.96	0.09	1.00 ± 13.3%
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	6.05	6.05	6.05	0.87	1.15 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	5.95	5.95	5.95	0.87	1.15 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.66	4.66	4.66	0.33	2.25 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.64	4.64	4.64	0.30	2.75 ± 11.0%
2300	± 50 / ± 100	52.8 ± 5%	1.85 ± 5%	4.35	4.35	4.35	0.52	1.60 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.26	4.26	4.26	0.64	1.33 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	4.15	4.15	4.15	0.86	1.16 ± 11.0%
3500	± 50 / ± 100	51.3 ± 5%	3.31 ± 5%	3.45	3.45	3.45	0.95	1.31 ± 13.1%
3700	± 50 / ± 100	51.0 ± 5%	3.55 ± 5%	3.37	3.37	3.37	0.95	1.44 ± 13.1%

[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.

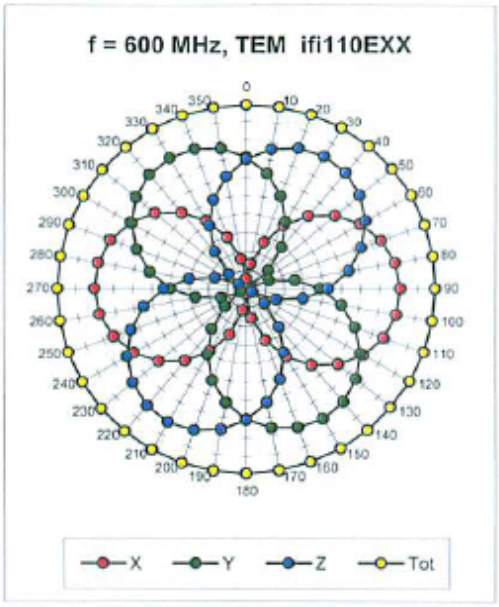
Frequency Response of E-Field

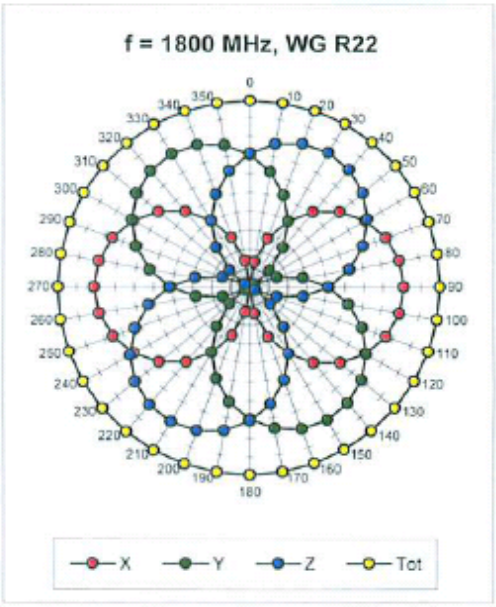
(TEM-Cell:ifi110 EXX, Waveguide: R22)

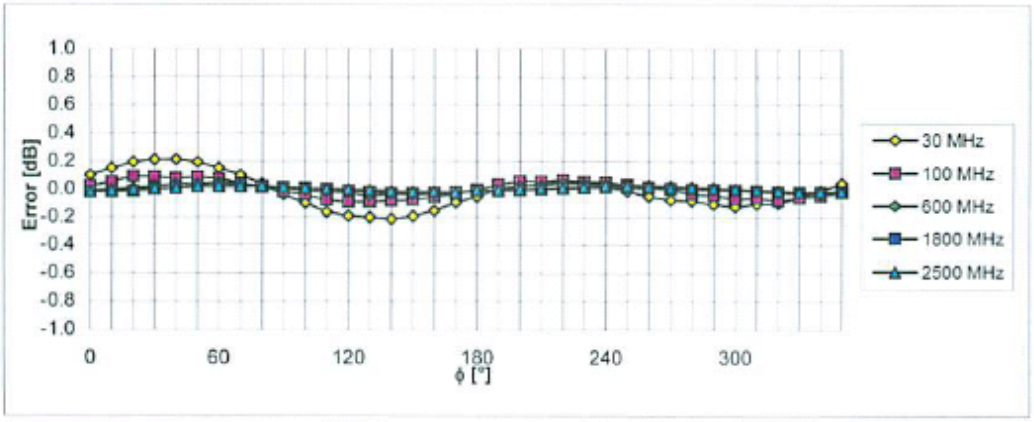


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



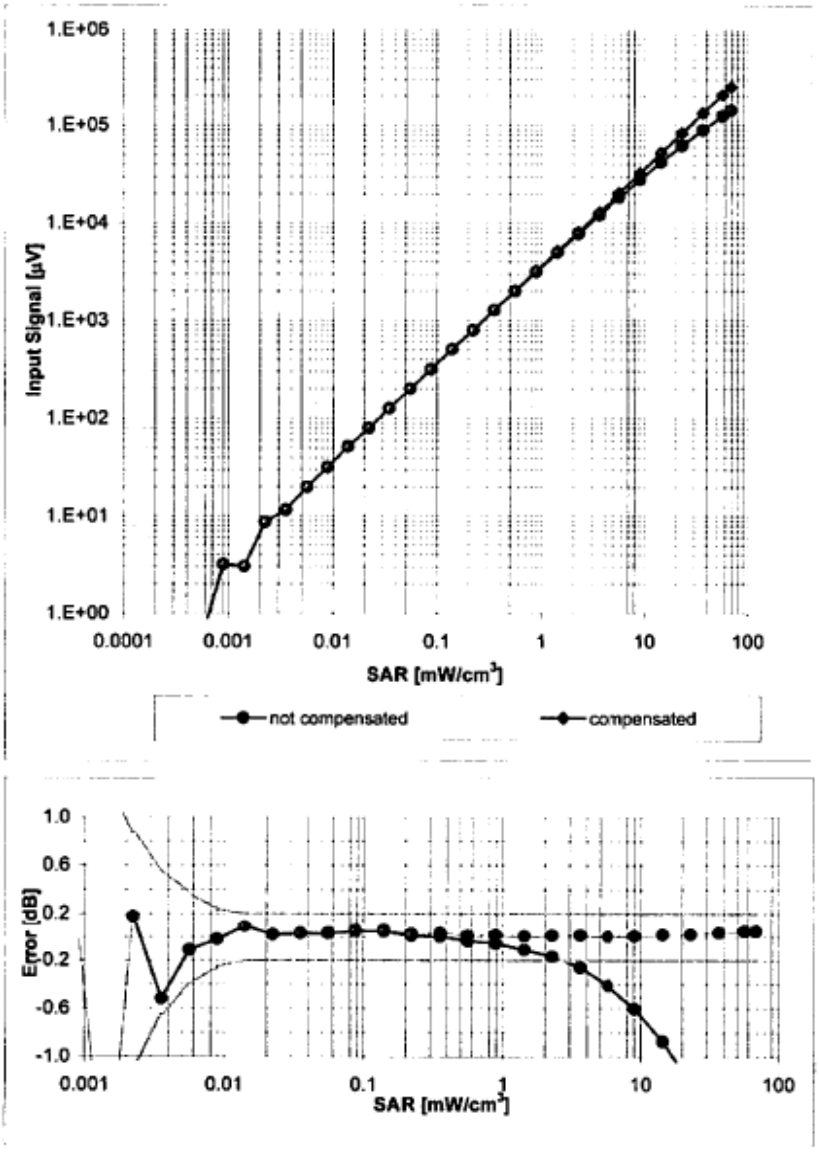




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

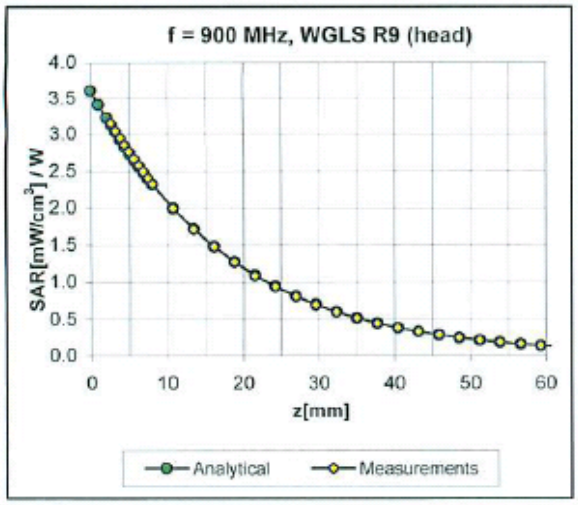
(Waveguide R22, f = 1800 MHz)

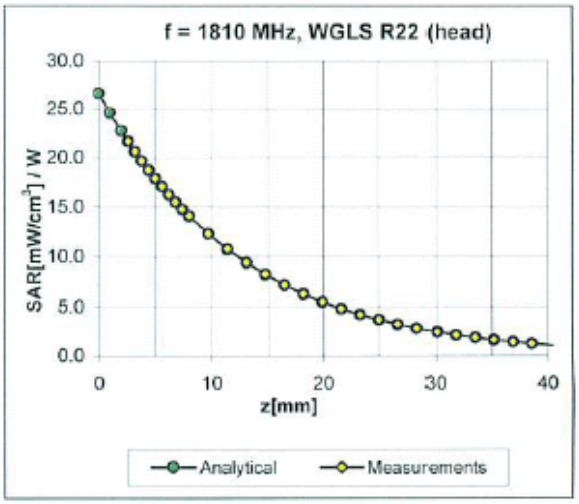


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ES3DV3 SN:3163 April 23, 2010

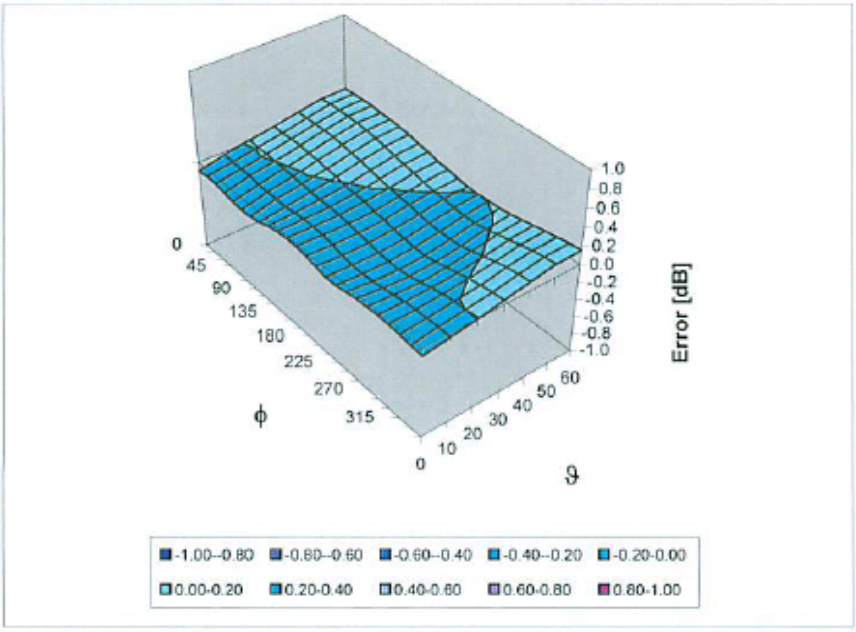
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4.0 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Schmid & Partner Engineering AG

s p e a g

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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3163**
Place of Assessment:	**Zurich**
Date of Assessment:	**April 28, 2010**
Probe Calibration Date:	**April 23, 2010**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1810 MHz.

Assessed by:

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Dosimetric E-Field Probe ES3DV3 SN:3163

Conversion factor (± standard deviation)

150 MHz	*ConvF*	8.1 ± 10%	ε_r = 52.3 σ = 0.76 mho/m (head tissue)
250 MHz	*ConvF*	7.5 ± 10%	ε_r = 47.6 σ = 0.83 mho/m (head tissue)
300 MHz	*ConvF*	7.2 ± 9%	ε_r = 45.3 σ = 0.87 mho/m (head tissue)
150 MHz	*ConvF*	7.8 ± 10%	ε_r = 61.9 σ = 0.80 mho/m (body tissue)
250 MHz	*ConvF*	7.4 ± 10%	ε_r = 59.4 σ = 0.88 mho/m (body tissue)
300 MHz	*ConvF*	7.2 ± 9%	ε_r = 58.2 σ = 0.92 mho/m (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.

Note: The standard deviation for each Conversion factor stated in above numerical assessments were taken at k = 1.

Calibration Laboratory of
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S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
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: Motorola CGISS

Certificate No: ES3-3185_Nov09

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3185

Calibration procedure(s): QA CAL-01.v6, QA CAL-12.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes

Calibration date: November 23, 2009

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: November 23, 2009

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Accredited by the Swiss Accreditation Service (SAS) **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3185

Manufactured:	March 25, 2008
Last calibrated:	November 18, 2008
Recalibrated:	November 23, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ES3DV3 SN:3185 November 23, 2009

DASY - Parameters of Probe: ES3DV3 SN:3185

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.36	1.27	1.11	± 10.1%
DCP (mV)[B]	93.1	92.7	92.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5%
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY - Parameters of Probe: ES3DV3 SN:3185

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
300	± 50 / ± 100	45.3 ± 5%	0.87 ± 5%	6.68	6.68	6.68	0.24	0.92 ± 13.3%
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	6.08	6.08	6.08	0.22	1.49 ± 13.3%
750	± 50 / ± 100	41.9 ± 5%	0.89 ± 5%	5.96	5.96	5.96	0.92	1.04 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	5.63	5.63	5.63	0.64	1.21 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.83	4.83	4.83	0.41	1.71 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.65	4.65	4.65	0.55	1.44 ± 11.0%
2300	± 50 / ± 100	39.5 ± 5%	1.67 ± 5%	4.53	4.53	4.53	0.40	1.83 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.22	4.22	4.22	0.41	1.87 ± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	4.17	4.17	4.17	0.44	1.89 ± 11.0%
3500	± 50 / ± 100	37.9 ± 5%	2.91 ± 5%	3.99	3.99	3.99	0.85	1.21 ± 13.1%
3700	± 50 / ± 101	37.7 ± 5%	3.12 ± 5%	3.64	3.64	3.64	0.85	1.21 ± 13.1%

[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.

DASY - Parameters of Probe: ES3DV3 SN:3185

Calibration Parameter Determined in Body Tissue Simulating Media

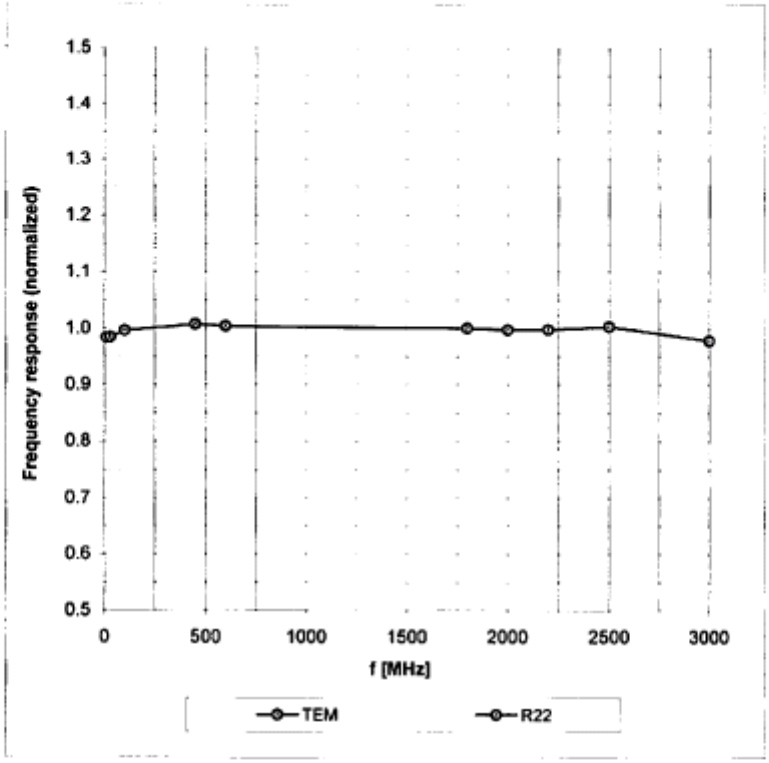
f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	6.55	6.55	6.55	0.17	1.00	± 13.3%
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	5.60	5.60	5.60	0.76	1.15	± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	5.48	5.48	5.48	0.94	1.10	± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.57	4.57	4.57	0.29	2.39	± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.52	4.52	4.52	0.30	2.70	± 11.0%
2300	± 50 / ± 100	52.8 ± 5%	1.85 ± 5%	4.21	4.21	4.21	0.46	1.74	± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.02	4.02	4.02	0.58	1.44	± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	3.92	3.92	3.92	0.82	1.20	± 11.0%
3500	± 50 / ± 100	51.3 ± 5%	3.31 ± 5%	3.33	3.33	3.33	0.90	1.32	± 13.1%
3700	± 50 / ± 101	51.0 ± 5%	3.55 ± 5%	3.26	3.26	3.26	0.90	1.46	± 13.1%

[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.

ES3DV3 SN:3185 November 23, 2009

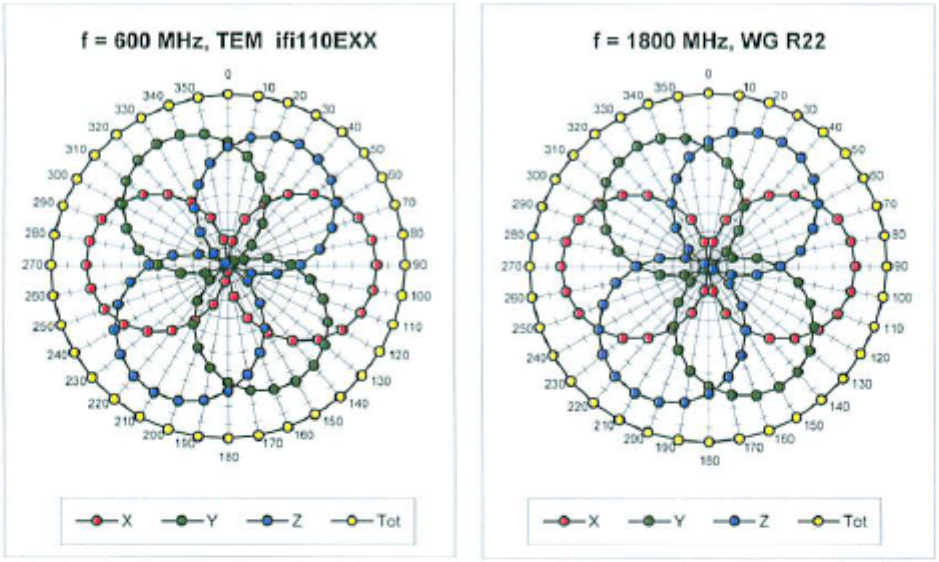
Frequency Response of E-Field

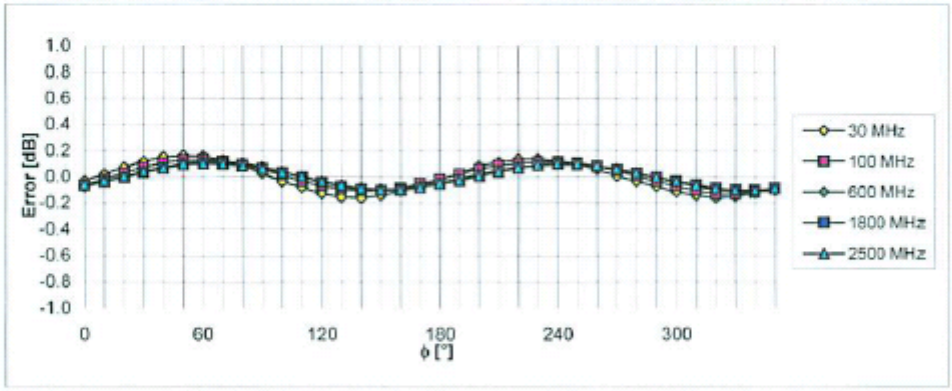
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

Receiving Pattern (ϕ), ϑ = 0°

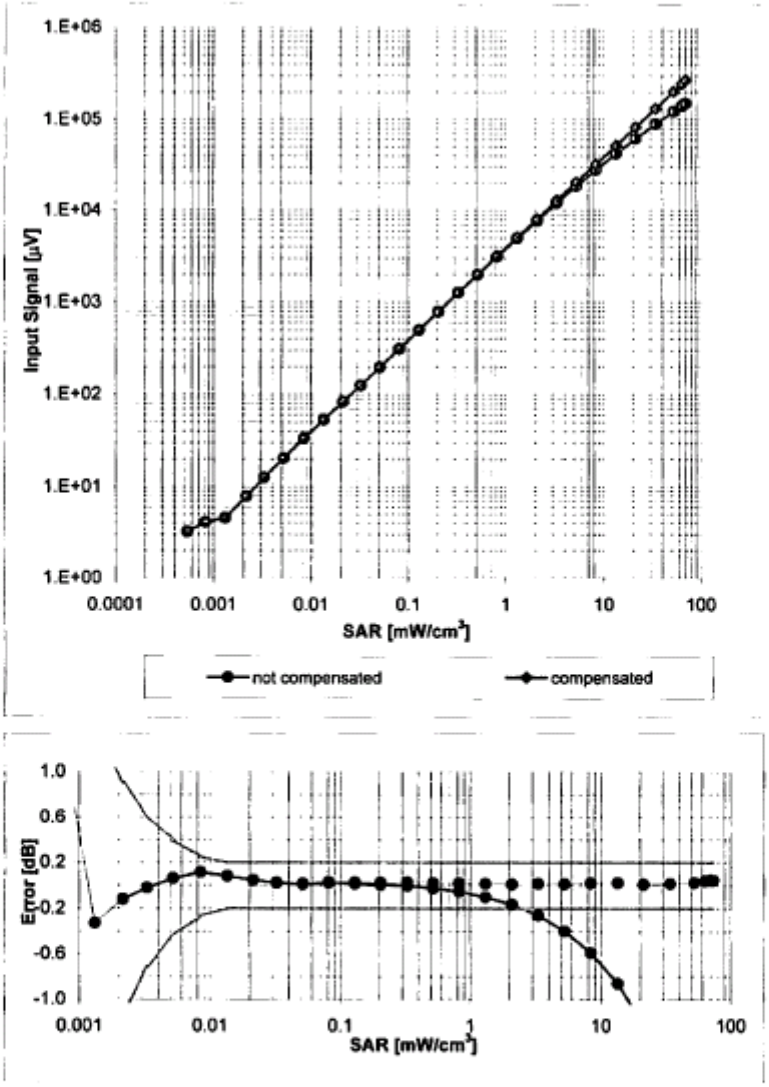




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

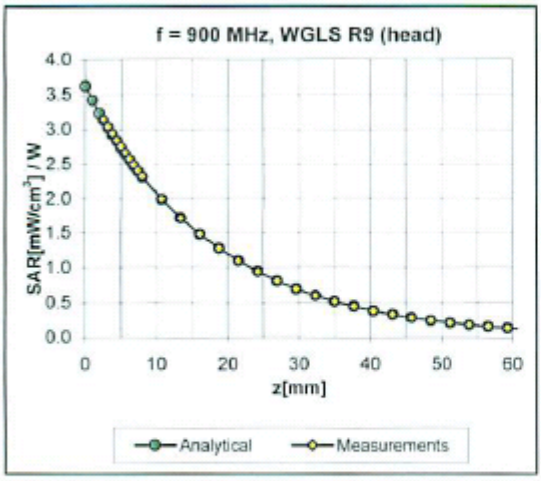
Dynamic Range f(SAR_{head})

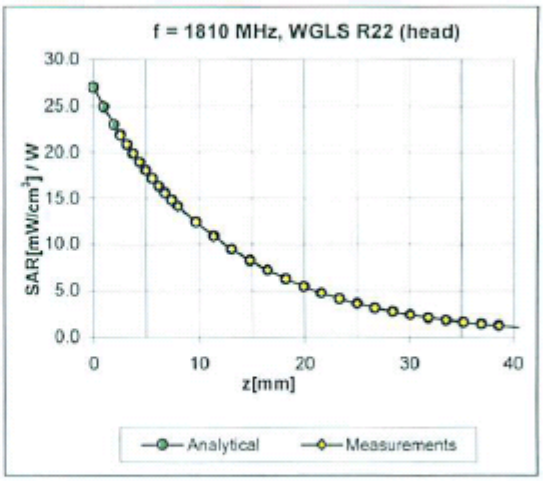
(Waveguide R22, f = 1800 MHz)



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

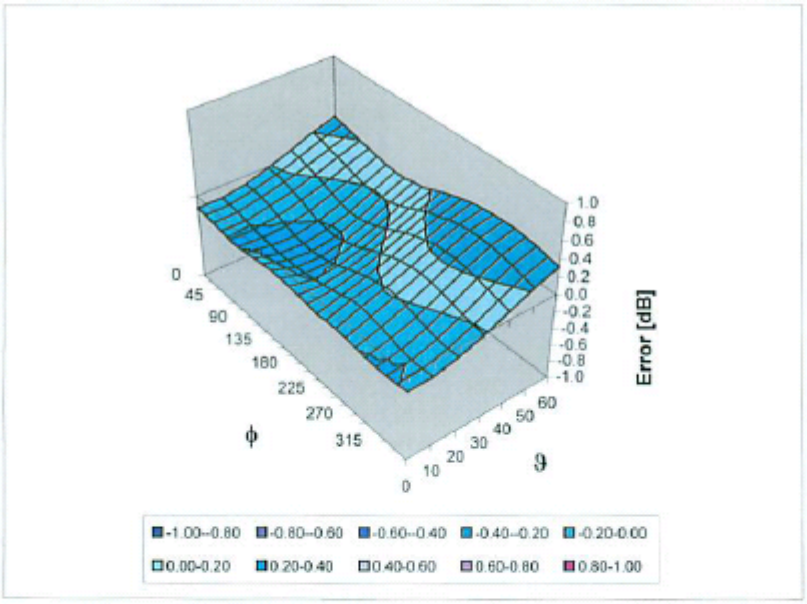
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4.0 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3185**
Place of Assessment:	**Zurich**
Date of Assessment:	**November 26, 2009**
Probe Calibration Date:	**November 23, 2009**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1810 MHz.

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Dosimetric E-Field Probe ES3DV3 SN:3185

Conversion factor (± standard deviation)

150 MHz	*ConvF*	**7.7 ± 10%**	ε_r = 52.3 σ = 0.76 mho/m (head tissue)
250 MHz	*ConvF*	**7.0 ± 10%**	ε_r = 47.6 σ = 0.83 mho/m (head tissue)
150 MHz	*ConvF*	**7.4 ± 10%**	ε_r = 61.9 σ = 0.80 mho/m (body tissue)
250 MHz	*ConvF*	**7.0 ± 10%**	ε_r = 59.4 σ = 0.88 mho/m (body tissue)
300 MHz	*ConvF*	**6.9 ± 9%**	ε_r = 58.2 σ = 0.92 mho/m (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.

Note: The standard deviation for each Conversion factor stated in above numerical assessments were taken at k = 1.