


MOTOROLA


TESTING CERT #2518.01

FCC ID: AZ489FT4826
DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 3

Networks & Enterprise
EME Test Laboratory
 8000 West Sunrise Blvd
 Fort Lauderdale, FL. 33322

Date of Report: Jan 11, 2007
Report Revision: B
Report ID: PCII rpt_PMUE1678B_Rev B_070111
 SR4573

Responsible Engineer: Kim Uong (EME lead Eng.)
Date/s Tested: 12/08/06-12/18/06, 1/10/07
Manufacturer/Location: Motorola – Penang
Sector/Group/Div.: NE/GTDC
Date submitted for test: 11/13/06
DUT Description: 403-470 MHz 4W Trunking Popular w/o Keypad
Test TX mode(s): CW
Max. Power output: 4.8W
Nominal Power: 4.0W
Tx Frequency Bands: 403-470MHz
Signaling type: FM
Model(s) Tested: PMUE1678B
Model(s) Certified: PMUE1678B
Serial Number(s): 004TGL3002
Classification: Occupational/Controlled
Rule Part(s): 90



Approved Accessories:

Antenna(s):

PM4E4002A (403-433 MHz Stubby ¼ wave antenna, -4.5dBi); PM4E4003A (430-470 MHz Stubby ¼ wave antenna, -4.5dBi);
 NAE6483AR (403-520 MHz Whip ¼ wave antenna, -2.0dBi).

Battery(ies):

HNN9008A (NiMH High Capacity Battery); HNN9009A (NiMH Ultra High Capacity Battery); HNN9010A (NiMH Ultra High Capacity Battery Factory Mutual); HNN9011B (NiCd High Capacity Battery Factory Mutual); HNN9012B (NiCd High Capacity Battery);
 HNN9013D (Li Ion High Capacity Battery).

Body worn accessory(ies):

HLN9670A (Leather Case, Thin Battery w/ Swivel); HLN9676A (Leather Case, Standard Battery w/ Swivel); HLN9714A (Belt Clip);
 HLN9952A (Belt Clip Carry Holder); HLN9677A (Leather DTMF case, Thin Battery w/ Belt Loop); HLN9689A (Leather DTMF case,
 Standard Battery w/ Belt Loop); HLN9690A (Leather DTMF case, Thin Battery w/ Swivel); HLN9694A (Leather DTMF case, Standard
 Battery w/ Swivel); HLN9701B (Hard Nylon Case, Belt Loop, D-ring, for all battery sizes); HLN9652A (Leather Case, Thin Battery w/ belt
 Loop); HLN9665A (Leather Case, Standard Battery w/ Belt Loop).

Audio/Data cable accessory(ies):

See section 3.0 for list of approved audio accessories.

Max. Calc. : 1g Avg. SAR: 6.38 W/kg (Body); 10g Avg. SAR: 4.59 W/kg (Body)
Max. Calc. : 1g Avg. SAR: 3.60 W/kg (Face); 10g Avg. SAR: 2.71 W/kg (Face)

The S.A.R. results clearly demonstrate compliance to ICNIRP (1998) Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300GHz), 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 2.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola EME Laboratory.

This reporting format is consistent with the test report guidelines of the TIA TSB-150 December 2004
 The results and statements contained in this report pertain only to the device(s) evaluated.

Signature on file – Deanna Zakharia
 Deanna Zakharia N&E EME Lab Senior Resource Manager,
 Laboratory Director,

Approval Date: 1/11/07

Certification Date: 1/11/07

Certification No.: L1070107

Part 1 of 2

1.0	Introduction and Overview.....	3
2.0	Referenced Standards and Guidelines.....	3
2.1	SAR Limits	4
3.0	Description of Device Under Test (DUT).....	4
4.0	Description of Test System	5
4.1	Description of Robotics/Probes/Readout Electronics.....	5
4.2	Description of Phantom(s).....	6
4.2.1	Flat Phantom.....	6
4.2.2	SAM Phantom	6
4.3	Description of Equivalent Tissues	6
5.0	Additional Test Equipment.....	7
6.0	SAR Measurement System Verification.....	7
6.1	Equivalent Tissue Test results	7
6.2	System Check Test results	8
7.0	DUT Test Strategy and Methodology	8
7.1	DUT Configuration(s)	8
7.2	Device Positioning Procedures.....	9
7.2.1	Body	9
7.2.2	Head	9
7.2.3	Face	10
8.0	Environmental Test Conditions.....	10
9.0	Test Results Summary.....	10
9.1	Highest SAR results calculation methodology	14
10.0	Conclusion.....	14

APPENDICES

A	Measurement Uncertainty	15
B	Probe Calibration Certificates	18

Part 2 of 3

C	Dipole Calibration Certificates
D	Test System Verification Scans

Part 3 of 3

E	DUT Scans (Shortened Scans and Highest SAR configurations)
F	DUT Supplementary Data (e.g. Power Slump)
G	DUT Test Position Photos
H	DUT and Body-worn Accessory Photos
I	DUT Antenna Separation Distances and Offered Accessory Test Status

Report Revision History

Date	Revision	Comments
7/16/04	O	Release of new battery accessories compliance results.
8/01/05	A	Release of new battery accessory compliance results.
1/11/07	B	Design changed and maximum Power output has been reduced from 5.3W to 4.8W.

1.0 Introduction and Overview

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the N&E EME Test Lab for the model number PMUE1678B of FCC ID: AZ489FT4826. The results herein reflect final test results.

The results herein clearly demonstrate compliance to FCC Occupational/Controlled RF Exposure limits of 8.0 mW/g per the requirements of 47 CFR 2.1093(d) and ICNIRP (1998) Guidelines for limiting exposure in time-varying electric, magnetic and electromagnetic fields (up to 300GHz) RF Exposure limits of 10.0W/kg averaged over 10grams of contiguous tissue.

2.0 Referenced Standards and Guidelines

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

- BS EN 50361:2001 Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz – 3GHz)
- BS EN 50360:2001 Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz – 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 Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-2005 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (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”

2.1 SAR Limits

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)	1.60	8.0
Spatial Peak – ICNIRP/ANSI - (hands/wrists/feet/ankles averaged over 10-g)	4.0	20.0
Localized SAR - ICNIRP - (Head and Trunk 10-g)	2.0	10.0

3.0 Description of Device Under Test (DUT)

FCC ID: AZ489FT4826 is a UHF portable two-way radio that operates using frequency modulation (FM) incorporating traditional simplex transmission protocol. This radio is intended to be assessed using CW transmission via its' inherent test mode signaling capability. The model represented under this filing utilizes removable antennas and is capable of transmitting in the 403-470 MHz band. The nominal output power is 4W with maximum output power of 4.8W as defined by the upper limit of the production line final test station. The intended operating positions are “at the face” with the DUT 1 to 2 inches 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 connect to the radio. This device will be marketed to and used by employees solely for occupational operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies, which can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means. Motorola also makes available to its customers training classes on the proper use of two-way radios and wireless data devices.

FCC ID: AZ489FT4826 is offered with the options and accessories listed on the coversheet of this report as well as the audio accessories listed below:

AAHMN9052E	Standard Remote Speaker Microphone
AAHMN9053E	Noise-Cancelling Remote Speaker Microphone
NTN1722A	Integrated Ear Microphone/Receiver System w/PTT
NTN1723A	Integrated Ear Microphone/Receiver System w/Palm PTT
NTN1724A	Integrated Ear Microphone/Receiver System w/Ring PTT
AARMN4019A	Over-the-Head, Medium weight, Dual Muff Headset w/Noise Cancelling Microphone & In-line PTT
AARMN4018B	Light Weight Headset w/Boom Microphone & In-line PTT
AARMN4031B	Light Weight Headset w/Swivel Boom Microphone
AARMN4017A	Ultra Light Headset
AARMN4032A	Over-the-Head, Medium Weight, Dual Muff Headset w/Noise Cancelling Microphone
AARMN4022A	Two Wire Earpiece w/ Microphone & PTT (Beige)

AARMN4029A	Two Wire Earpiece w/Microphone & PTT (Black)
AARMN4021A	One Wire Earpiece (Beige)
AARMN4028A	One Wire Earpiece (Black)
RLN4941A	Receive-Only Earpiece w/Translucent Tube, Rubber Eartip & 3.5mm Plug
RLN4922A	Complete Discrete Earpiece Kit-use with any standard two wire earpiece kit
AAHLN9716C	Audio accessory adaptor
HMN9725D	Remote Speaker Microphone

Test Output Power

A table of the characteristic power slump versus time is provided in Appendix F.

4.0 Description of Test System



4.1 Descriptions of Robotics/probes/Readout Electronics

The laboratory utilizes a Dosimetric Assessment System (DASY4™) SAR measurement system Version 4.7 build 44 manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot, DAE3V1, and ET3DV6 E-Field probes. Please reference the SPEAG user manual and application notes for detailed probe, robot, and SAR computational procedures. Section 5.0 presents relevant 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.

4.2 Description of Phantom(s)

4.2.1 Flat Phantom

Phantom Type	Phantom Material	Phantom Dimensions (cm)	Support structure opening dimensions (cm)	Support structure material	Loss Tangent (wood)
Flat	High Density Polyethylene (HDPE)	80x30x20x0.2	68.58x20.32	Wood	< 0.05

4.3 Description of Equivalent tissues

Type of Simulated Tissue

The simulated tissue used is also compliant to that specified in EN50361:2001 at the head and face; and in FCC Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01) and 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".

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.

Simulated Tissue Composition

% of listed ingredients	450MHz	
	Head	Body
Sugar	56	46.5
Diacetin	NA	NA
De ionized -Water	39.1	50.53
Salt	3.8	1.87
HEC	1.0	1.0
Bact.	0.1	0.1

Reference section 6.1 for target parameters

5.0 Additional Test Equipment

Equipment Type	Model Number	Serial Number	Calibration Due Date
Power Meter (Agilent)	E4419B	MY403300364	1/31/2007
Power Sensor (HP)	8482B	3318A06773	4/19/2007
Power Sensor (HP)	8482B	3318A06774	4/22/2007
Bi-Directional Coupler (NARDA)	3020A	40296	2/17/2008
Signal Generator (HP)	E4438C	MY42082269	6/23/2008
AMP (Amplifier Research)	10W1000	28782	CNR
Agilent PNA-L Network Analyzer	N5230A	MY45001092	5/22/2007
Dielectric Probe Kit (HP)	85070C	US99360076	CNR
Speag Dipole	D450V2	1001	5/25/2008

6.0 SAR Measurement System Verification

The SAR measurements were conducted with probe model/serial number ET3DV6/SN1383 and ET3DV6/SN1545. The 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. The table below summarizes the system performance check results normalized to 1W.

Dipole validation scans at the head from SPEAG are provided in APPENDIX D. The N&E EME lab validated the dipole to the applicable IEEE 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 N&E EME system performance validation are provided herein.

6.1 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 5.0.

Actual versus Target tissue parameters (12/8/06 – 12/18/06, 1/10/07)

FCC Body				
Frequency (MHz)	Di-electric Constant Target	Di-electric Constant Meas. (Range)	Conductivity Target S/m	Conductivity Meas. (Range) S/m
450	56.7	57.3-57.8	0.94	0.92-0.95
436.5	56.8	57.5-58.1	0.94	0.92-0.94

CENELEC/IEEE Head				
Frequency (MHz)	Di-electric Constant Target	Di-electric Constant Meas. (Range)	Conductivity Target S/m	Conductivity Meas. (Range) S/m
450	44.1/43.5	43.1-44.1	0.88/0.87	0.85-0.89
436.5	44.2/43.7	43.4-44.4	0.88/0.87	0.84-0.88

6.2 System Check Test Results

Probe Serial #	Tissue Type	Probe Cal Date	Dipole Kit / Serial #	System Perf. Result when normalized to 1W (mW/g)	Reference S.A.R @ 1W (mW/g)	Test Date(s)
1383	FCC Body	2/22/06	SPEAG D450V2 /1001	4.26 +/- 0.05	4.43 +/- 10%	12/8/06, 12/13/06-12/15/06 4 test days
1383	CENELEC /IEEE Head	2/22/06	SPEAG D450V2 /1001	4.97 +/- 0.15	5.11 +/- 10%	12/17/06-12/18/06 2 test days
1545	FCC Body	9/21/06	SPEAG D450V2 /1001	4.25 +/- 0.00	4.43 +/- 10%	1/10/07 1 test day

Note: See APPENDIX D for an explanation of the reference SAR targets stated above.
(System performance results reflects the median performance +/- ½ of the test date(s) performance ranges)

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 17025 A2LA guidelines.

7.0 DUT Test Strategy and Methodology

7.1 DUT Configuration(s)

The DUT is a portable device with PTT operation using FM transmission signaling operational at the body, and face using the offered applicable audio accessories. The device is placed in the test positions presented in Appendix G.

Test Plan

All options and accessories listed on the cover page of this report were considered in order to develop the SAR test plan for this product. SAR measurements were performed using a flat phantom with the applicable simulated tissue to assess performance at the body and face respectively using the relevant transmission modes.

Note that a coarse-to-cube approximation methodology was utilized to determine the worst-case SAR performance configuration for each applicable body location. The test configurations that produced the highest SAR results for each body position using the coarse-to-cube approximation methodology were assessed using the full DASY4™ coarse and 7x7x7 cube scans.

Assessments at the Body [Pages 11,12; Tables 1]

- Assessment of the offered antennas of the 403-470MHz band using applicable test configurations at the body.
- Assessment of the offered batteries with the worst case configuration from the above.
- Assessment of the offered body worn accessories with the worst case configuration from the above.
- Assessment of the offered audio accessories with the worst case configuration

from the above.

- Assessment across the band of each offered antenna using the worst case configuration from the above.

Assessments at the Body 2.5cm [\[Page 12; Table 1\]](#)

- Assessment with the DUT's back and the antenna at 2.5cm from the phantom.
- Assessment with the DUT's front separated 2.5cm from the phantom without a body worn accessory using the worst case test configuration from the body assessment above.

Assessments at the Face [\[Page 13; Table 2\]](#)

- Assessment of the offered antennas of the 403-470MHz band using applicable test configurations at the face.
- Assessment of the offered batteries with the worst case configuration from the above.
- Assessment of the offered audio accessories with the worst case configuration from the above.
- Assessment across the band of each offered antenna using the worst case configuration from the above.

Shortened scan assessment at the Body [\[Page 14; Table 3\]](#)

- A "shortened" scan was performed using the offered battery and test configuration that produced the highest SAR results overall. Note that the shortened scan is obtained by first running a coarse scan to find the peak area and then, using a newly charged battery, a cube scan only was performed. The shortened scan represents the cube scan performance results.

7.2 Device Positioning Procedures

Reference Appendix G for photos of the DUT tested positions.

7.2.1 Body

The DUT was positioned in normal use configuration against the phantom with the offered body worn accessory. The DUT was positioned with its' back and the antenna at 2.5cm from the phantom. The DUT was positioned with its' front at 2.5cm from the phantom. Attached accessories are allowed to be straight down from the radio.

7.2.2 Head

NA.

7.2.3 Face

The DUT was positioned with its' front side separated 2.5cm from the phantom with and without the offered applicable audio accessories.

8.0 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 $\pm 2^{\circ}\text{C}$ of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was 15cm $\pm$ 0.5cm. 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:

	Target	Measured
Ambient Temperature	20 - 25 $^{\circ}\text{C}$	Range: 21.8-23.2 $^{\circ}\text{C}$ Avg. 22.5 $^{\circ}\text{C}$
Relative Humidity	30 - 70 %	Range: 40.6-66.7% Avg. 57.6%
Tissue Temperature	NA	Range: 19.9-21.6 $^{\circ}\text{C}$ Avg. 20.7 $^{\circ}\text{C}$

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 S.A.R scans are repeated.

9.0 Test Results Summary

All SAR results obtained by the tests described in Section 7.1 are listed below. As noted in section 7.1, a coarse-to-cube approximation methodology, was utilized to ascertain the worst-case test configuration for each body location. The worst case test configurations observed for each body location and band (in bold with *) were then assessed using the full DASY4™ coarse and 7x7x7 cube methodology, and they are presented in the worst case configuration table below. The associated SAR plots are provided in APPENDIX E. Appendix E also presents shortened SAR cube scans to assess the validity of the calculated results presented herein. Note: The results of the shortened cube scans presented in Appendix E demonstrate that the scaling methodology used to determine the calculated SAR results presented herein are valid.

Table1

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 (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)
Assessment of offered antennas												
MeC-AB-061208-03/004TGL3002	NAE6483AR	436.500	HNN9013D	Against Phantom	HLN9714A	HMN9052E	4.78	-0.444	7.42	5.45	4.13	3.03
CM-AB-061213-02/004TGL3002	PMAE4002A	418.000	HNN9013D	Against Phantom	HLN9714A	HMN9052E	4.60	-0.260	8.81	6.41	4.88	3.55
CM-AB-061213-03/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	HMN9052E	4.57	-0.329	10.50	7.56	5.95	4.28
Assessment of offered batteries with the worst case configuration from the above												
CM-AB-061213-04/004TGL3002	PMAE4003A	450.000	HNN9008A	Against Phantom	HLN9714A	HMN9052E	4.92	-0.659	9.26	6.69	5.39	3.89
CM-AB-061213-05/004TGL3002	PMAE4003A	450.000	HNN9009A	Against Phantom	HLN9714A	HMN9052E	5.00	-0.688	8.80	6.34	5.16	3.71
CM-AB-061213-06/004TGL3002	PMAE4003A	450.000	HNN9010A	Against Phantom	HLN9714A	HMN9052E	4.87	-0.766	8.05	5.83	4.80	3.48
CM-AB-061213-08/004TGL3002	PMAE4003A	450.000	HNN9011B	Against Phantom	HLN9714A	HMN9052E	4.74	-1.470	6.47	4.69	4.60	3.33
CM-AB-061213-09/004TGL3002	PMAE4003A	450.000	HNN9012B	Against Phantom	HLN9714A	HMN9052E	4.99	-0.841	5.13	3.76	3.11	2.28
Assessment of offered body worn accessories with the worst case configuration from the above												
CM-AB-061213-10/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9952A w/HLN9714A	HMN9052E	4.80	-0.458	8.20	5.98	4.56	3.32
CM-AB-061213-11/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9652A	HMN9052E	4.81	-0.329	4.79	3.55	2.58	1.91
CM-AB-061213-12/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9670A	HMN9052E	4.75	-0.221	2.98	2.21	1.58	1.17
CM-AB-061213-13/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9701B	HMN9052E	4.82	-0.375	5.81	4.29	3.17	2.34
Assessment of offered audio accessories with the worst case configuration from the above												
CM-AB-061213-14/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	NTN1722A	4.84	-0.419	10.20	7.41	5.62	4.08
CM-AB-061213-15/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	NTN1723A	4.74	-0.224	9.76	7.05	5.20	3.76
CM-AB-061213-16/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	NTN1724A	4.74	-0.458	10.40	7.53	5.85	4.24
CM-AB-061213-17/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	HMN9053E w/RLN4941A	4.90	-0.573	11.20	8.08	6.39	4.61
CM-AB-061213-18/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4018B	4.87	-0.434	10.70	7.80	5.91	4.31
CM-AB-061214-02/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4031B	4.93	-0.407	10.70	7.78	5.88	4.27
CM-AB-061214-03/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4017A	4.92	-0.425	11.00	7.98	6.07	4.40
CM-AB-061214-04/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4019A	4.94	-0.507	10.40	7.62	5.84	4.28
CM-AB-061214-05/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4032A	4.91	-0.494	10.40	7.52	5.83	4.21
*CM-AB-061214-06/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/RLN4922A	4.95	-0.583	11.40	8.28	6.52	4.73
MeC-AB-070110-09/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	HLN9716C W/HMN9725D	4.86	-0.442	10.60	7.69	5.87	4.26

Table1 (continued)

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 (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)
Assessment across the band and applicable band edges for each offered antenna with the worst case configuration from the above												
CM-AB-061214-07/004TGL3002	NAE6483AR	403.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.87	0.0575	5.81	4.25	2.91	2.13
CM-AB-061214-08/004TGL3002	NAE6483AR	436.500	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.64	-0.393	7.75	5.66	4.39	3.20
CM-AB-061214-09/004TGL3002	NAE6483AR	470.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.78	-0.950	3.19	2.32	1.99	1.45
CM-AB-061214-10/004TGL3002	PMAE4002A	403.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.85	0.308	4.69	3.43	2.35	1.72
CM-AB-061214-11/004TGL3002	PMAE4002A	418.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.56	-0.230	8.06	5.84	4.47	3.24
CM-AB-061214-12/004TGL3002	PMAE4002A	433.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.56	-0.306	10.30	7.49	5.82	4.23
CM-AB-061214-13/004TGL3002	PMAE4003A	430.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.62	-0.210	7.05	5.12	3.84	2.79
CM-AB-061215-02/004TGL3002	PMAE4003A	470.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.56	-0.560	4.70	3.39	2.81	2.03
Assessment at 2.5cm separation												
CM-AB-061215-03/004TGL3002	PMAE4003A	450.000	HNN9013D	DUT back at 2.5cm	None	RMN4029A W/ RLN4922A	4.94	-0.343	5.72	4.22	3.10	2.28
CM-AB-061215-04/004TGL3002	PMAE4003A	450.000	HNN9013D	DUT back; ant at 2.5cm	None	RMN4029A W/ RLN4922A	4.89	-0.461	8.64	6.31	4.80	3.51
CM-AB-061215-05/004TGL3002	PMAE4003A	450.000	HNN9013D	DUT front at 2.5cm	None	RMN4029A W/ RLN4922A	4.88	-0.754	4.70	3.46	2.80	2.06

Table 2

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 (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)
Assessment of offered antennas												
CM-Face-061217-02/004TGL3002	NAE6483AR	436.500	HNN9013D	DUT front 2.5cm	None	None	4.90	-0.422	6.07	4.50	3.34	2.48
CM-Face-061217-03/004TGL3002	PMAE4002A	418.000	HNN9013D	DUT front 2.5cm	None	None	4.68	-0.266	4.95	3.66	2.70	2.00
CM-Face-061217-04/004TGL3002	PMAE4003A	450.000	HNN9013D	DUT front 2.5cm	None	None	4.92	-0.433	7.27	5.37	4.02	2.97
Assessment of offered batteries with the worst case configuration from the above												
CM-Face-061217-05/004TGL3002	PMAE4003A	450.000	HNN9013D	DUT front 2.5cm	None	None	4.90	-0.684	6.56	4.85	3.84	2.84
*CM-Face-061217-06/004TGL3002	PMAE4003A	450.000	HNN9009A	DUT front 2.5cm	None	None	4.94	-0.717	7.06	5.22	4.16	3.08
CM-Face-061217-07/004TGL3002	PMAE4003A	450.000	HNN9010A	DUT front 2.5cm	None	None	4.81	-0.623	6.75	4.99	3.90	2.88
CM-Face-061217-08/004TGL3002	PMAE4003A	450.000	HNN9011B	DUT front 2.5cm	None	None	4.84	-0.532	5.88	4.34	3.32	2.45
CM-Face-061217-09/004TGL3002	PMAE4003A	450.000	HNN9012B	DUT front 2.5cm	None	None	4.90	-0.488	6.75	4.98	3.78	2.79
Assessment of offered applicable audio accessories with the worst case configuration from the above												
CM-Face-061217-10/004TGL3002	PMAE4003A	450.000	HNN9009A	DUT front 2.5cm	None	RMN4028A	4.94	-1.13	5.66	4.18	3.67	2.71
Assessment at the band edges for each offered antenna with the worst case configuration from the above												
CM-Face-061217-11/004TGL3002	NAE6483AR	403.000	HNN9009A	DUT front 2.5cm	None	None	5.04	0.0664	2.84	2.11	1.42	1.06
CM-Face-061217-12/004TGL3002	NAE6483AR	436.500	HNN9009A	DUT front 2.5cm	None	None	4.72	-1.19	5.78	4.28	3.87	2.86
CM-Face-061217-13/004TGL3002	NAE6483AR	470.000	HNN9009A	DUT front 2.5cm	None	None	4.84	-1.13	1.19	1.41	1.23	0.91
CM-Face-061217-14/004TGL3002	PMAE4002A	403.000	HNN9009A	DUT front 2.5cm	None	None	5.04	0.127	1.56	1.15	0.78	0.58
CM-Face-061218-02/004TGL3002	PMAE4002A	418.000	HNN9009A	DUT front 2.5cm	None	None	5.00	-0.348	4.56	3.38	2.47	1.83
CM-Face-061218-03/004TGL3002	PMAE4002A	433.000	HNN9009A	DUT front 2.5cm	None	None	4.68	-0.571	6.79	5.03	3.97	2.94
CM-Face-061218-04/004TGL3002	PMAE4003A	430.000	HNN9009A	DUT front 2.5cm	None	None	4.72	-0.615	3.83	2.83	2.24	1.66
CM-Face-061218-05/004TGL3002	PMAE4003A	470.000	HNN9009A	DUT front 2.5cm	None	None	4.84	-0.898	4.14	3.05	2.55	1.88

Table 3

Assessment with the worst case configuration at the body and face using the DASY 4 full coarse and 7x7x7 cube scan measurements												
Run Number/ SN	Antenna	Freq. (MHz)	Battery	Test position	Carry Case	Additional attachments	Initial Power (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)
CM-AB-061215- 12/004TGL3002	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.78	-0.707	10.80	7.76	6.38	4.59
CM-Face-061218- 07/004TGL3002	PMAE4003A	450.000	HNN9009A	DUT front 2.5cm	None	None	4.97	-0.992	5.73	4.32	3.60	2.71
CM-AB-061215- 13/004TGL3002 (Shorten scan)	PMAE4003A	450.000	HNN9013D	Against Phantom	HLN9714A	RMN4029A W/ RLN4922A	4.80	-0.669	10.80	7.79	6.30	4.54

9.1 Highest SAR results calculation methodology

The calculated maximum 1-gram and 10-gram averaged SAR results reported herein for the full DASY™ coarse and 7x7x7 cube measurements are determined by scaling the measured SAR to account for power leveling variations and power slump. For this device the Maximum Calculated 1-gram and 10-gram averaged peak SAR is calculated using the following formula:

Max. Calc. 1-g/10-g Avg. SAR = ((SAR meas. / (10^{^(Pdrift/10)}))*(Pmax/Pint))* DC%

P_{max} = Maximum Power (W)

P_{int} = Initial Power (W)

Pdrift = DASY drift results (dB) - (for conservative results positive drifts are not accounted for)

SAR_{meas.} = Measured 1-g/10-g Avg. SAR (mW/g)

DC % = Transmission mode duty cycle in % where applicable

50% duty cycle is applied for PTT operation.

10.0 Conclusion

The highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for FCC ID: AZ489FT4826 model PMUE1678B.

Max. Calc. : 1g Avg. SAR: 6.38 W/kg (Body); 10g Avg. SAR: 4.59 W/kg (Body)

Max. Calc. : 1g Avg. SAR: 3.60 W/kg (Face); 10g Avg. SAR: 2.71 W/kg (Face)

The 1g/10g average results above at the body replace the previously reported 1g/10g average results of 3.61/2.67 mW/g at the body. The previously reported 1g/10g average result at the face 5.77/4.2 mW/g will remain current.

These test results clearly demonstrate compliance with FCC Occupational/Controlled Environment Exposure limits of **8.0W/kg** per the requirements of 47 CFR 2.1093(d) and ICNIRP, Occupational/Controlled SAR Exposure limits of **10W/kg** averaged over 10grams per the guidelines published in the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998.

APPENDIX A

Measurement Uncertainty

Uncertainty Budget for Device Under Test, for 30 MHz to 3 GHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h =</i> <i>c x f / e</i>	<i>i =</i> <i>c x g / e</i>	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>u_i</i> (±%)	10 g <i>u_i</i> (±%)	<i>v_i</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)			<i>k</i> =2				22	22	

FCD-0558 Rev 5

Uncertainty Budget for System Validation (dipole & flat phantom) for 30 MHz to 3 GHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob. Dist.	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>u_i</i> (±%)	10 g <i>u_i</i> (±%)	<i>v_i</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)			<i>k</i> =2				18	17	

FCD-0558 Rev 5

Notes for Tables 1 and 2

- 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) *c_i* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- g) *u_i* – SAR uncertainty
- h) *v_i* - 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 Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola CGISS**

Certificate No: **ET3-1383_Feb06**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1383**

Calibration procedure(s) **QA CAL-01.v5 and QA CAL-12.v4**
Calibration procedure for dosimetric E-field probes

Calibration date: **February 22, 2006**

Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41495277	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41498087	3-May-05 (METAS, No. 251-00466)	May-06
Reference 3 dB Attenuator	SN: S5054 (3c)	11-Aug-05 (METAS, No. 251-00499)	Aug-06
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	11-Aug-05 (METAS, No. 251-00500)	Aug-06
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	2-Feb-06 (SPEAG, No. DAE4-654_Feb06)	Feb-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

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

Issued: February 22, 2006

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

Certificate No: ET3-1383_Feb06

Page 1 of 9

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



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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

ET3DV6 SN:1383

February 22, 2006

Probe ET3DV6

SN:1383

Manufactured:	August 16, 1999
Last calibrated:	February 24, 2005
Recalibrated:	February 22, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1383

February 22, 2006

DASY - Parameters of Probe: ET3DV6 SN:1383**Sensitivity in Free Space^A****Diode Compression^B**

NormX	1.87 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	90 mV
NormY	1.63 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	90 mV
NormZ	1.70 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	90 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

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

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	9.4	5.0
SAR _{be} [%]	With Correction Algorithm	0.0	0.0

TSL 1810 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	8.3	4.5
SAR _{be} [%]	With Correction Algorithm	0.1	0.3

Sensor Offset

Probe Tip to Sensor Center	2.7 mm
Optical Surface Detection	NOT in Tolerance

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

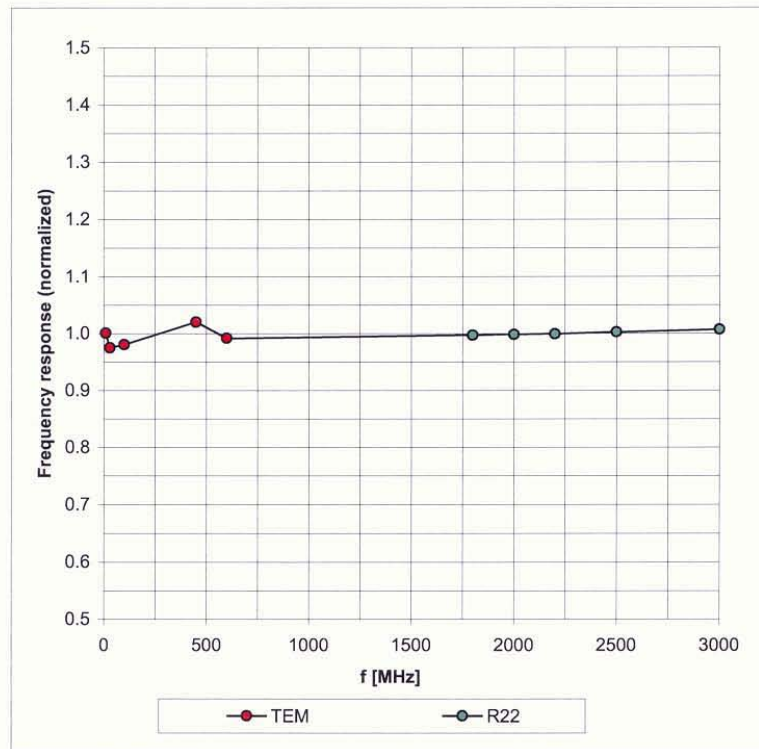
^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).^B Numerical linearization parameter: uncertainty not required.

ET3DV6 SN:1383

February 22, 2006

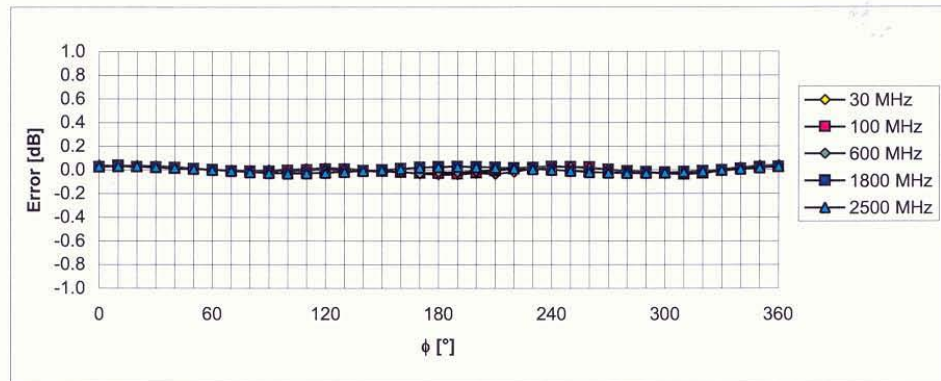
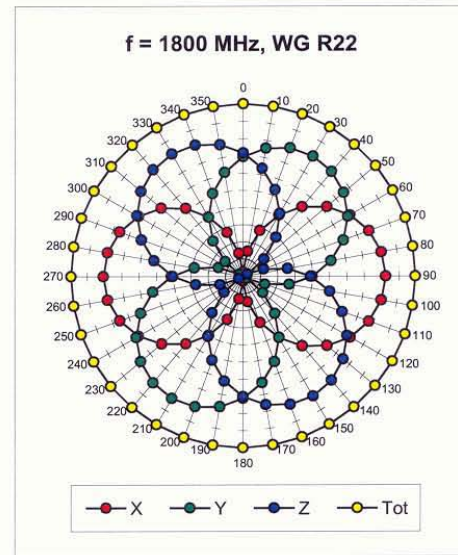
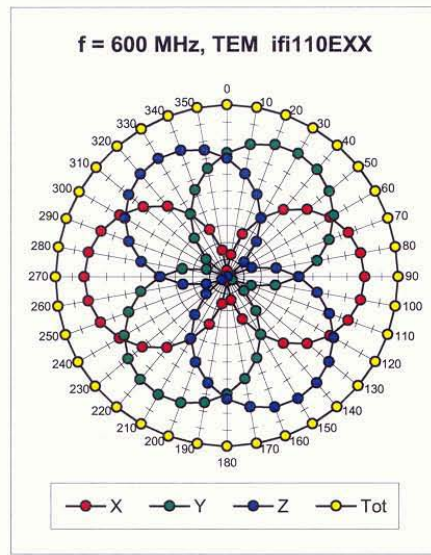
Frequency Response of E-Field

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

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

ET3DV6 SN:1383

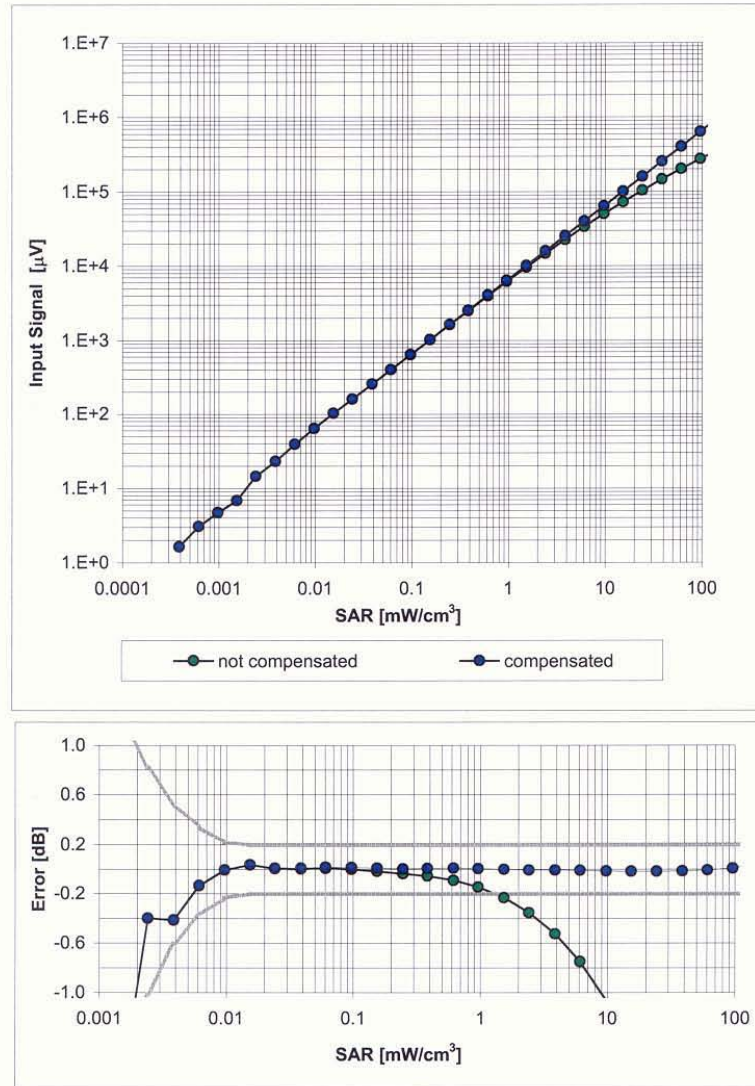
February 22, 2006

Receiving Pattern (ϕ), $\vartheta = 0^\circ$ Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

ET3DV6 SN:1383

February 22, 2006

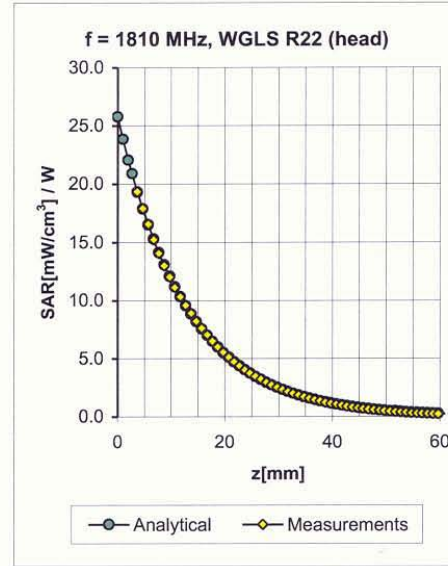
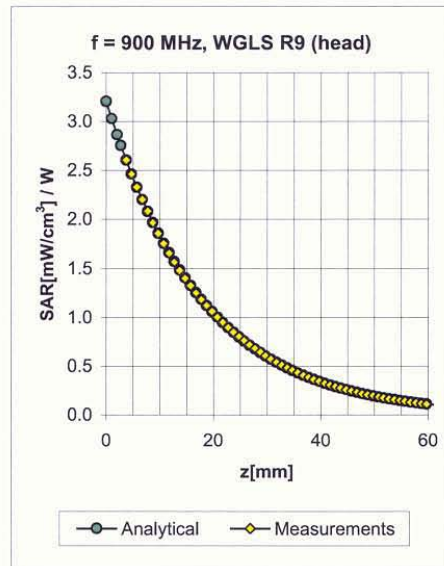
Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800$ MHz)

Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

ET3DV6 SN:1383

February 22, 2006

Conversion Factor Assessment

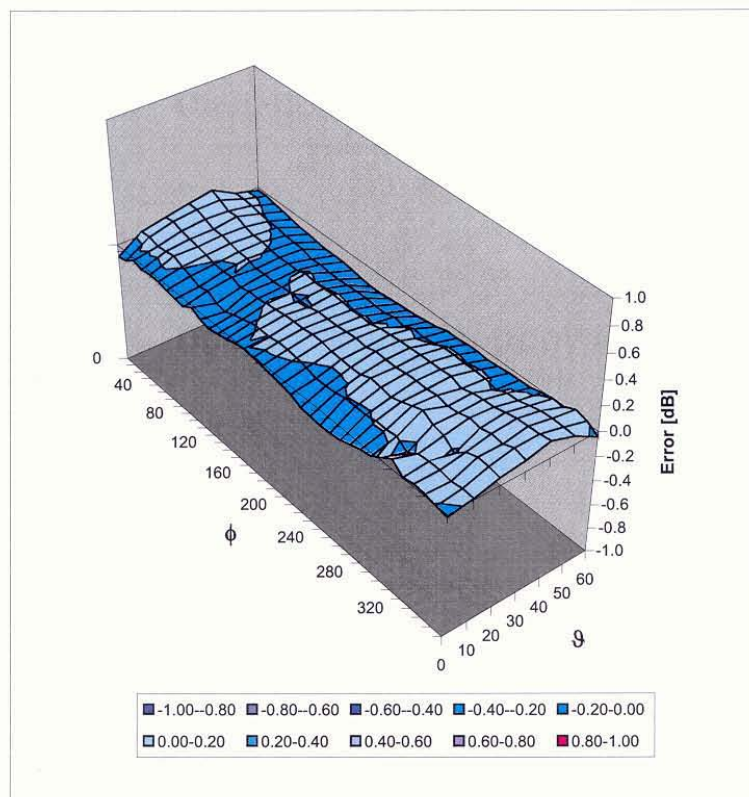


f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.30	2.95	6.74 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.74	1.72	6.21 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.77	1.59	5.13 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	1.12	1.16	4.56 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.27	3.94	7.12 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.62	1.94	5.89 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.88	1.77	4.66 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	1.29	1.16	4.29 ± 11.8% (k=2)

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ET3DV6 SN:1383

February 22, 2006

Deviation from Isotropy in HSLError (ϕ , θ), $f = 900$ MHzUncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, <http://www.speag.com>

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1383

Place of Assessment:

Zurich

Date of Assessment:

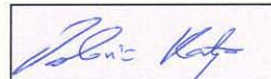
February 23, 2006

Probe Calibration Date:

February 22, 2006

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:



ET3DV6-SN:1383

Page 1 of 2

February 23, 2006

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
 Phone +41 1 245 9700, Fax +41 1 245 9779
 info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6 SN:1383Conversion factor ($\pm$ standard deviation)

150 MHz	<i>ConvF</i>	$8.4 \pm 10\%$	$\epsilon_r = 52.3$ $\sigma = 0.76 \text{ mho/m}$ (head tissue)
250 MHz	<i>ConvF</i>	$7.7 \pm 10\%$	$\epsilon_r = 47.6$ $\sigma = 0.83 \text{ mho/m}$ (head tissue)
300 MHz	<i>ConvF</i>	$7.6 \pm 9\%$	$\epsilon_r = 45.3$ $\sigma = 0.87 \text{ mho/m}$ (head tissue)
750 MHz	<i>ConvF</i>	$6.5 \pm 7\%$	$\epsilon_r = 41.9$ $\sigma = 0.89 \text{ mho/m}$ (head tissue)
150 MHz	<i>ConvF</i>	$8.2 \pm 10\%$	$\epsilon_r = 61.9$ $\sigma = 0.80 \text{ mho/m}$ (body tissue)
250 MHz	<i>ConvF</i>	$7.7 \pm 10\%$	$\epsilon_r = 59.4$ $\sigma = 0.88 \text{ mho/m}$ (body tissue)
300 MHz	<i>ConvF</i>	$7.6 \pm 9\%$	$\epsilon_r = 58.2$ $\sigma = 0.92 \text{ mho/m}$ (body tissue)
750 MHz	<i>ConvF</i>	$6.3 \pm 7\%$	$\epsilon_r = 55.5$ $\sigma = 0.96 \text{ mho/m}$ (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.

ET3DV6-SN:1383

Page 2 of 2

February 23, 2006

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



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

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

Accreditation No.: **SCS 108**

Client **Motorola CGISS**

Certificate No: **ET3-1545_Sep06**

CALIBRATION CERTIFICATE

Object **ET3DV6R - SN:1545**

Calibration procedure(s) **QA CAL-01.v5 and QA CAL-12.v4
 Calibration procedure for dosimetric E-field probes**

Calibration date: **September 21, 2006**

Condition of the calibrated item **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41496087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5066 (20b)	4-Apr-06 (METAS, No. 251-00550)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

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

Issued: September 21, 2006

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

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



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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

ET3DV6R SN:1545

September 21, 2006

Probe ET3DV6R

SN:1545

Manufactured:	October 16, 2000
Last calibrated:	October 25, 2005
Recalibrated:	September 21, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6R SN:1545

September 21, 2006

DASY - Parameters of Probe: ET3DV6R SN:1545**Sensitivity in Free Space^A****Diode Compression^B**

NormX	2.11 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	90 mV
NormY	2.17 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	96 mV
NormZ	1.87 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	94 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

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

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{to} [%]	Without Correction Algorithm	8.9	4.7
SAR _{to} [%]	With Correction Algorithm	0.1	0.1

TSL 1810 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{to} [%]	Without Correction Algorithm	11.8	7.0
SAR _{to} [%]	With Correction Algorithm	0.2	0.4

Sensor OffsetProbe Tip to Sensor Center **2.7 mm**

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

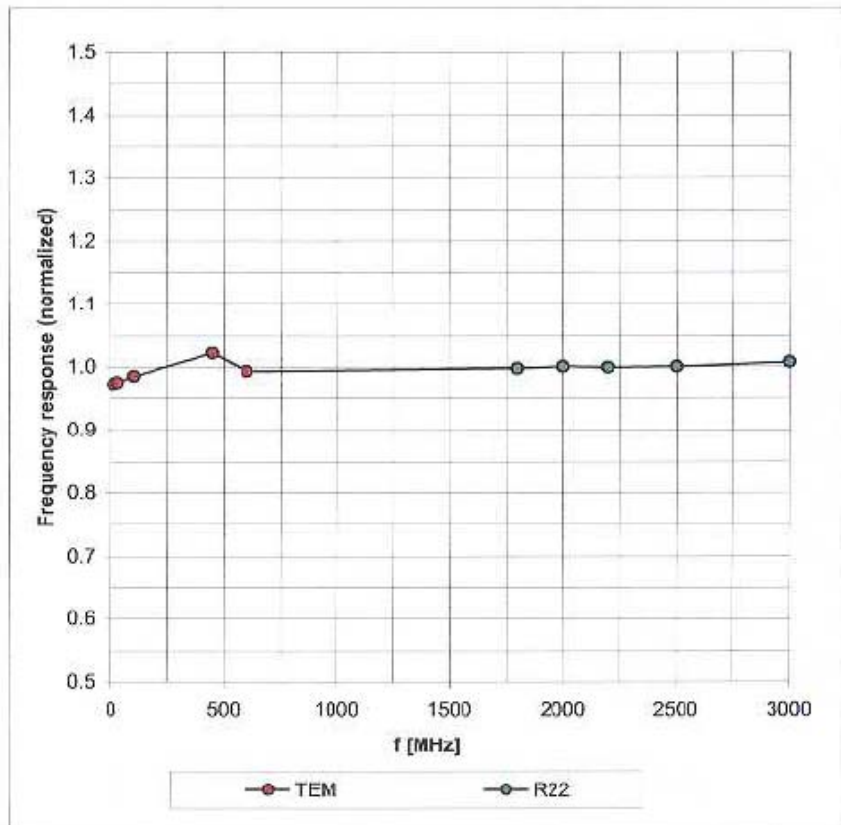
^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).^B Numerical linearization parameter: uncertainty not required.

ET3DV6R SN:1545

September 21, 2006

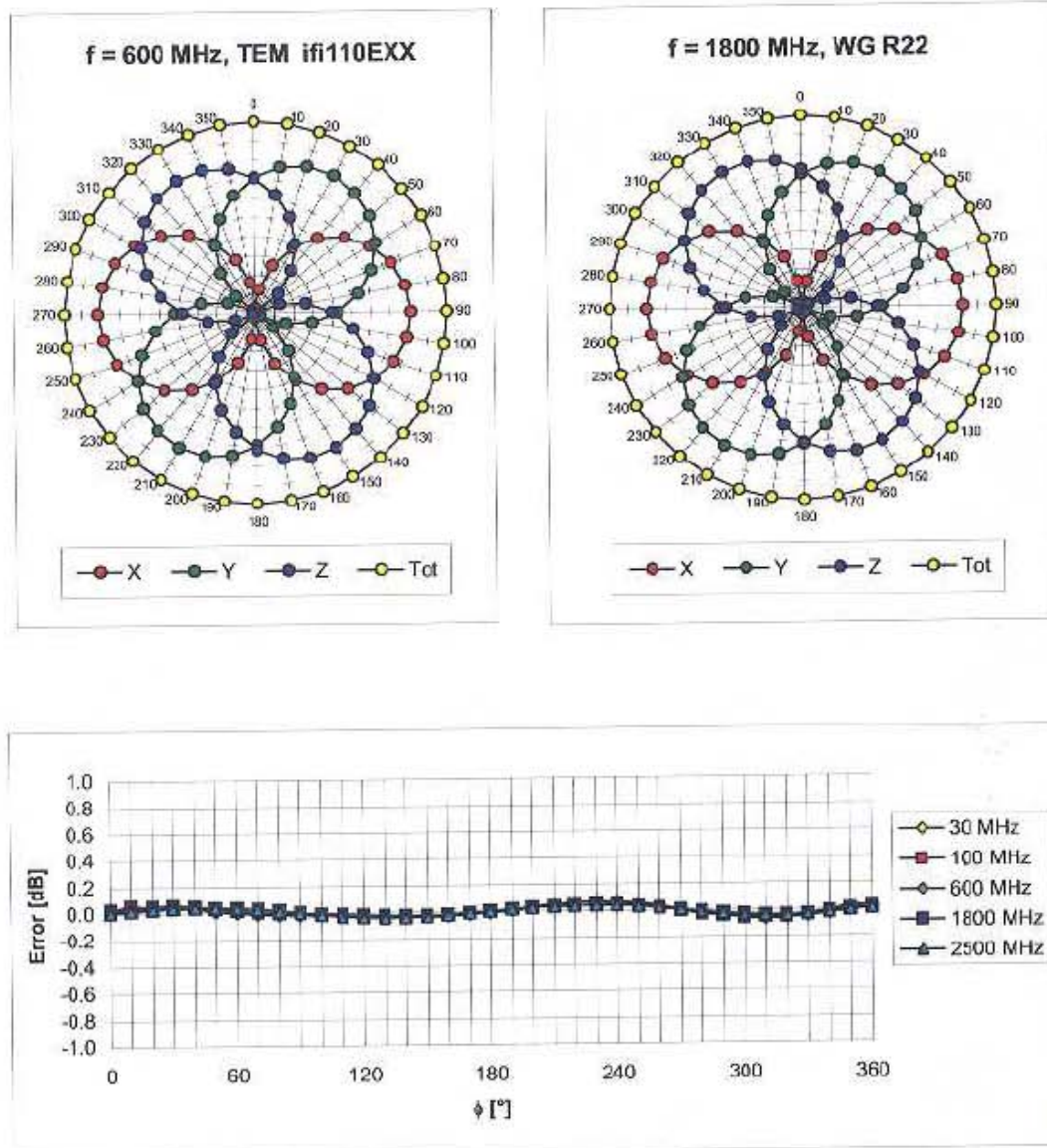
Frequency Response of E-Field

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

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

ET3DV6R SN:1545

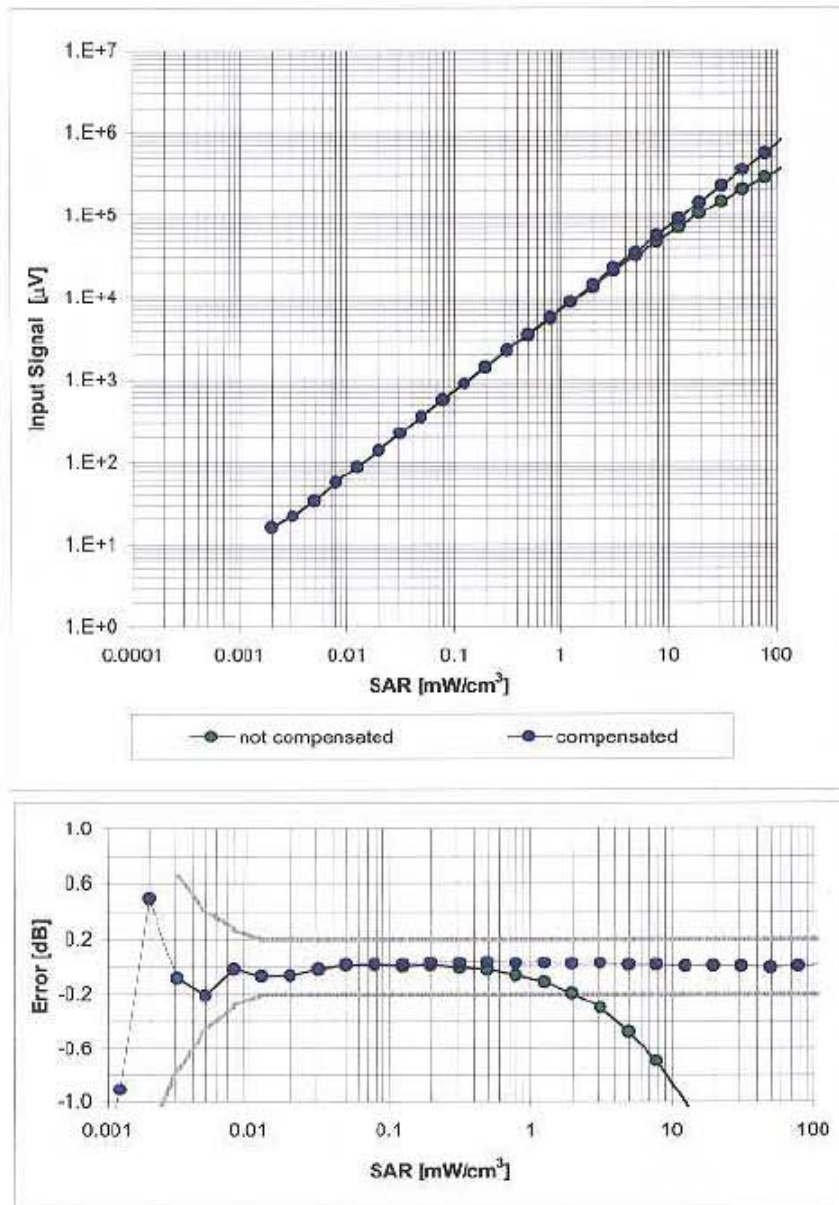
September 21, 2006

Receiving Pattern (ϕ), $\theta = 0^\circ$ Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

ET3DV6R SN:1545

September 21, 2006

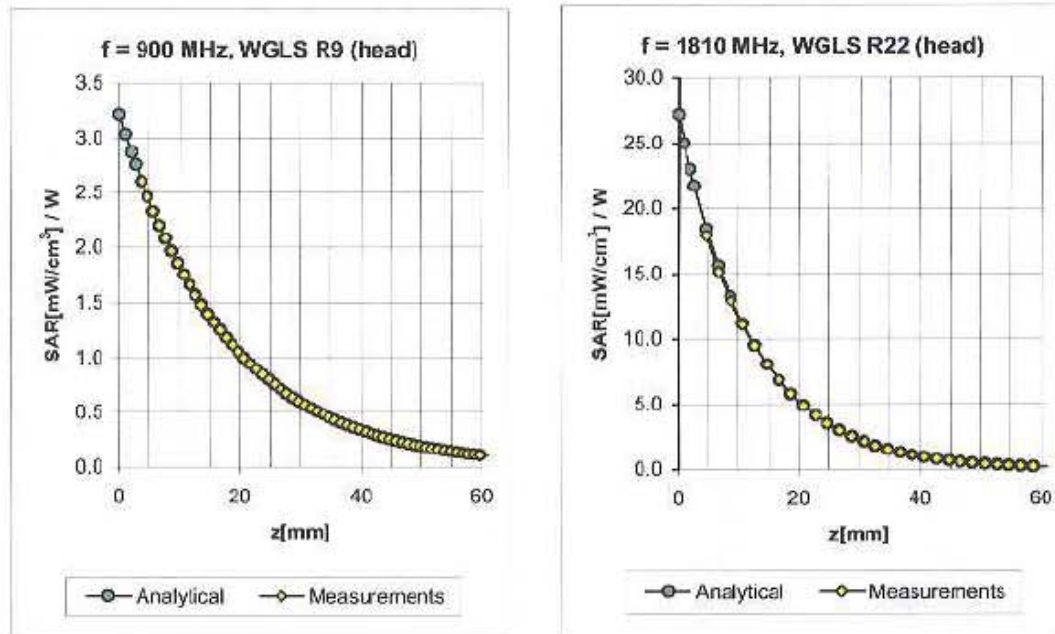
Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$)

Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

ET3DV6R SN:1545

September 21, 2006

Conversion Factor Assessment



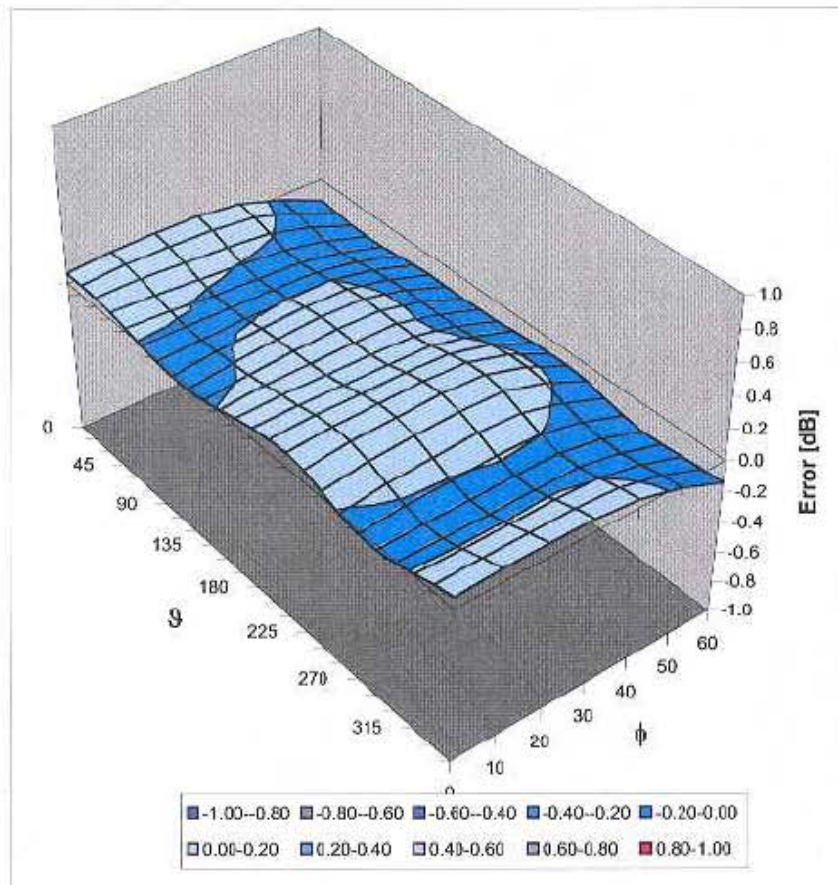
f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.38	1.92	6.70 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.65	1.78	5.98 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.47	2.86	4.89 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.77	1.91	4.34 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.32	1.94	7.46 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.56	1.99	5.74 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.64	2.66	4.35 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.78	1.77	3.87 ± 11.8% (k=2)

^c The validity of ± 100 MHz only applies for DASYS 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.

ET3DV6R SN:1545

September 21, 2006

Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz**Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)**

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, <http://www.speag.com>

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:

ET3DV6R

Serial Number:

1545

Place of Assessment:

Zurich

Date of Assessment:

September 25, 2006

Probe Calibration Date:

September 21, 2006

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:



Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
 Phone +41 1 245 9700, Fax +41 1 245 9779
 info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ET3DV6R SN:1545Conversion factor ($\pm$ standard deviation)

150 MHz	<i>ConvF</i>	$8.1 \pm 10\%$	$\epsilon_r = 52.3$ $\sigma = 0.76 \text{ mho/m}$ (head tissue)
250 MHz	<i>ConvF</i>	$7.4 \pm 10\%$	$\epsilon_r = 47.6$ $\sigma = 0.83 \text{ mho/m}$ (head tissue)
300 MHz	<i>ConvF</i>	$7.3 \pm 9\%$	$\epsilon_r = 45.3$ $\sigma = 0.87 \text{ mho/m}$ (head tissue)
750 MHz	<i>ConvF</i>	$6.2 \pm 7\%$	$\epsilon_r = 41.9$ $\sigma = 0.89 \text{ mho/m}$ (head tissue)
150 MHz	<i>ConvF</i>	$7.9 \pm 10\%$	$\epsilon_r = 61.9$ $\sigma = 0.80 \text{ mho/m}$ (body tissue)
250 MHz	<i>ConvF</i>	$7.4 \pm 10\%$	$\epsilon_r = 59.4$ $\sigma = 0.88 \text{ mho/m}$ (body tissue)
300 MHz	<i>ConvF</i>	$7.3 \pm 9\%$	$\epsilon_r = 58.2$ $\sigma = 0.92 \text{ mho/m}$ (body tissue)
750 MHz	<i>ConvF</i>	$6.0 \pm 7\%$	$\epsilon_r = 55.5$ $\sigma = 0.96 \text{ mho/m}$ (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.