



**MOTOROLA**



Certificate Number: 1449-01

**FCC ID: AZ489FT5804  
DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2**

**Government & Enterprise Mobility Solutions  
EME Test Laboratory  
8000 West Sunrise Blvd  
Fort Lauderdale, FL. 33322**

**Date of Report:** 3/31/06  
**Report Revision:** Rev. O  
**Report ID:** FCC rpt PCII XTS2500 7/800 PSM  
060331\_SR3387\_3337

**Responsible Engineer:** Michael Sailsman (Sr. Staff Eng.)  
**Date/s Tested:** 2/6/06-2/10/06, 3/11/06-3/13/06 & 3/20/06  
**Manufacturer/Location:** IL23  
**Sector/Group/Div.:** GEMS/GTDG  
**Date submitted for test:** 1/24/06  
**DUT Description:** Portable; full featured 256 channel  
**Test TX mode(s):** CW  
**Max. Power output:** 3.6W (800MHz band); 3.0W (700MHz band)  
**Nominal Power:** 1-3 watts  
**Tx Frequency Bands:** 764-776MHz, 794-806MHz, 806-825MHz, 851-870MHz  
**Signaling type:** FM  
**Model(s) Tested:** H46UCH9PW7AN  
**Model(s) Certified:** H46UCH9PW7AN  
**Serial Number(s):** 205ABW0130, 205ABW0134  
**Classification:** Occupational/Controlled  
**Rule Part(s):** 90



**Applicable approved accessories:**

**Antenna(s):**

NAF5042A (806-870MHz ¼ wave stubby antenna; -5dBi gain), NAF5080A (762-870MHz ½ wave antenna; -0.5dBi gain), NAF5039A (806-870MHz ½ wave dipole; 2dBi gain); NAF5037A (806-870MHz ½ wave antenna; 1dBi)

**Battery(ies):**

NTN9816B (1525 NiCad high capacity Factory Mutual Intrinsically safe); NTN9857B (1800mAh NiMH Ultra capacity Factory Mutual Intrinsically safe)

**Body worn accessory(ies):**

NA

**Audio/Data cable accessory(ies):**

RMN5073A (24 inch PSM); RMN5074A (18 inch PSM)

**Max. Calc. 1-g/10-g Avg. SAR: 5.56/3.86 W/kg (Body)**

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.

Deanna Zakharia's signature on file for Ken Enger  
**Ken Enger GEMS EME Lab Senior Resource Manager,  
Laboratory Director,**

**Approval Date:** 4/3/06

**Certification Date:** 4/3/06

**Certification No.:** 060317AD/ 060318AD/ 060319AD

**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)..... 5  
         4.2.1 Flat Phantom..... 5  
         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..... 9  
 8.0 Environmental Test Conditions..... 9  
 9.0 Test Results Summary..... 10  
     9.1 Highest S.A.R. results calculation methodology..... 12  
 10.0 Conclusion..... 12

**APPENDICES**

A Measurement Uncertainty..... 13  
 B Probe Calibration Certificates..... 16  
 C Dipole Calibration Certificates..... 35

**Part 2 of 2**

D Test System Verification Scans..... 2  
 E DUT Scans (Shortened scans & Highest SAR configurations)..... 11  
 F DUT Supplementary Data (e.g. Power Slump)..... 15  
 G DUT Test Position Photos..... 16  
 H DUT and Accessory Photos..... 17  
 I DUT Body-worn Separation Distances..... 18

**Report REVISION HISTORY**

Date	Revision	Comments
3/31/06	O	Addendum to FCC report dated 8/31/01Rev A. Release of PCII results with new offered PSM accessory

## 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 GEMS EME Test Lab for the model number H46UCH9PW7AN of FCC ID: AZ489FT5804. The results herein reflect PCII results of new offered PSM accessory.

The test results presented herein clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of **8.0 W/kg** per the requirements of 47 CFR 2.1093(d).

## 2.0 Referenced Standards and Guidelines

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

- 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) C95.1-1999 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)

The XTS2500 Portable Radio, Model number H46UCH9PW7AN is a handheld transceiver which operates as a traditional simplex 2-way radio. 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.

The transmit duty cycle, 50% maximum for this type of device, is controlled by the user via the push – to - talk button. The transmitter is capable of operating in the 764-870MHz band: For the purpose of this evaluation, the transmit bands are grouped as follows: 764-776, 794-825 MHz, and 851-870 MHz with a rated conducted power of 3.0 watts. The maximum conducted power, as defined by the production line final test station upper limit, is 3.6 watts in the 800MHz band splits and 3.0W in the 700MHz band splits.

FCC ID: AZ489FT5804 was evaluated with the applicable accessories listed on the cover page to demonstrate compliance with the new offered PSMs. Please reference the report on file dated 8/31/01 Rev A for information on previously offered accessories.

**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 4.6 build 23 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

**4.2.2 SAM Phantom**

Phantom Type	Material Parameters	Material Thickness (mm)	Support structure material	Loss Tangent (wood)
NA	200MHz -3GHz; Er = <5, Loss Tangent = <0.05	2mm +/- 0.2mm	Wood	< 0.05

**4.3 Description of Equivalent tissues**

**Type 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 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 Glycol based 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	835	
	Head	Body
Sugar	NA	44.9
DGBE (Glycol)	NA	NA
Diacetin	NA	NA
De ionized -Water	NA	53.06
Salt	NA	0.94
HEC	NA	1
Bact.	NA	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 (HP)	437B	3125U21972	11/30/2006
Power Meter (HP)	437B	3737U26425	11/30/2006
Power Sensor (HP)	8481H	2703A14631	8/11/2006
Power Sensor (HP)	8482B	3318A06773	3/22/2006
Bi-Directional Coupler (NARDA)	3020A	40296	11/17/2007
Signal Generator (Agilent)	E4438C	MY42082269	1/31/2007
AMP (Amplifier Research)	10WD1000	28782	CNR
<b>Tissue Station</b>			
Network Analyzer (HP)	8753D	3410A06417	2/7/2006
Network Analyzer (HP)	8753D	3410A09135	1/22/2007
Dielectric Probe Kit (HP)	85070C	US99360076	CNR
<b>Dipole</b>			
Speag Dipole	D835V2	435	4/12/2006

**6.0 SAR Measurement System Verification**

The SAR measurements were conducted with probe model/serial number ET3DV6/SN1384 & 1547. 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 GEMS 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 GEMS 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 S.A.R. 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 Agilent (HP) probe kit model 85070C and a HP8753D Network Analyzer.

**Actual versus Target tissue parameters (3/6/05 – 3/20/05)**

Frequency (MHz)	FCC Body			
	Di-electric Constant Target	Di-electric Constant Meas. (Range)	Conductivity Target S/m	Conductivity Meas. (Range) S/m
770	55.5	54.0-55.7	0.96	0.92-0.93
815.5	55.3	53.8-54.1	0.97	0.96-0.99
835	55.2	53.6-56.9	0.97	0.99-1.01
860	55.1	53.4-54.5	1.00	1.02-1.03

## 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)
1384	FCC Body	5/26/05	SPEAG D835V2 435	9.885 +/- 0.185	9.65 +/- 10%	3/11/06-3/20/06 (4 test days)
1547	FCC Body	10/25/05	SPEAG D835V2 435	10.265 +/- 0.155	9.65 +/- 10%	2/6/06-2/10/06 (2 test days)

Note: See APPENDIX D for an explanation of the reference S.A.R. 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 S.A.R. 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 FM transmission signaling operational at the body using the applicable offered accessories listed on the cover page. 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 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 [Page 10&11 of 38; Tables 1 &2]

- Tests were performed using the new offered PSMs with each of the offered antennas. For the antennas with a transmit range of 806-870MHz, tests were done at the center of the sub band splits and then at the band edges of the entire 806-870MHz band. Note that the 823.9875MHz test frequency with the NAF5042 antenna was included because it was a test condition from the previous filing and was the highest “fast scan” result for the RMN5073A PSM. Regarding the NAF5080A antenna, tests were done at the center of both 800MHz sub band splits and one frequency within the 700MHz band splits. Band edges assessments were based on the combined band of 764-870MHz. An engineering decision was made not to test additional frequencies based on overall compliance performance.

**Shortened scan assessment at the Body** [APPENDIX E Part 2 of 2]

- 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 new offered PSMs were connected to the DUT and was positioned in normal use configuration against the phantom with each of the offered antennas

**7.2.2 Head**

NA

**7.2.3 Face**

NA

**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 +/- 2°C of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was 15cm +/- 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 S.A.R. tests reported herein:

	<b>Target</b>	<b>Measured</b>
<b>Ambient Temperature</b>	20 - 25 °C	Range: 21.6-22.8°C Avg. 22.3°C
<b>Relative Humidity</b>	30 - 70 %	Range: 38.7-53.8% Avg. 46.8%
<b>Tissue Temperature</b>	NA	Range: 20.4-21.8°C Avg. 21.23°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.

### 9.0 Test Results Summary

All S.A.R. 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 were then assessed using the full DASY4™ coarse and 7x7x7 cube methodology, and they are presented as bolded results. The associated S.A.R. 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) 764-870MHz band; W/ PSM kit RMN5073A and offered antennas												
Run Number/ SN	Antenna location	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)
<b>Assessment at the body with NAF5042A antenna - 806-870MHz; across the applicable band splits</b>												
<b>*CM-Ab-060206-05/205ABW0130</b>	PSM	823.9875	NTN9816A	Against phantom	clip of PSM	RMN5073A	3.62	-0.0904	9.68	6.73	4.94	3.44
ErC-Ab-060312-02/205ABW0134	PSM	815.0000	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.62	-0.0397	7.80	5.45	3.94	2.75
ErC-Ab-060312-03/205ABW0134	PSM	860.0000	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.67	-0.1400	8.17	5.66	4.22	2.92
CM-Ab-060210-06/205ABW0134	PSM	806.0125	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.54	-0.126	7.83	5.46	4.10	2.86
CM-Ab-060210-03/205ABW0134	PSM	868.9875	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.52	-0.0599	9.24	6.38	4.79	3.31
<b>Assessment at the body with NAF5037A antenna - 806-870MHz; across the applicable band splits</b>												
ErC-Ab-060312-10/205ABW0134	PSM	815.0000	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.52	-0.0973	1.66	1.17	0.87	0.61
ErC-Ab-060312-11/205ABW0134	PSM	860.0000	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.59	-0.6850	0.394	0.275	0.23	0.16
ErC-Ab-060312-16/205ABW0134	PSM	806.0125	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.61	-0.0906	1.93	1.36	0.99	0.69
ErC-Ab-060312-17/205ABW0134	PSM	868.9875	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.57	-0.4030	0.311	0.216	0.17	0.12
<b>Assessment at the body with NAF5039A antenna - 806-870MHz; across the applicable band splits</b>												
ErC-Ab-060312-22/205ABW0134	PSM	815.0000	NTN9857B	Against phantom	clip of PSM	RMN5073A	3.62	-0.1840	0.947	0.665	0.49	0.35
ErC-Ab-060312-23/205ABW0134	PSM	860.0000	NTN9857B	Against phantom	clip of PSM	RMN5073A	3.67	-0.4910	1.170	0.789	0.66	0.44
ErC-Ab-060312-28/205ABW0134	PSM	806.0125	NTN9857B	Against phantom	clip of PSM	RMN5073A	3.69	-0.1400	0.850	0.597	0.44	0.31
ErC-Ab-060312-29	PSM	868.9875	NTN9857B	Against phantom	clip of PSM	RMN5073A	3.57	-0.0416	1.460	0.991	0.74	0.50
<b>Assessment at the body with NAF5080A antenna - 762-870MHz range; across the applicable band splits (700MHz band max power is 3W)</b>												
AG-Ab-060313-15/205ABW0134	PSM	773.0000	NTN9816B	Against phantom	clip of PSM	RMN5073A	2.99	-0.1150	1.45	1.02	0.75	0.53
ErC-Ab-060313-08/205ABW0134	PSM	815.000	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.56	-0.0555	1.28	0.90	0.66	0.46
ErC-Ab-060313-09/205ABW0134	PSM	860.0000	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.63	-0.4660	0.241	0.168	0.13	0.09
ErC-Ab-060313-07/205ABW0134	PSM	764.0125	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.04	-0.0737	1.11	0.79	0.56	0.40
AG-Ab-060313-16/205ABW0134	PSM	868.9875	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.66	-0.4070	0.187	0.13	0.10	0.07

**\*Assessment with the worst case test configuration above using the full DASY 4 coarse and 7x7x7 cube scan measurements.**

ErC-Ab-060320-03/205ABW0134	PSM	823.9875	NTN9816B	Against phantom	clip of PSM	RMN5073A	3.61	-0.1080	7.88	5.52	<b>4.04</b>	<b>2.83</b>
-----------------------------	-----	----------	----------	-----------------	-------------	----------	------	---------	------	------	-------------	-------------

**Table 2**

**Assessments at the body (CW) 764-870MHz band; W/ PSM kit RMN5074A and offered antennas**

Run Number/ SN	Antenna location	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)
<b>Assessment at the body with NAF5042A antenna - 806-870MHz; across the applicable band splits</b>												
CM-Ab-060206-07/205ABW0130	PSM	823.9875	NTN9816A	Against phantom	clip of PSM	RMN5074A	3.60	-0.0513	10.1	6.99	5.11	3.54
ErC-Ab-060312-04/205ABW0134	PSM	815.0000	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.66	-0.2080	7.15	5.01	3.75	2.63
ErC-Ab-060312-05/205ABW0134	PSM	860.0000	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.64	-0.0111	8.51	5.86	4.27	2.94
CM-Ab-060210-07/205ABW0134	PSM	806.0125	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.53	-0.0085	7.35	5.13	3.76	2.62
<b>*CM-Ab-060210-05/205ABW0134</b>	PSM	868.9875	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.54	-0.0981	10.8	7.47	5.62	3.89
<b>Assessment at the body with NAF5037A antenna - 806-870MHz; across the applicable band splits</b>												
ErC-Ab-060312-12/205ABW0134	PSM	815.0000	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.55	-0.1710	1.96	1.37	1.03	0.72
ErC-Ab-060312-13/205ABW0134	PSM	860.0000	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.52	-0.3340	0.734	0.507	0.41	0.28
ErC-Ab-060312-18/205ABW0134	PSM	806.0125	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.61	-0.1750	2.09	1.46	1.09	0.76
ErC-Ab-060312-19/205ABW0134	PSM	868.9875	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.55	-0.5630	0.302	0.210	0.17	0.12
<b>Assessment at the body with NAF5039A antenna - 806-870MHz; across the applicable band splits</b>												
ErC-Ab-060312-24/205ABW0134	PSM	815.0000	NTN9857B	Against phantom	clip of PSM	RMN5074A	3.58	-0.4680	0.937	0.654	0.52	0.37
ErC-Ab-060312-25/205ABW0134	PSM	860.0000	NTN9857B	Against phantom	clip of PSM	RMN5074A	3.66	-0.4870	1.070	0.727	0.60	0.41
ErC-Ab-060313-02/205ABW0134	PSM	806.0125	NTN9857B	Against phantom	clip of PSM	RMN5074A	3.65	-0.0607	1.11	0.77	0.56	0.39
ErC-Ab-060313-03/205ABW0134	PSM	868.9875	NTN9857B	Against phantom	clip of PSM	RMN5074A	3.64	-0.5070	1.18	0.79	0.66	0.45
<b>Assessment at the body with NAF5080A antenna - 762-870MHz range; across the applicable band splits (700MHz band max power is 3W)</b>												
AG-Ab-060313-17/205ABW0134	PSM	773.0000	NTN9816B	Against phantom	clip of PSM	RMN5074A	2.94	-0.0740	1.72	1.21	0.89	0.63
AG-Ab-060313-11/205ABW0134	PSM	815.0000	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.61	-0.1480	1.49	1.04	0.77	0.54
AG-Ab-060313-12/205ABW0134	PSM	860.0000	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.64	-0.4810	0.36	0.25	0.20	0.14
AG-Ab-060313-10/205ABW0134	PSM	764.0125	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.06	-0.0976	1.66	1.16	0.85	0.59
AG-Ab-060313-18/205ABW0134	PSM	868.9875	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.62	-0.6050	0.19	0.13	0.11	0.08

**\*Assessment with the worst case test configuration above using the full DASY 4 coarse and 7x7x7 cube scan measurements.**

AG-Ab-060313-19/205ABW0134	PSM	868.9875	NTN9816B	Against phantom	clip of PSM	RMN5074A	3.55	-0.0650	10.80	7.49	<b>5.56</b>	<b>3.86</b>
----------------------------	-----	----------	----------	-----------------	-------------	----------	------	---------	-------	------	-------------	-------------

## 9.1 Highest S.A.R. results calculation methodology

The calculated maximum 1-gram and 10-gram averaged SAR results reported herein for the full DASYS™ 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:

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

$P_{\text{max}}$  = Maximum Power (W)

$P_{\text{int}}$  = Initial Power (W)

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

SAR<sub>meas.</sub> = Measured 1 gram averaged peak 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: AZ489FT5804 models H46UCH9PW7AN.

**At the Body: 1-g Avg. = 5.56W/kg; 10-g Avg. = 3.86W/kg**

These test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of **8.0W/kg** per the requirements of 47 CFR 2.1093(d).

**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 = 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<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	1 g <i>u<sub>i</sub></i> (±%)	10 g <i>u<sub>i</sub></i> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
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	∞
<b>Test sample Related</b>									
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	∞
<b>Phantom and Tissue Parameters</b>									
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	∞
<b>Combined Standard Uncertainty</b>			RSS				11	11	411
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<i>k</i> =2				22	22	

**Uncertainty Budget for System Performance Check  
(dipole & flat phantom) for 30 MHz to 3 GHz**

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

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: **ET3-1384\_May05**

**CALIBRATION CERTIFICATE**

Object: **ET3DV6 - SN:1384**

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

Calibration date: **May 26, 2005**

Condition of the calibrated item: **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°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)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-05
DAE4	SN: 617	19-Jan-05 (SPEAG, No. DAE4-617_Jan05)	Jan-05

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	<i>N. Vetterli</i>
Approved by:	Katja Pokovic	Technical Manager	<i>Katja Pokovic</i>

Issued: May 26, 2005

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 <sub>x,y,z</sub>	sensitivity in free space
ConF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\phi$	$\phi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ 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<sub>x,y,z</sub>*: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). *NORM<sub>x,y,z</sub>* are only intermediate values, i.e., the uncertainties of *NORM<sub>x,y,z</sub>* does not effect the  $E^2$ -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub>* = *NORM<sub>x,y,z</sub>* \* *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<sub>x,y,z</sub>*: 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<sub>x,y,z</sub>* \* *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  $\pm 50$  MHz to  $\pm 100$  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:1384

May 26, 2005

### DASY - Parameters of Probe: ET3DV6 SN:1384

#### Sensitivity in Free Space<sup>A</sup>

#### Diode Compression<sup>B</sup>

NormX	1.78 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	92 mV
NormY	1.76 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	92 mV
NormZ	1.94 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	92 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 <sub>be</sub> [%]	Without Correction Algorithm	10.1	5.1
SAR <sub>be</sub> [%]	With Correction Algorithm	0.1	0.2

TSL                      1810 MHz      Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR <sub>be</sub> [%]	Without Correction Algorithm	14.5	9.5
SAR <sub>be</sub> [%]	With Correction Algorithm	1.0	0.1

#### Sensor Offset

Probe Tip to Sensor Center                      2.7 mm

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

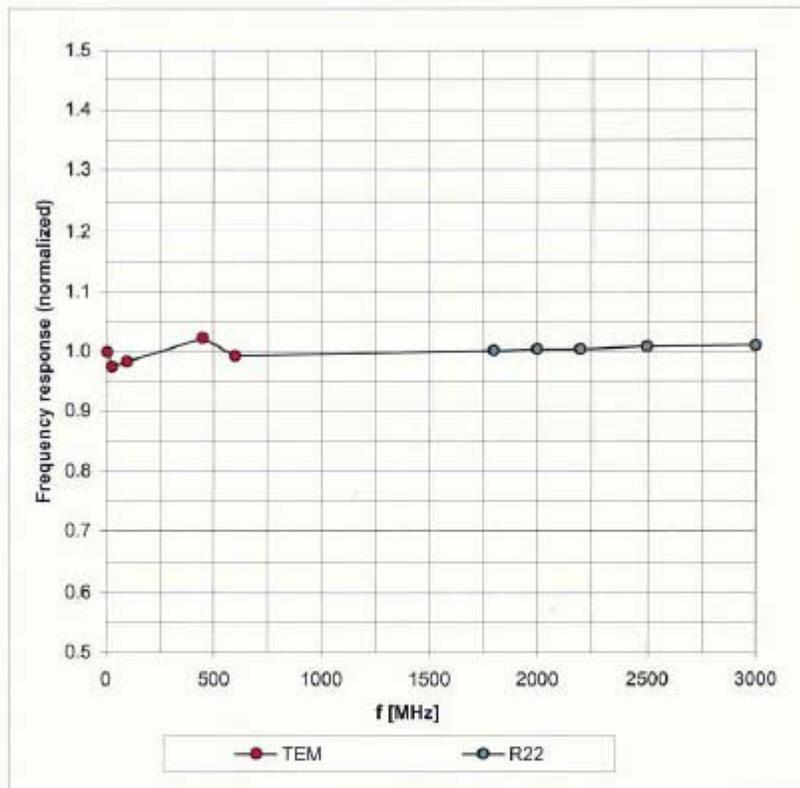
<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

<sup>B</sup> Numerical linearization parameter; uncertainty not required.

ET3DV6 SN:1384

May 26, 2005

### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

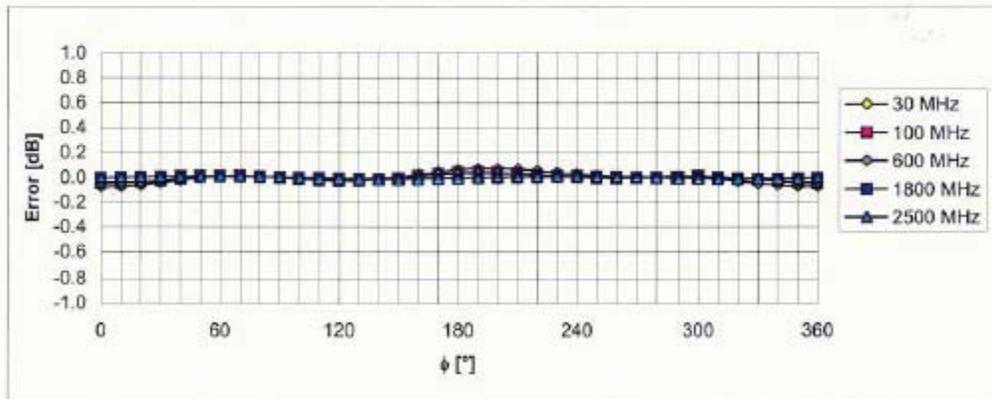
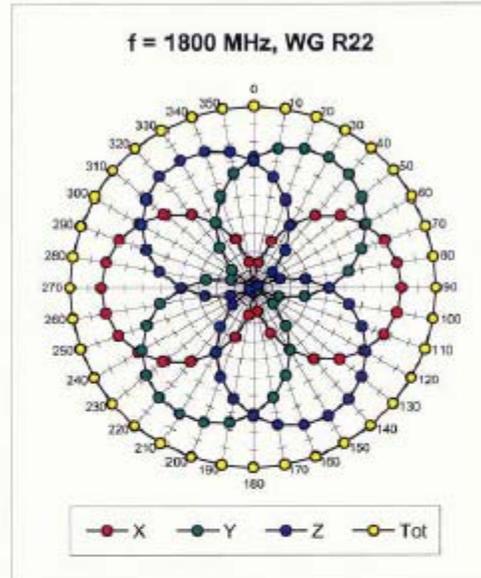
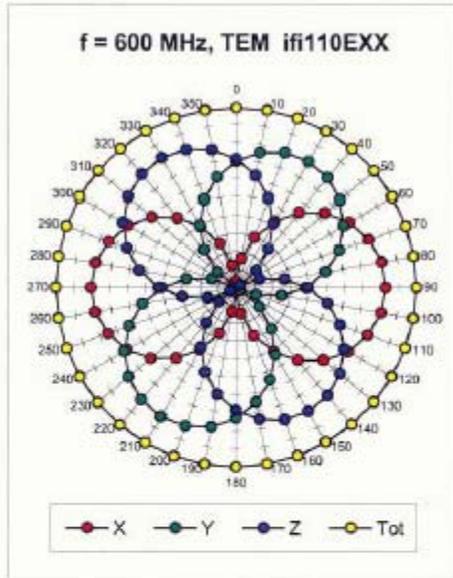


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

ET3DV6 SN:1384

May 26, 2005

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

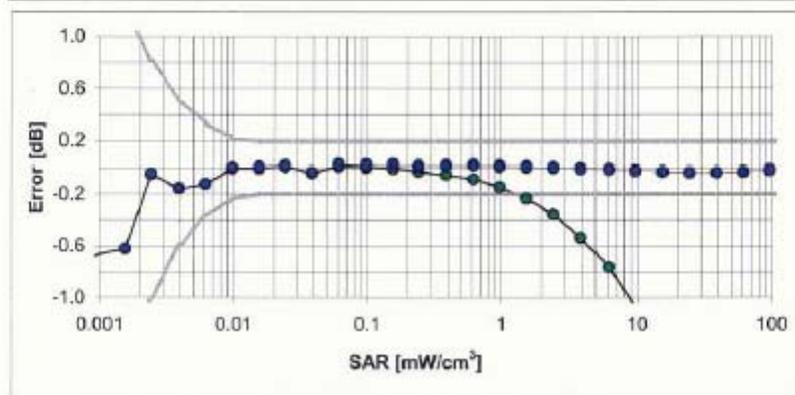
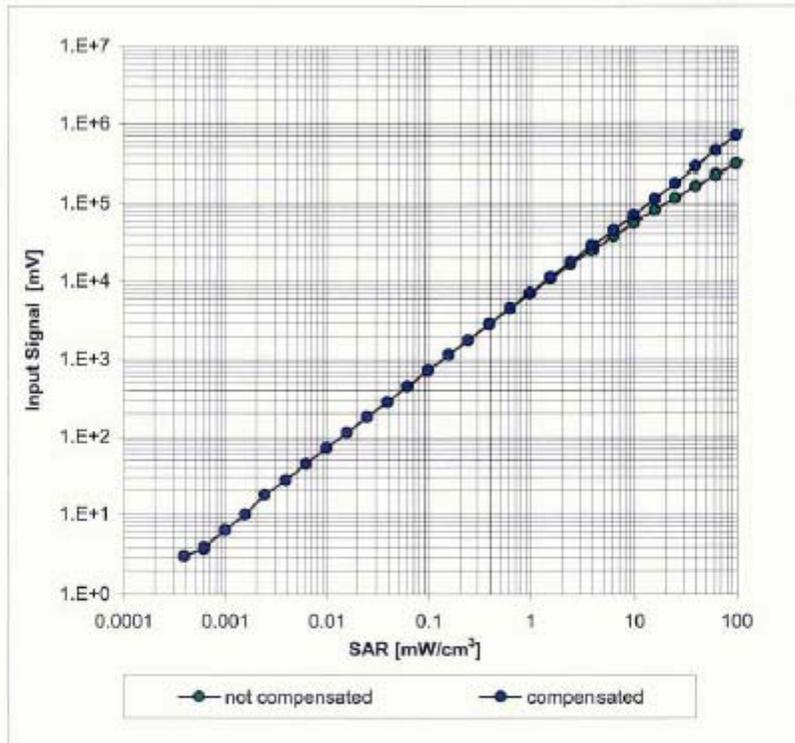


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

ET3DV6 SN:1384

May 26, 2005

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

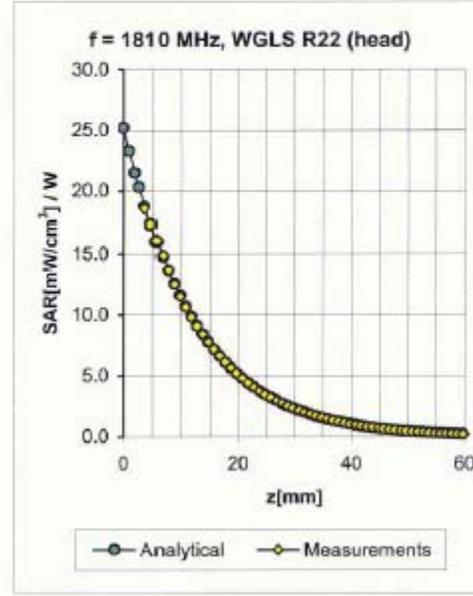
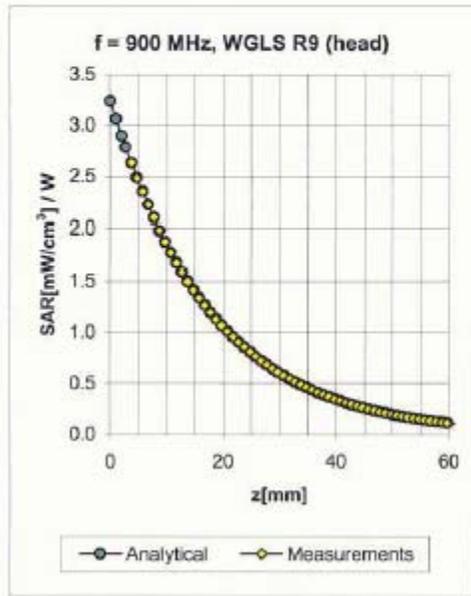


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

ET3DV6 SN:1384

May 26, 2005

### Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.08	1.62	7.51 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.84	1.67	6.53 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.73	2.19	5.31 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.81	2.05	4.71 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.10	1.75	7.10 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.66	1.95	6.19 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.67	2.58	4.80 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.93	1.80	4.46 ± 11.8% (k=2)

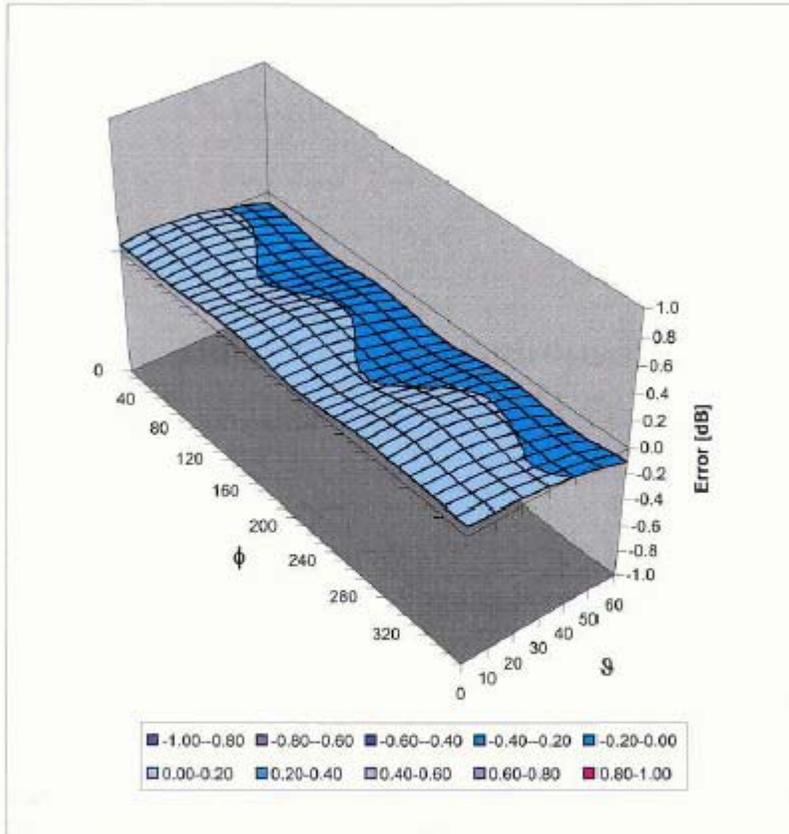
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ET3DV6 SN:1384

May 26, 2005

### Deviation from Isotropy in HSL

Error ( $\phi, \theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

**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: **ET3-1547\_Oct05**

**CALIBRATION CERTIFICATE**

Object: **ET3DV6 - SN:1547**

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

Calibration date: **October 25, 2005**

Condition of the calibrated item: **In Tolerance**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°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	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	SN: 654	29-Nov-04 (SPEAG, No. DAE4-654_Nov04)	Nov-05

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

Calibrated by:	Name <b>Nico Vetterli</b>	Function Laboratory Technician	Signature 
Approved by:	Name <b>Katja Pokovic</b>	Technical Manager	

Issued: October 25, 2005

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 <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ 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<sub>x,y,z</sub>:** Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* 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<sub>x,y,z</sub>:** 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<sub>x,y,z</sub> \* 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  $\pm 50$  MHz to  $\pm 100$  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:1547

October 25, 2005

### DASY - Parameters of Probe: ET3DV6 SN:1547

#### Sensitivity in Free Space<sup>A</sup>

#### Diode Compression<sup>B</sup>

NormX	1.41 ± 10.1%	$\mu V/(V/m)^2$	DCP X	88 mV
NormY	1.30 ± 10.1%	$\mu V/(V/m)^2$	DCP Y	88 mV
NormZ	1.27 ± 10.1%	$\mu V/(V/m)^2$	DCP Z	88 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		<b>3.7 mm</b>	<b>4.7 mm</b>
SAR <sub>bs</sub> [%]	Without Correction Algorithm	8.8	4.4
SAR <sub>bs</sub> [%]	With Correction Algorithm	0.1	0.3

**TSL                    1810 MHz    Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		<b>3.7 mm</b>	<b>4.7 mm</b>
SAR <sub>bs</sub> [%]	Without Correction Algorithm	13.2	8.9
SAR <sub>bs</sub> [%]	With Correction Algorithm	0.9	0.1

#### Sensor Offset

Probe Tip to Sensor Center                    **2.7 mm**

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

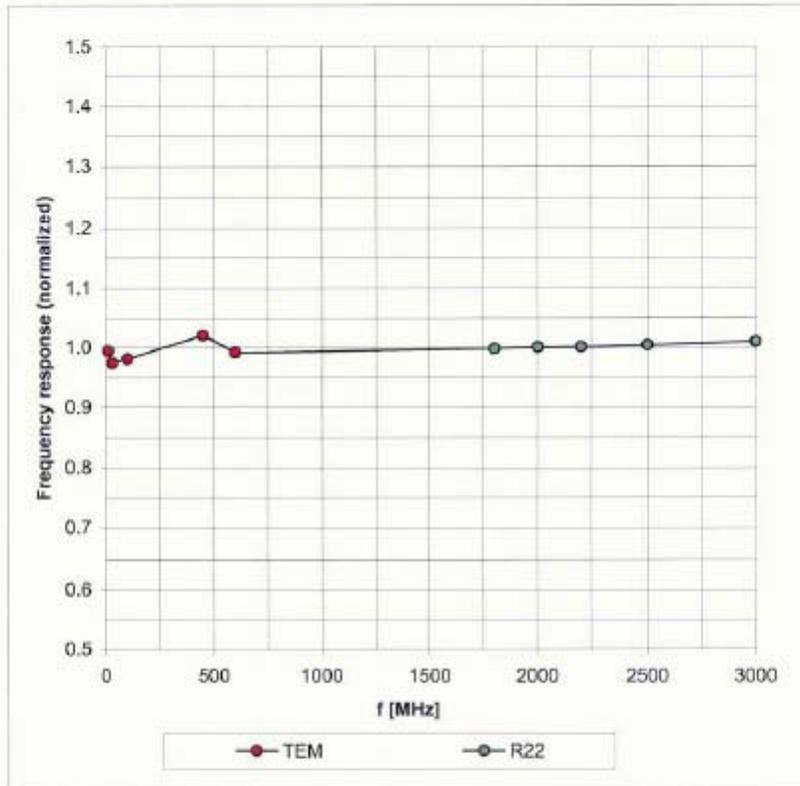
<sup>B</sup> Numerical linearization parameter; uncertainty not required.

ET3DV6 SN:1547

October 25, 2005

### Frequency Response of E-Field

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

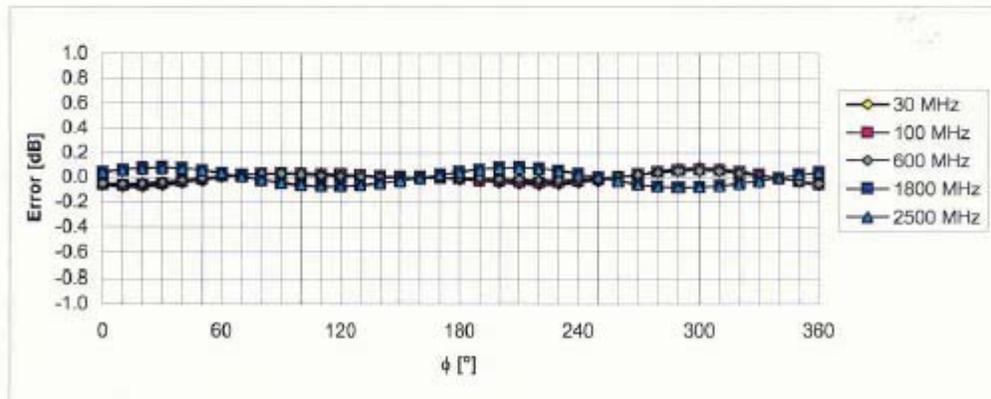
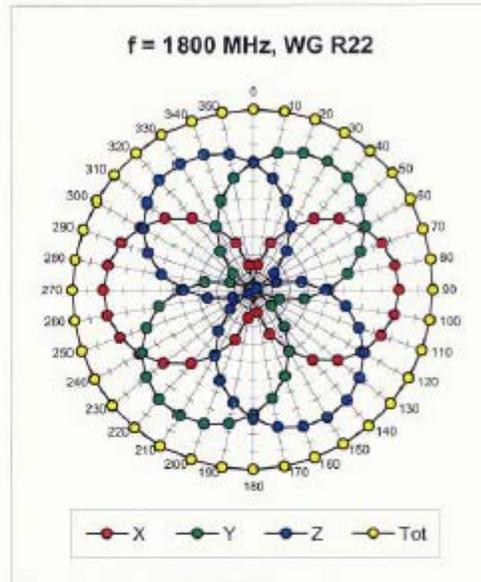
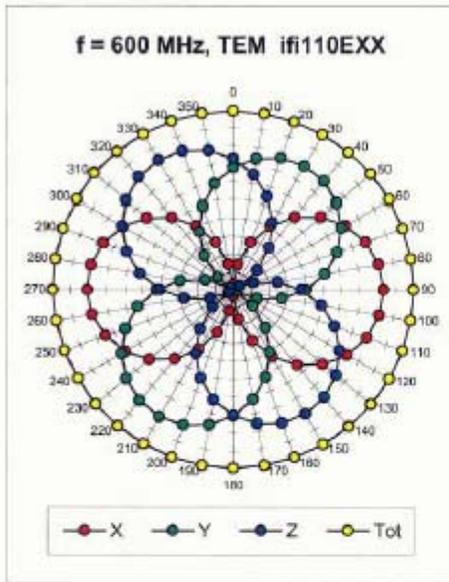


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

ET3DV6 SN:1547

October 25, 2005

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

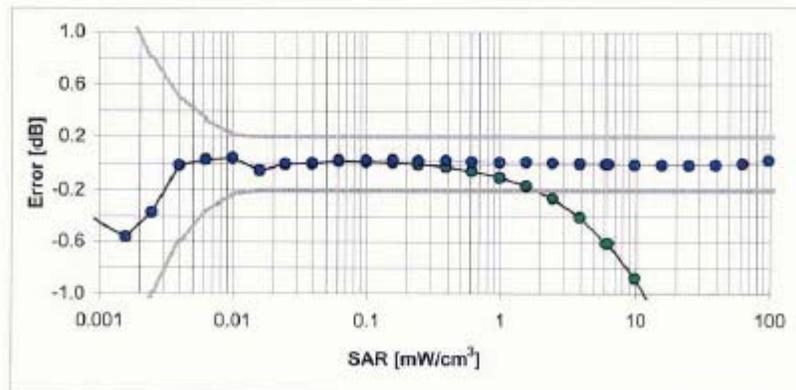
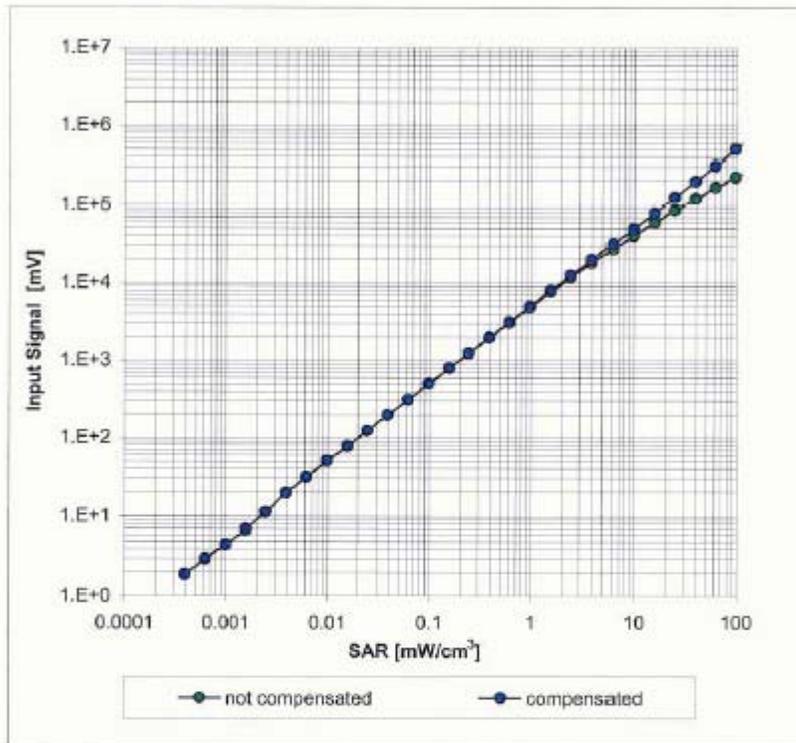


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

ET3DV6 SN:1547

October 25, 2005

### Dynamic Range f(SAR<sub>head</sub>) (Waveguide R22, f = 1800 MHz)

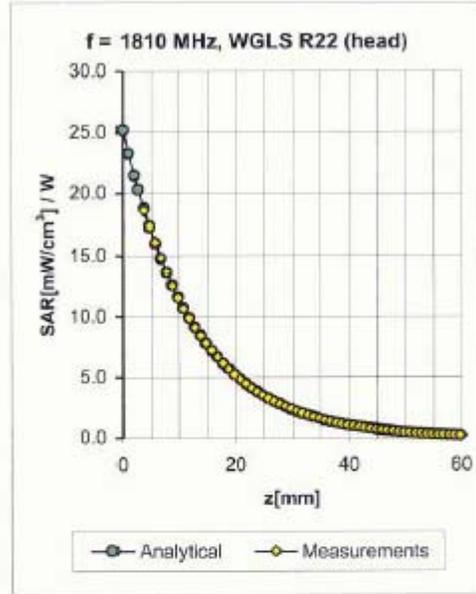
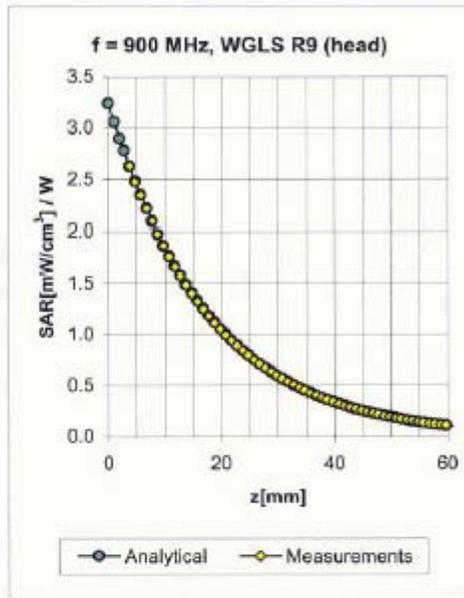


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ET3DV6 SN:1547

October 25, 2005

### Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.03	2.20	6.54 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.66	1.76	5.92 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.64	2.27	4.87 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.73	2.16	4.22 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.04	2.30	6.91 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.55	1.98	5.82 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.60	2.66	4.36 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.86	1.76	4.15 ± 11.8% (k=2)

<sup>c</sup> 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.

Schmid & Partner Engineering AG

**s p e a g**

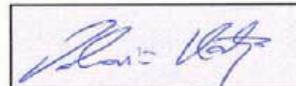
Zeughausstrasse 43, 8004 Zurich, Switzerland  
Phone +41 1 245 9700, Fax +41 1 245 9779  
info@speag.com, http://www.speag.com

### **Additional Conversion Factors** for Dosimetric E-Field Probe

Type:	<b>ET3DV6</b>
Serial Number:	<b>1384</b>
Place of Assessment:	<b>Zurich</b>
Date of Assessment:	<b>May 30, 2005</b>
Probe Calibration Date:	<b>May 26, 2005</b>

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 recalibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 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 ET3DV6 SN:1384**

Conversion factor ( $\pm$  standard deviation)

150 MHz	<i>ConvF</i>	8.9 $\pm$ 10 %	$\epsilon_r = 52.3$ $\sigma = 0.76 \text{ mho/m}$ (head tissue)
250 MHz	<i>ConvF</i>	8.1 $\pm$ 10 %	$\epsilon_r = 47.6$ $\sigma = 0.83 \text{ mho/m}$ (head tissue)
300 MHz	<i>ConvF</i>	8.0 $\pm$ 9 %	$\epsilon_r = 45.3$ $\sigma = 0.87 \text{ mho/m}$ (head tissue)
750 MHz	<i>ConvF</i>	6.8 $\pm$ 7 %	$\epsilon_r = 41.9$ $\sigma = 0.89 \text{ mho/m}$ (head tissue)
150 MHz	<i>ConvF</i>	8.6 $\pm$ 10 %	$\epsilon_r = 61.9$ $\sigma = 0.80 \text{ mho/m}$ (body tissue)
250 MHz	<i>ConvF</i>	8.1 $\pm$ 10 %	$\epsilon_r = 59.4$ $\sigma = 0.88 \text{ mho/m}$ (body tissue)
300 MHz	<i>ConvF</i>	8.0 $\pm$ 9 %	$\epsilon_r = 58.2$ $\sigma = 0.92 \text{ mho/m}$ (body tissue)
750 MHz	<i>ConvF</i>	6.6 $\pm$ 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.**

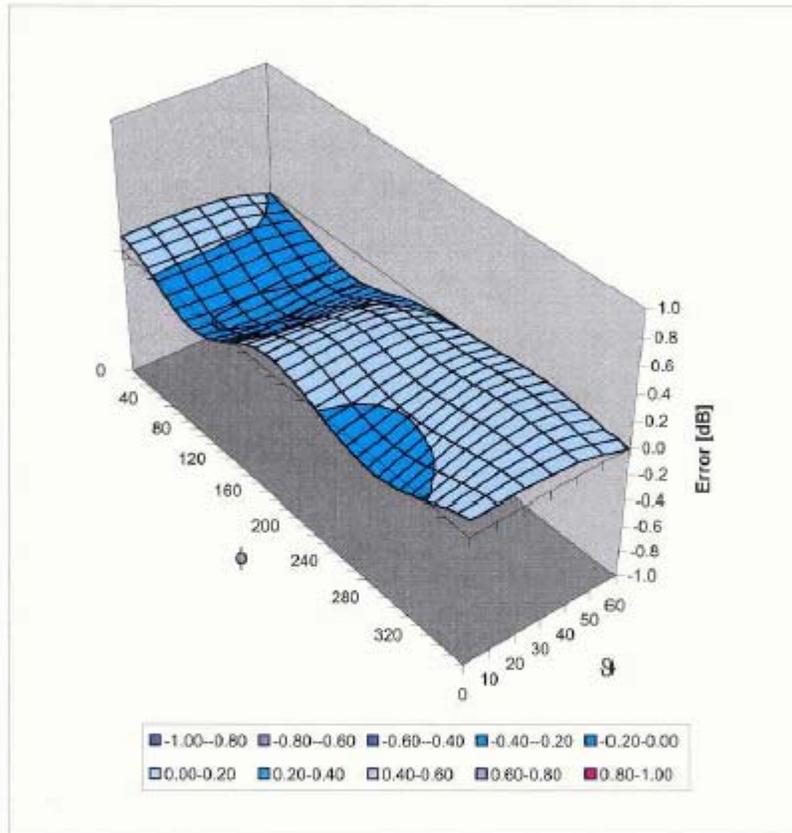
**Please see also Section 4.7 of the DASY4 Manual.**

ET3DV6 SN:1547

October 25, 2005

### Deviation from Isotropy in HSL

Error ( $\phi, \theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

**Appendix C**  
**Dipole 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 **Mot. CGISS**

Certificate No: **D835V2-435\_Oct04/2**

**CALIBRATION CERTIFICATE (Replacement of No: D835V2-435\_Oct04)**

Object **D835V2 - SN: 435**

Calibration procedure(s) **QA CAL-05.v6  
Calibration procedure for dipole validation kits**

Calibration date: **October 26, 2004**

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 ± 3)°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 EPM E442	GB37480704	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Power sensor HP 8481A	US37292783	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference Probe ET3DV6	SN 1680	23-Feb-04 (SPEAG, No. ET3-1680_Feb04)	Feb-05
DAE4	SN 601	22-Jul-04 (SPEAG, No. DAE4-601_Jul04)	Jul-05
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-03)	In house check: Oct-05
RF generator R&S SML-03	100698	27-Mar-02 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Nov 04

Calibrated by:	Name <b>Mike Meili</b>	Function Laboratory Technician	Signature 
Approved by:	Name <b>Katja Pokovic</b>	Technical Manager	

Issued: November 11, 2004

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
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

**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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

**Measurement Conditions**

DASY system configuration, as far as not given on page 1.

DASY Version	DASY4	V4.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.8 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	condition	
SAR measured	250 mW input power	2.30 mW / g
SAR normalized	normalized to 1W	9.20 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>9.30 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.51 mW / g
SAR normalized	normalized to 1W	6.04 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>6.10 mW / g ± 16.5 % (k=2)</b>

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	51.0 $\Omega$ - 7.6 j $\Omega$
Return Loss	- 22.4 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.391 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	December 15, 2000

### DASY4 Validation Report for Head TSL

Date/Time: 11/11/04 14:09:47

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN435**

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.89 \text{ mho/m}$ ;  $\epsilon_r = 41.8$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1680; ConvF(6.4, 6.4, 6.4); Calibrated: 2/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 7/22/2004
- Phantom: Flat Phantom half size; Type: QD000P49AA; Serial: SN:1001
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

**Pin = 250 mW; d = 15 mm/Area Scan (81x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.44 mW/g

**Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.7 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 3.38 W/kg

**SAR(1 g) = 2.3 mW/g; SAR(10 g) = 1.51 mW/g**

Maximum value of SAR (measured) = 2.5 mW/g



0 dB = 2.5mW/g