

 MOTOROLA SOLUTIONS	 ACCREDITED TESTING CERT # 2518.01
DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2	
Motorola Solutions Inc. EME Test Laboratory 8000 West Sunrise Blvd Fort Lauderdale, FL. 33322.	Date of Report: 2/22/12 Report Revision: O Report ID: SR9956 APX7000 PCII U2 VHF 1of 2 Rev O 120222
<p> Responsible Engineer: Michael Sailsman (Senior Staff Eng.) Report Author: Michael Sailsman (Senior Staff Eng.) Date/s Tested: 12/2/11; 12/9/11 Manufacturer/Location: Penang Sector/Group/Div.: Astro Engineering Subscriber Solutions Date submitted for test: 10/12/11 DUT Description: 136-174MHz 1-6W, 450-520MHz 1-5W, 2.402-2.480 GHz (Bluetooth), 6.25kHz/12.5kHz/25kHz, Basic Top Display Model W/GPS. Capable of digital and analog FM transmission. Also capable of TDMA transmission and Bluetooth. </p> <p> Test TX mode(s): CW (PTT) Max. Power output: 6.6W (VHF), 5.6W (UHF R2), 0.012W (Bluetooth) Nominal Power: 6.0W (VHF), 5.0W (UHF R2), 0.012W (Bluetooth) Tx Frequency Bands: 136 - 174 MHz; 450-520 MHz; 2.402-2.480 GHz Signaling type: FM; TDMA; FHSS Model(s) Tested: H97TGD9PW1AN (MNUT1015A) Model(s) Certified: H97TGD9PW1AN (MNUT1015A) Serial Number(s): CAI1004W9P Classification: Occupational/Controlled FCC ID: AZ489FT4893; Rule part 90 150.8 - 174MHz; 450-512MHz. Results outside these bands are not applicable to demonstrate FCC compliance. IC: 109U-89FT4893; 138-144MHz; 148-149.9MHz and 150.05-174MHz; 450-470MHz. Results outside these bands are not applicable to demonstrate IC compliance. </p> <p style="text-align: center;">* Refer to section 15 of part 1 for highest SAR summary results.</p> <p> The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams result is not applicable to FCC filing. The test results clearly demonstrate compliance with ICNIRP (1998) Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz), Health Physics 74, 494-522 RF Exposure limits of 10 W/kg averaged over 10grams of contiguous tissue. </p> <p> Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 3.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc EME Laboratory. I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements. This reporting format is consistent with the suggested guidelines of the TIA TSB-150 December 2004. The results and statements contained in this report pertain only to the device(s) evaluated. </p>	
 Deanna Zakharia EMS EME Lab Senior Resource Manager, Laboratory Director Approval Date: 2/24/2012	Certification Date: 2/24/2012 Certification No.: 120206AD

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Report Revision History

Date	Revision	Comments
2/22/12	O	Initial release

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the Motorola Solutions Inc. EME Test Laboratory for model number H97TGD9PW1AN (MNUT1015A). The information herein is to demonstrate Class II Permissive Change compliance based on results of a new offered antenna kit model FAF5260A.

2.0 Abbreviations / Definitions

CNR: Calibration Not Required

EME: Electromagnetic Energy

C4FM CQPSK: Continuous 4 level Frequency modulation Compatible Quadrature Phase-Shift Keying

CW: Continuous Wave

F2: 2 slot TDMA

DSP: Digital signal processing

FHSS: Frequency Hopping Spread Spectrum

BT: Bluetooth

DUT: Device Under Test

DC: Duty Cycle

FM: Frequency Modulation/Factory Mutual

NA: Not Applicable

PTT: Push to Talk

RSM: Remote Speaker Microphone

SAR: Specific Absorption Rate

TDMA: Time Division Multiple Access

Audio accessories: These accessories allow communication while the DUT is worn on the body.

Body worn accessories: These accessories allow the DUT to be worn on the body of the user.

Maximum Power: Defined as the upper limit of the production line final test station.

3.0 Referenced Standards and Guidelines

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

- IEC62209-1*(2005) Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)
- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 2.1093(d) sub-part J:2011
- Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.

- IEEE 1528*(2003), Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
 - American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992
 - Institute of Electrical and Electronics Engineers (IEEE) C95.1-2005
 - International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
 - Ministry of Health (Canada) Safety Code 6 (2009), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
 - Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2003)
 - ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio frequency range between 9 kHz and 300 GHz." and "Attachment to resolution # 303 from July 2, 2002"
 - IEC62209-2 Edition 1.0 2010-03, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).
- * The IEC62209-1 and IEEE 1528 are applicable for hand-held devices used in close proximity to the ear only.

4.0 SAR Limits

TABLE 1

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

5.0 SAR Result Scaling Methodology:

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

$$Max_Calc = SAR_meas \cdot 10^{\frac{-Drift}{10}} \cdot \frac{P_max}{P_int} \cdot DC$$

P_max = Maximum Power (W)

P_int = Initial Power (W)

Drift = DASY drift results (dB)

SAR_meas = Measured 1-g or 10-g Avg. SAR (W/kg)

DC = Transmission mode duty cycle in % where applicable

50% duty cycle is applied for PTT operation

Note: for conservative results, the following are applied:

If P_int > P_max, then P_max/P_int = 1.

Drift = 1 for positive drift

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

6.0 Description of Device Under Test (DUT):

This device operates using TDMA and analog frequency modulation (FM) signaling incorporating traditional simplex two-way radio transmission protocol.

Time Division Multiple Access (TDMA) is used to allocate portions of the RF signal by dividing time into two slots. Time allocation enables each unit to transmit its voice information without interference from other transmitting units. Transmission from a unit or base station is accommodated during two time-slot lengths of 30 milliseconds with frame length of 60 milliseconds. C4FM CQPSK modulation is used at 12.5 kHz channel spacing. The TDMA technique requires sophisticated algorithms and a digital signal processor (DSP) to perform voice compressions/decompressions and RF modulation/demodulation. The maximum duty cycle for TDMA is 50% for F2 (2 slot TDMA) protocol and is controlled by software. The FM signal is continuous. However, because of hand shaking or Push-To-Talk (PTT) between users and/or base stations a conservative 50% duty cycle is applied. This device also incorporates a Class 1 Bluetooth device which is a Frequency Hopping Spread Spectrum (FHSS) technology. The Bluetooth radio modem is used to wireless link audio accessories. The maximum actual transmission duty cycle is imposed by the Bluetooth standard. The maximum duty cycle for BT is 76.1%.

The model represented under this filing utilizes removable antennas (VHF and UHF bands) and an internal fixed antenna (BT), capable of transmitting in the 450-520MHz, 136-174 MHz and 2.402-2.480 GHz bands respectively. The VHF band nominal output power is 6.0W with maximum output power of 6.6W, the UHF band nominal output power is 5W

with maximum output power of 5.6W and the nominal BT output power is 0.012W and the maximum output power is 0.012W as defined by the upper limit of the production line final test station. The intended operating positions are “at the face” with the DUT at least 1 inch from the mouth, and “at the body” by means of the offered body worn accessories. Body worn audio and PTT operation is accomplished by means of optional remote accessories that are connected to the radio. Operation at the body without an audio accessory attached is possible by means of wireless BT accessories.

7.0 Optional Accessories and Test Criteria:

This device is offered with optional accessories. The following sections identify the test criteria and details for each accessory category applicable for this PCII filing only. Please refer to the initial filing for a detailed listing of previously approved offered accessories.

7.1 Antennas:

There is one UHF band antenna applicable for this PCII filing. The table below lists its description.

TABLE 2

Antenna Models	Description	Selected for test	*Tested
*FAF5260A	UHF/GPS Antenna 450 - 520MHz /1575MHz ¼ wave 9.3cm -2 dBd	Yes	Yes

*Refer to APPENDIX G for antenna separation distances. Antenna is only applicable for UHF band.

7.2 Batteries:

There is 1 battery applicable for this PCII filing. The table below lists the previously approved battery, and battery description.

TABLE 3

Battery Models	Description	Selected for test	*Tested	Comments
NNTN7034A	Impres Li-ion 4200 mAH Battery	Yes	Yes	

*Refer to APPENDIX G for antenna separation distances.

7.3 Body worn Accessories:

There are 2 body worn models applicable for this PCII filing. The table below lists the previously approved body worn accessories, and body worn accessory descriptions.

TABLE 4

Body worn Models	Description	Selected for test	*Tested	Comments
PMLN5325B	Nylon case 3.0 in. Fix BL 4200 mAH	Yes	Yes	
NTN5343A	Carry Strap	Yes	Yes	Tested with PMLN5325B

*Refer to APPENDIX G for antenna separation distances. Note that the previously filed worst case body worn model NTN8266B is no longer offered for the devices under this FCC ID. The accessories listed above reflect the next applicable worst case body worn.

7.4 Audio Accessories:

There is 1 audio accessory model applicable for this PCII filing. The table below lists the previously approved offered audio accessory and its description.

TABLE 5

Audio Acc. Models	Description	Selected for test	*Tested	Comments
PMLN5101A	IMPRES Temple Transducer	Yes	Yes	

8.0 Description of Test System:



8.1 Descriptions of Robotics/Probes/Readout Electronics:

The laboratory utilizes a Dosimetric Assessment System (DASY5™) SAR measurement system Version 52.6.2.424 manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot, DAE4 and ES3DV3 E-field probe. The DASY5™ system is operated per the instructions in the DASY5™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME SAR compliance was calibrated according to ISO/IEC 17025 A2LA guidelines. Section 9.0 presents additional test equipment information. Appendices B and C present the applicable calibration certificates. The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

8.2 Description of Phantom(s)

8.2.1 Dual Flat Phantom

Not Applicable

8.2.2 SAM Phantom

Not Applicable

8.2.3 Elliptical Phantom

TABLE 6

Phantom ID (s)	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
OVAL1108 OVAL1090	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190	2mm +/- 0.2mm	Wood	< 0.05

8.3 Description of Simulated Tissue:

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

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

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in table 7 below for 450MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters for each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Simulated Tissue Composition (by mass)

TABLE 7

% of listed ingredients	450 MHz	
	Head	Body
Sugar	56.0	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 10.1 for target parameters

9.0 Additional Test Equipment:

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

TABLE 8

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Power Meter (Agilent)	E4419B	MY50000505	9/6/2011	9/6/2012
Power Meter (Agilent)	E4418B	GB40206553	4/6/2011	4/6/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495730	4/22/2011	4/22/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495733	4/28/2011	4/28/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50280001	8/8/2011	8/8/2012
Bi-Directional Coupler (NARDA)	3020A	40296	2/5/2010	2/5/2012
Signal Generator (Agilent)	E4421B	US40051446	8/12/2010	8/12/2012
AMP (Amplifier Research)	1W1000	16625	CNR	CNR
Dickson Temperature Recorder	TM125	1195889	3/9/2011	3/9/2012
Omega Digital Thermometer with J Type TC Probe	HH202A	18812	5/3/2011	5/3/2012
Agilent PNA-L Network Analyzer	N5230A	MY45001092	6/9/2011	6/9/2012
Dielectric Probe Kit (HP)	85070C	US99360076	CNR	CNR
Speag Dipole	D450V3	1075	8/22/2011	8/22/2013

10.0 SAR Measurement System Verification:

The SAR measurements were conducted with probe model/serial number ES3DV3/3163. 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.

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

10.1 Equivalent Tissue Test Results:

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

TABLE 9

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
450	IEEE/ IEC Head	0.87 (0.83-0.91)	43.5 (41.3-45.7)	0.83	43.1	12/2/11
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.87-59.5)	0.91	55.0	12/9/11
465	IEEE/ IEC Head	0.87 (0.83-0.91)	43.4 (41.2-45.6)	0.84	42.6	12/2/11
465	FCC Body	0.94 (0.89-0.99)	56.6 (53.8-59.4)	0.93	54.8	12/9/11
485	IEEE/ IEC Head	0.87 (0.83-0.91)	43.3 (41.1-45.5)	0.87	42.2	12/2/11
485	FCC Body	0.94 (0.89-0.99)	56.6 (53.8-59.4)	0.94	54.4	12/9/11
503	IEEE/ IEC Head	0.87 (0.83-0.91)	43.2 (41.0-45.4)	0.88	42.0	12/2/11
503	FCC Body	0.94 (0.89-0.99)	56.5 (53.7-59.3)	0.96	54.1	12/9/11
512	IEEE/ IEC Head	0.87 (0.83-0.91)	43.2 (41.0-45.4)	0.89	42.0	12/2/11
512	FCC Body	0.94 (0.89-0.99)	56.5 (53.7-59.3)	0.97	54.0	12/9/11
520	IEEE/ IEC Head	0.88 (0.84-0.92)	43.1 (40.9-45.3)	0.90	41.9	12/2/11
520	FCC Body	0.95 (0.90-1.0)	56.4 (53.6-59.2)	0.97	53.8	12/9/11

*520MHz data is not applicable for demonstrating FCC compliance

10.2 System Check Test Results:

System performance checks were conducted each day during the SAR assessment. The results are normalized to 1W. APPENDIX D explains how the targets were set and includes DASY plots for each day during the SAR assessment. The table below summarizes the daily system check results used for the SAR assessment.

TABLE 10

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Reference SAR @ 1W (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3163	FCC Body	SPEAG D450V3 /1075	4.65 (+/- 10%)	4.40	12/2/11
				4.48	12/9/11

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

11.0 Environmental Test Conditions:

The EME Laboratory's 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 at least 15cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the SAR tests reported herein:

TABLE 11

	Target	Measured
Ambient Temperature	18 - 25 °C	Range: 21.4-22.8°C Avg. 22.2°C
Relative Humidity	30 - 70 %	Range: 47.3-59.3% Avg. 51.4%
Tissue Temperature	NA	Range: 21.2-21.8°C Avg. 21.3C

Relative humidity target range is a recommended target

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

12.0 DUT Test Methodology

12.1 Measurements

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

12.2 DUT Configuration(s)

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were considered in order to demonstrate Class II permissive change compliance.

12.3 DUT Positioning Procedures

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

12.3.1 Body:

The DUT was positioned in normal use configuration against the phantom with the offered body worn accessory as well as with the offered audio accessories as applicable.

12.3.2 Head:

Not applicable.

12.3.3 Face:

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

12.4 DUT Test Channels:

The number of test channels was determined by using the following IEEE 1528 equation. The use of this equation produces the same or more test channels compared to the FCC KDB 447498 number of test channels formula.

$$N_c = 2 * \text{roundup}[10 * (f_{high} - f_{low}) / f_c] + 1$$

Where

N_c = Number of channels

F_{high} = Upper channel

F_{low} = Lower channel

F_c = Center channel

12.5 DUT Test Plan:

A new offered antenna (FAF5260A) was assessed across its frequency band at the body and face locations using the highest applicable configuration found during the initial compliance assessment on file with the FCC. Note that the highest configuration filed with the FCC in the relevant band utilized a belt clip (NTN8266B) that is no longer offered for this device. Therefore, the next highest applicable configuration (located in table 11 of the previously submitted report part 1 of 1) was used to assess the new antenna. All modes of operation identified in section 6.0 were considered during the development of the test plan.

13.0 DUT Test Data

13.1 Assessment at the Body (450-520 MHz band):

New offered antenna FAF5260A tested across the bandwidth using the previously approved worst case battery NNTN7034A, applicable carry case/strap PMLN5325A/NTN5243A and audio accessory PMLN5101A. SAR plots of the highest results are presented in appendix F.

TABLE 12

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (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)	Run#
FAF5260A	NNTN7034A	PMLN5325A with carry strap NTN5243A	PMLN5101A	450.0	5.35	-0.29	8.71	6.44	4.87	3.60	HvH-Ab-111209-04
				465.0	5.46	-0.14	8.81	6.53	4.67	3.46	HvH-Ab-111209-05
				485.0	5.38	-0.22	7.98	5.91	4.37	3.24	HvH-Ab-111209-06
				502.5	5.42	-0.34	8.39	6.16	4.69	3.44	HvH-Ab-111209-07
				512.0	5.51	-0.33	7.94	5.80	4.35	3.18	HvH-Ab-111209-08
				*520.0	5.56	-0.320	8.11	5.93	4.40	3.21	CM-Ab-111209-09

*520MHz data is not applicable for demonstrating FCC compliance

13.2 Assessments at the Face (450-520 MHz band):

New offered antenna FAF5260A tested across the bandwidth using the previously approved worst case battery NNTN7034A. SAR plots of the highest results are presented in appendix F.

TABLE 13

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (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)	Run#
FAF5260A	NNTN7034A	None	None	450.0	5.44	-0.22	7.01	5.26	3.80	2.85	HvH-Face-111202-06
				465.0	5.54	-0.21	6.22	4.66	3.30	2.47	HvH-Face-111202-07
				485.0	5.44	-0.23	5.87	4.40	3.19	2.39	HvH-Face-111202-08
				502.5	5.37	-0.29	5.66	4.22	3.16	2.35	CM-Face-111202-09
				512.0	5.50	-0.16	6.48	4.82	3.42	2.55	CM-Face-111202-10
				*520.0	5.59	-0.700	7.64	5.68	4.50	3.34	CM-Face-111202-11

*520MHz data is not applicable for demonstrating FCC compliance

14.0 Simultaneous Transmission Exclusion:

FCC part 15 subpart C source-based time-averaged conducted output power for BT is less than $60 / f$ -GHz. Therefore, simultaneous transmission SAR results are not reported herein.

15.0 Conclusion:

The highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing: Model H97TGD9PW1AN (MNUT1015A).

TABLE 14

Designator	Frequency (MHz)	Max Calc at Body (mW/g)		Max Calc at Face (mW/g)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
FCC	450-512	4.87	3.60	3.80	2.85
IC	450-470	4.87	3.60	3.80	2.85
Overall	450-520	4.87	3.60	4.50	3.34

The FCC “Max Calc at the Face” reflect the new SAR compliance value at the head for this FCC ID.

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams result is not applicable to FCC filing.

The test results clearly demonstrate compliance with the relevant standard(s) listed in section 3.0 for occupational/controlled RF Exposure limits of 10 W/kg averaged over 10 grams of contiguous tissue.

APPENDIX A

Measurement Uncertainty

The Measurement Uncertainty tables indicated in this APPENDIX are applicable to the DUT test frequencies ranging from 100MHz to 800MHz and for Dipole test frequencies ranging from 300MHz to 800MHz. Therefore, the highest tolerance for the probe calibration uncertainty is indicated.

Uncertainty Budget for Device Under Test, for 100 MHz to 800 MHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$
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 %)
Measurement System								
Probe Calibration	E.2.1	10.0	N	1.00	1	1	10.0	10.0
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
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0
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				14	13
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				27	27

FCD-0558 Uncertainty Budget Rev.8

Uncertainty Budget for System Validation (dipole & flat phantom) for 300 MHz to 800 MHz

<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
Measurement System									
Probe Calibration	E.2.1	9.0	N	1.00	1	1	9.0	9.0	∞
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				11	11	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				22	22	

FCD-0558 Uncertainty Budget Rev.8

Notes for Tables 1, 2, 3 and 4

- Column headings *a-k* are given for reference.
- Tol. - tolerance in influence quantity.
- Prob. Dist. – Probability distribution
- N, R - normal, rectangular probability distributions
- Div. - divisor used to translate tolerance into normally distributed standard uncertainty
- c_i - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- u_i – SAR uncertainty
- 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 Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3163_Apr11**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3163**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-12.v6, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **April 13, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41495277	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: April 13, 2011

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, 8094 Zurich, Switzerland



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: SCS 108

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ 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
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ 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 affect 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR:** PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR:** VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- 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.

Probe ES3DV3

SN:3163

Manufactured: October 8, 2007
Calibrated: April 13, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3163

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.34	1.14	1.06	$\pm 10.1 \%$
DCP (mV) ^B	100.6	102.9	102.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	112.6	$\pm 2.7 \%$
			Y	0.00	0.00	1.00	105.3	
			Z	0.00	0.00	1.00	98.4	

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

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

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3163

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	45.3	0.87	6.88	6.88	6.88	0.25	1.08	± 13.4 %
450	43.5	0.87	6.53	6.53	6.53	0.17	1.84	± 13.4 %
750	41.9	0.89	6.39	6.39	6.39	0.99	1.10	± 12.0 %
900	41.5	0.97	6.04	6.04	6.04	0.99	1.08	± 12.0 %
1810	40.0	1.40	5.05	5.05	5.05	0.89	1.16	± 12.0 %
1950	40.0	1.40	4.88	4.88	4.88	0.87	1.17	± 12.0 %
2300	39.5	1.67	4.70	4.70	4.70	0.77	1.25	± 12.0 %
2450	39.2	1.80	4.44	4.44	4.44	0.77	1.25	± 12.0 %
2600	39.0	1.96	4.29	4.29	4.29	0.75	1.29	± 12.0 %
3500	37.9	2.91	4.06	4.06	4.06	0.99	1.26	± 13.1 %
3700	37.7	3.12	3.63	3.63	3.63	0.99	1.29	± 13.1 %

^c Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^f At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3- SN:3163

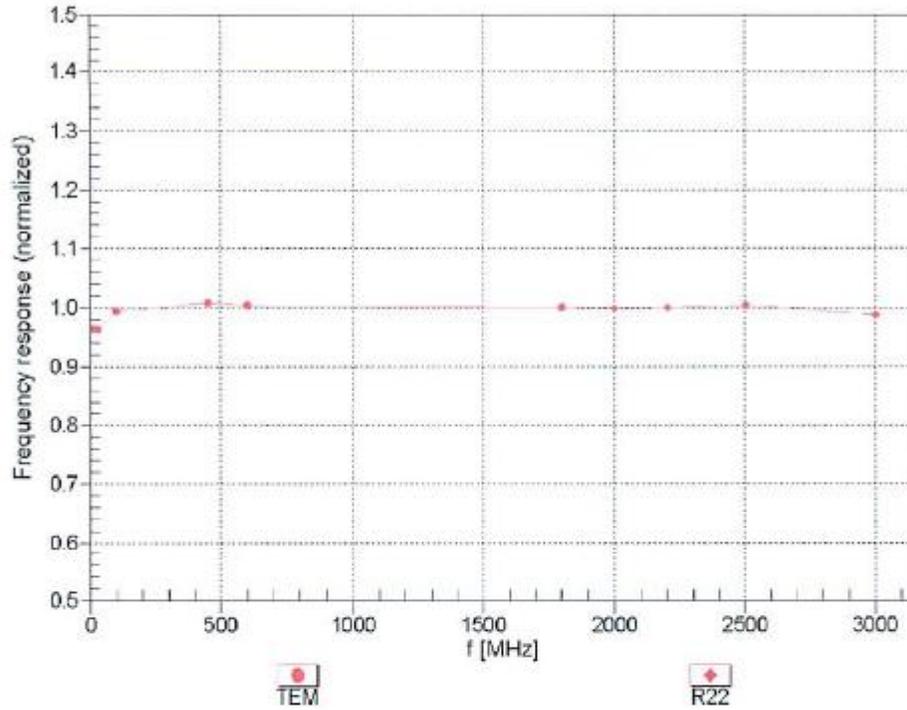
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	6.83	6.83	6.83	0.22	1.69	± 13.4 %
450	56.7	0.94	7.01	7.01	7.01	0.09	1.00	± 13.4 %
750	55.5	0.96	6.13	6.13	6.13	0.99	1.14	± 12.0 %
900	55.0	1.05	5.99	5.99	5.99	0.99	1.14	± 12.0 %
1810	53.3	1.52	4.87	4.87	4.87	0.87	1.30	± 12.0 %
1950	53.3	1.52	4.81	4.81	4.81	0.77	1.37	± 12.0 %
2300	52.9	1.81	4.38	4.38	4.38	0.90	1.15	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.99	1.05	± 12.0 %
2600	52.5	2.16	4.07	4.07	4.07	0.99	1.06	± 12.0 %
3500	51.3	3.31	3.47	3.47	3.47	0.99	1.37	± 13.1 %
3700	51.0	3.55	3.42	3.42	3.42	0.99	1.41	± 13.1 %

^c Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^f At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

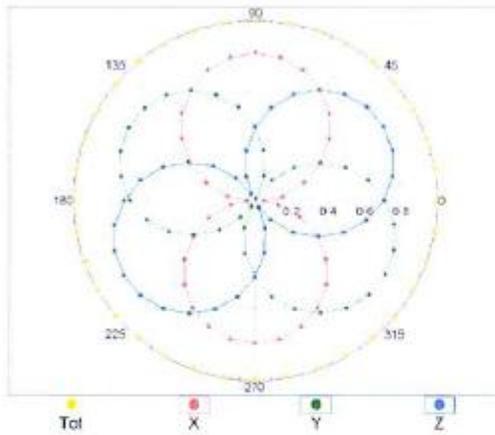
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



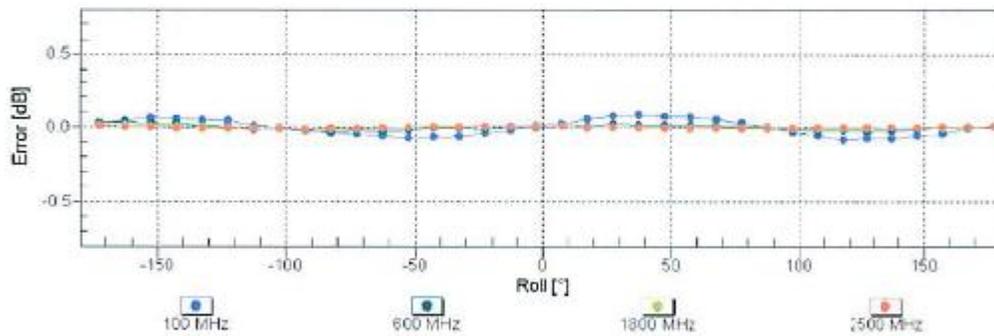
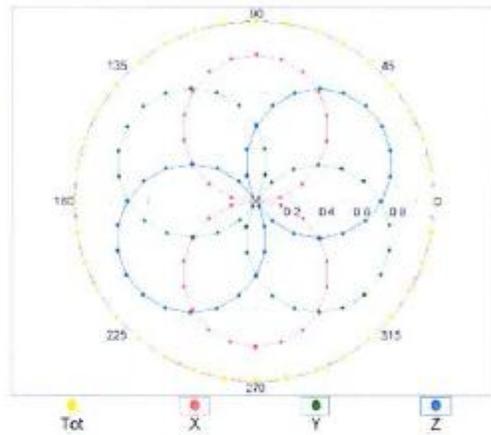
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz,TEM

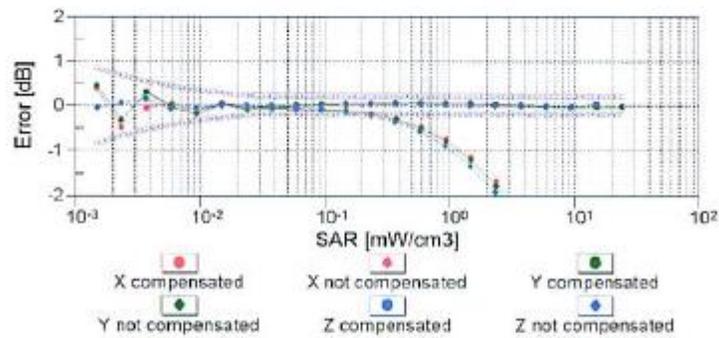
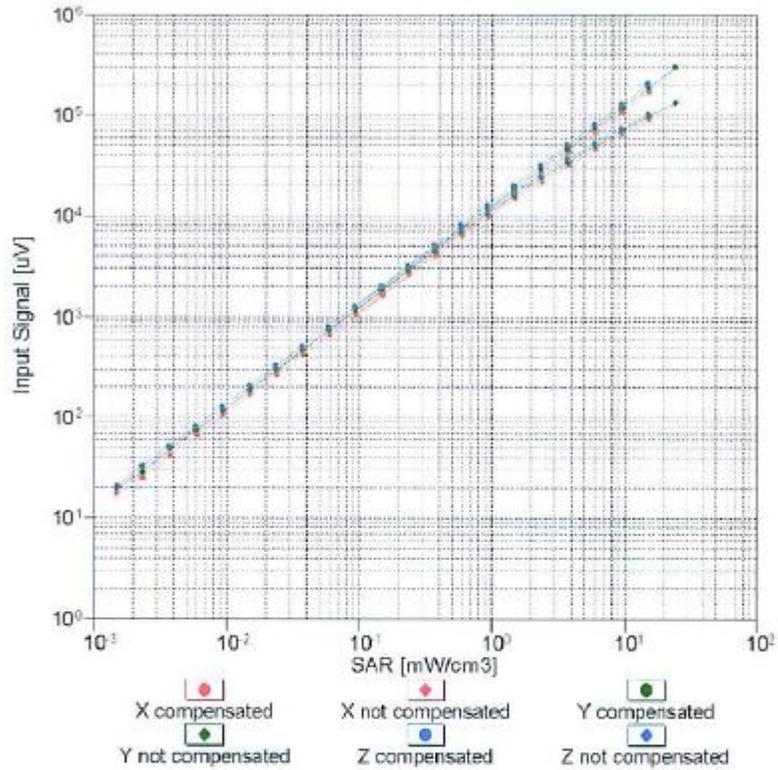


f=1800 MHz,R22



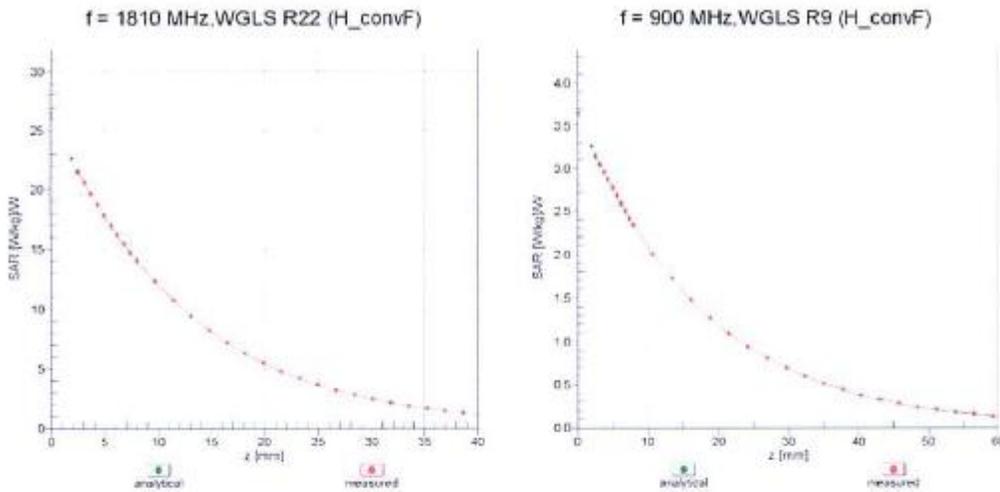
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range f(SAR_{head}) (TEM cell , f = 900 MHz)

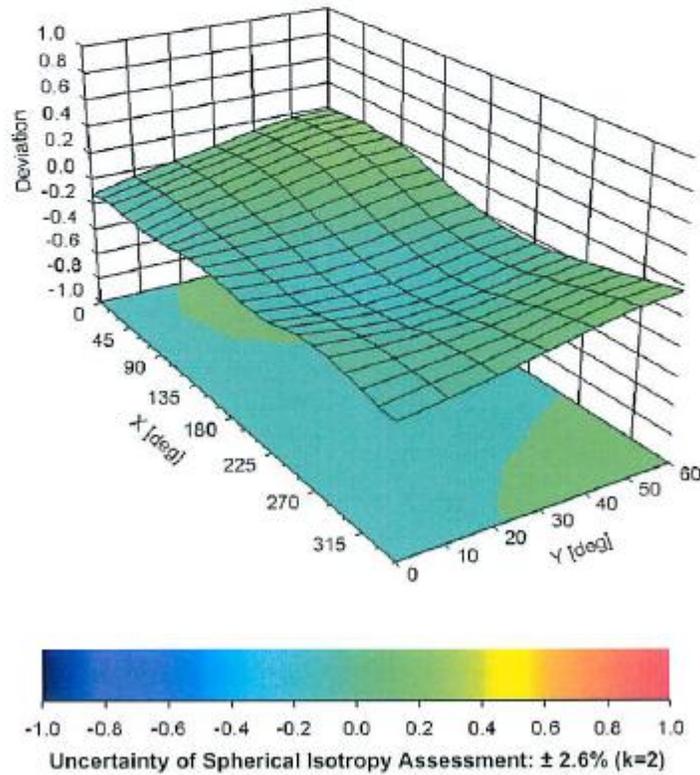


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), f = 900 MHz



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3163**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ES3DV3

Serial Number:

3163

Place of Assessment:

Zurich

Date of Assessment:

April 15, 2011

Probe Calibration Date:

April 13, 2011

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:



Dosimetric E-Field Probe ES3DV3 SN:3163

Conversion factor (\pm standard deviation)

150 MHz *ConvF* **8.2 \pm 10%**

$\epsilon_r = 52.3$
 $\sigma = 0.76 \text{ mho/m}$
 (head tissue)

250 MHz *ConvF* **7.7 \pm 10%**

$\epsilon_r = 47.6$
 $\sigma = 0.83 \text{ mho/m}$
 (head tissue)

150 MHz *ConvF* **7.9 \pm 10%**

$\epsilon_r = 61.9$
 $\sigma = 0.80 \text{ mho/m}$
 (body tissue)

250 MHz *ConvF* **7.5 \pm 10%**

$\epsilon_r = 59.4$
 $\sigma = 0.88 \text{ mho/m}$
 (body tissue)

Important Note:

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

Please see also DASYS Manual.

APPENDIX C
Dipole Calibration Certificates

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



S Schweizerischer Kalibrierdienst
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Multilateral Agreement for the recognition of calibration certificates**

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D450V3-1075_Aug11**

CALIBRATION CERTIFICATE

Object **D450V3 - SN: 1075**

Calibration procedure(s) **QA CAL-15.v6
Calibration procedure for dipole validation kits below 700 MHz**

Calibration date: **August 22, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.3 / 06327	29-Mar-11 (No. 217-01168)	Apr-12
Reference Probe ET3DV6	SN: 1507	29-Apr-11 (No. ET3-1507_Apr11)	Apr-12
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature

Issued: August 24, 2011

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

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



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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
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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:

- DASY4/5 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	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	44.5 \pm 6 %	0.86 mho/m \pm 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	398 mW input power	1.84 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	4.69 mW / g \pm 18.1 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.23 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	3.12 mW / g \pm 17.6 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	55.5 \pm 6 %	0.94 mho/m \pm 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	398 mW input power	1.80 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	4.50 mW / g \pm 18.1 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.20 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	3.01 mW / g \pm 17.6 % (k=2)

Appendix**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	59.4 Ω - 2.2 j Ω
Return Loss	- 21.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.6 Ω - 5.8 j Ω
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.355 ns
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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	June 24, 2010

DASY5 Validation Report for Head TSL

Date: 22.08.2011

Test Laboratory: SPEAG

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1075

Communication System: CW; Frequency: 450 MHz

Medium parameters used: $f = 450$ MHz; $\sigma = 0.86$ mho/m; $\epsilon_r = 44.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.59, 6.59, 6.59); Calibrated: 29.04.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Head Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:

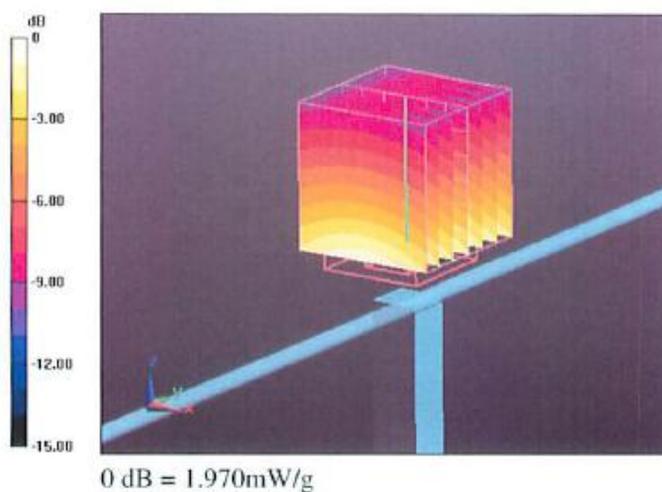
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 49.673 V/m; Power Drift = -0.06 dB

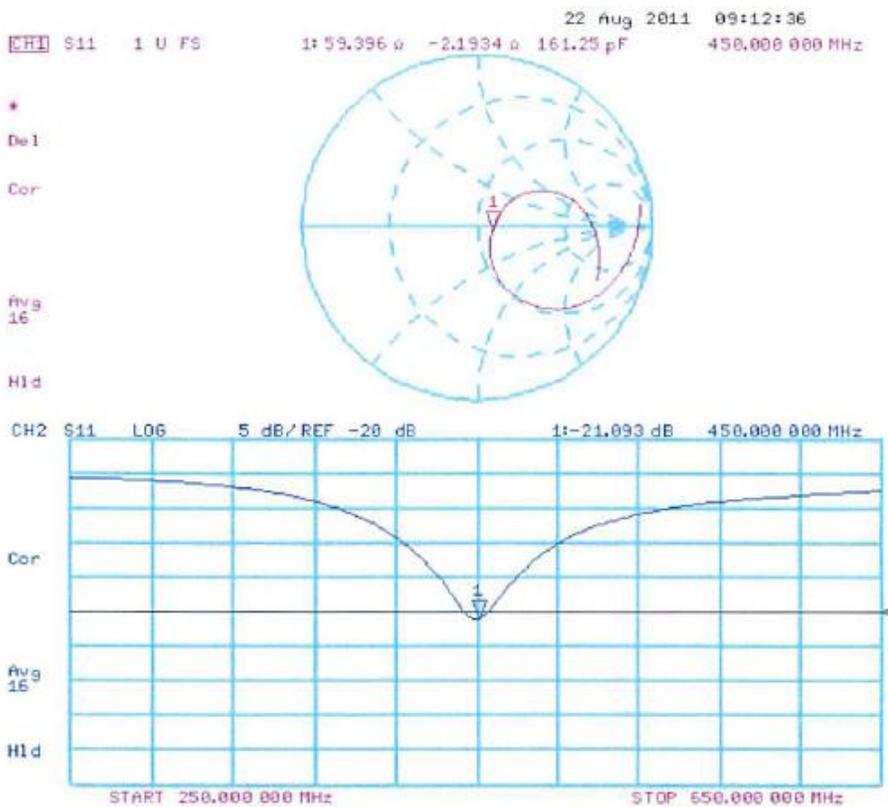
Peak SAR (extrapolated) = 2.798 W/kg

SAR(1 g) = 1.84 mW/g; SAR(10 g) = 1.23 mW/g

Maximum value of SAR (measured) = 1.967 mW/g



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.08.2011

Test Laboratory: SPEAG

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1075

Communication System: CW; Frequency: 450 MHz

Medium parameters used: $f = 450$ MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.05, 7.05, 7.05); Calibrated: 29.04.2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Body Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:

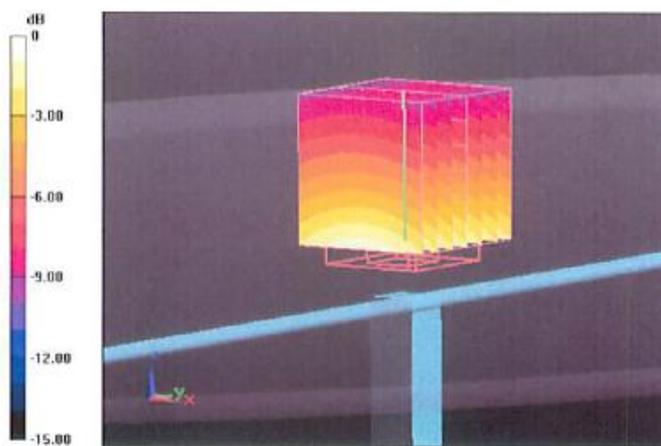
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 46.440 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 2.825 W/kg

SAR(1 g) = 1.8 mW/g; SAR(10 g) = 1.2 mW/g

Maximum value of SAR (measured) = 1.924 mW/g



0 dB = 1.920mW/g

Impedance Measurement Plot for Body TSL

