MOTOROLA

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TESTING CERT # 2518.01

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

Enterprise Mobility Solutions
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Date of Report:	**12/09/10**
Report Revision:	**A**
Report ID:	**SAR rpt_H98KGD9PW5AN (MNUD1002A)_ H98KGH9PW7AN (MNUD1006A)_Rev.A 101209_SR8455/8397/8396**

Responsible Engineer:	Michael Sailsman (Senior Staff Eng.)
Report Author:	Michael Sailsman (Senior Staff Eng.)
Date/s Tested:	6/6/10 – 6/30/10; 8/27/10-10/27/10
Manufacturer/Location:	Motorola, Schaumburg
Sector/Group/Div.:	G&PS
Date submitted for test:	6/7/10 & 8/6/10
DUT Description:	136-174 MHz 1-6W 6.25kHz/12.5kHz /25kHz, Basic Top and Dual Display Models. Capable of digital and analog FM transmission. Also capable of TDMA transmission and BT
Test TX mode(s):	CW (PTT); BT
Max. Power output:	6.6 Watts (VHF); not to exceed 10.0mW(BT)
Nominal Power:	6.0 Watts (VHF); 10mW(BT)
Tx Frequency Bands:	136-174 MHz (VHF); 2.402-2.480 GHz (BT)
Signaling type:	FM and TDMA; FHSS(BT)
Model(s) Tested:	H98KGD9PW5AN(MNUD1001A), H98KGD9PW5AN (MNUD1002A), H98KGH9PW7AN (MNUD1006A)
Model(s) Certified:	H98KGD9PW5AN (MNUD1002A), H98KGH9PW7AN (MNUD1006A)
Serial Number(s):	NUD1002A0052, NUD1002A0039, NUD1002A0068, NUD1006A0181
Classification:	Occupational/Controlled
FCC ID:	AZ489FT3829; Rule part 90 (150.8-173.4 MHz); Rule part 15 (2402-2480MHz)
IC:	109U-89FT3829

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

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams 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.

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

Signature on file **Deanna Zakharia** **EMS EME Lab Senior Resource Manager, Laboratory Director** **Approval Date:** 12/09/10	**Certification Date**: 12/09/10 **Certification No.:**

Part 1 of 2

APPENDICES

Part 2 of 2

Report Revision History

Date	Revision	Comments
12/09/10	A	Revised BT maximum conducted power

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the EMS EME Test Laboratory for model number H98KGD9PW5AN (MNUD1002A), H98KGH9PW7AN (MNUD1006A).

2.0 Abbreviations / Definitions

CNR: Calibration Not Required
CQPSK**:** Compatible Quadrature Phase-Shift Keying
CW: Continues Wave
DUT: Device Under Test
DC: Duty Cycle
FM: Frequency Modulation
NA: Not Applicable
PTT: Push to Talk
RSM: Remote Speaker Microphone
TDMA: Time Division Multiple Access
SAR: Specific Absorption Rate

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

3.0 Referenced Standards and Guidelines

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

- IEC62209-1*(2005) Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)
- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 2.1093 sub-part J:1999
- Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- IEEE 1528*(2003), Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronics Engineers (IEEE) C95.1-2005
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998

- Ministry of Health (Canada) Safety Code 6 (1999), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2003)
- ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio frequency range between 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:

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

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 digital and analog frequency modulation (FM) as well as TDMA 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 and includes 12.5kHz 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 2:1 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. The TDMA mode was not tested because its duty cycle is inherently 50% and would include an additional 50% duty cycle for PTT. 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 connect wireless audio accessories. The maximum actual transmission duty cycle of 76.1% is imposed by the Bluetooth standard.

The model represented under this filing utilizes a removable antenna (VHF) and an internal fixed antenna (BT) capable of transmitting in the 136-174 MHz and 2.402-2.480 GHz bands respectively. The nominal VHF output power is 6.0 watts with maximum output power of 6.6 watts and nominal BT output power of 0.010 watts and maximum output power not to exceed 0.010 watts as defined by 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 offered wireless BT accessories.

7.0 Optional Accessories and Test Criteria:

This device is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required. The following sections identify the test criteria and details for each accessory category. Model H98KGH9PW7AN (MNUD1006A) requires the use of carry holder PMLN5709A along with belt clips.

7.1 Antennas:

There is only one VHF antenna and one BT antenna offered for this product. The table below lists their descriptions.

TABLE 2

Antenna Models	Description	*Tested
NAR6593A	VHF/GPS (136-174 / 1575 MHz) 1/4 wave, -8.53dBd	Yes
84009370001	Internal speaker/mic/flex Bluetooth (2402-2481 MHz) ¼, -10dBd	Yes

*Refer to Exhibit 7B for antenna separation distances.

7.2 Batteries:

There is only one battery offered for this product. The table below lists the battery, and battery description.

TABLE 3

Battery Models	Description	*Tested	Comments
PMNN4403A	Impres Li Ion slim 2150mAh	Yes	Height = 85mm

*Refer to Exhibit 7B for antenna separation distances.

7.3 Body worn Accessories:

All body worn accessories were tested. The table below lists the body worn accessories, and body worn accessory descriptions.

TABLE 4

Body worn Models	Description	*Tested	Comments
NTN8266B	2.5" Belt Clip	Yes	NA
HLN6875A	3.0" Belt Clip	Yes	Tested with and without carry holder PMLN5709A
PMLN5709A	Plastic carry holder	Yes	Tested with HLN6875A for H98KGH9PW7AN (MNUD1006A)

*Refer to Exhibit 7B for antenna separation distances.

7.4 Audio Accessories:

All audio accessories were tested. The table below lists the audio accessories and their descriptions. Exhibit 7B illustrates the DUT with RMN5058A audio accessory along with individual photos of the two audio accessories.

TABLE 5

Audio Acc. Models	Description	Comments
PMLN5275A	Headset – Core Heavy Duty	Tested
RMN5058A	Headset – Core Light Weight	Tested
HMN4104A	RSM - IMPRES Display Submersible RSM w/jack & Channel Selector	Tested

8.0 Description of Test System:

8.1 Descriptions of Robotics/Probes/Readout Electronics:

The laboratory utilizes a Dosimetric Assessment System (DASY4™) SAR measurement system Version 4.7 build 80 manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot, DAE3/DAE4, and ES3DV3 E-field probe. The DASY4™ system is operated per the instructions in the DASY4™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME SAR compliance was calibrated according to ISO/IEC 17025 A2LA guidelines. Section 9.0 presents additional test equipment information. Appendices B and C present the applicable calibration certificates. The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

8.2 Description of Phantom(s)

8.2.1 Dual Flat Phantom
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)
OVAL1016 OVAL1022 OVAL1019 OVAL1011 OVAL1018	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 300 MHz and 2450MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at 300 MHz, 142 MHz, 155 MHz, 168 MHz 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	300MHz		2450MHz	
	Head	Body	Head	Body
Sugar	56.0	47.1	NA	NA
Diacetin	0	0	51.0	34.5
De ionized -Water	37.5	49.48	48.75	65.20
Salt	5.4	2.32	0.15	0.20
HEC	1.0	1.0	NA	NA
Bact.	0.1	0.1	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 (HP)	E4418B	US39251266	2/23/2010	2/23/2011
Power Meter (Agilent)	E4419B	MY40330364	2/23/2010	2/23/2011
Power Sensor (HP)	8481B	3318A10982	3/5/2010	3/5/2011
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495593	2/12/2010	2/12/2011
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495594	2/12/2010	2/12/2011
Bi-Directional Coupler (NARDA)	3020A	40296	2/5/2010	2/5/2012
Signal Generator (Agilent)	E4438C	MY42082269	2/18/2010	2/18/2012
AMP (Amplifier Research)	1W1000	16625	CNR	-
Dickson Temperature Recorder	TM125	1195889	2/16/2010	2/16/2011
Omega Digital Thermometer with J Type TC Probe	HH202A	18800	11/10/2009	11/10/2010
Omega Digital Thermometer with J Type TC Probe	HH202A	18801	4/19/2010	4/19/2011
Omega Digital Thermometer with J Type TC Probe	HH202A	18812	3/24/2010	3/24/2011
Tissue Station				
Agilent PNA-L Network Analyzer	N5230A	MY45001092	6/10/2010	6/10/2011
Network Analyzer (HP)	8753D	3410A09135	2/23/2010	2/23/2011
Dielectric Probe Kit (HP)	85070C	US99360076	CNR	-
Dipole				
Speag Dipole	D300V2	1001*	7/23/2008	7/23/2010
Speag Dipole	D300V2	1001	7/13/2010	7/13/2012
Speag Dipole	D300V2	1002	1/25/2010	1/25/2012
Speag Dipole	D2450V2	704	11/18/2008	11/28/2010

*Note: Applicable for tests performed prior to 7/23/10 only.

10.0 SAR Measurement System Verification:

The SAR measurements were conducted with probe model/serial number ES3DV3/SN3185, 3147 and 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
142	FCC Body	0.79 (0.75-0.83)	62.1 (59.0-65.2)	0.80	60.9	6/06/10
				0.81	61.1	6/07/10
				0.81	62.7	6/09/10
				0.82	61.1	6/26/10
				0.80	60.7	6/27/10
				0.80	61.0	6/28/10
				0.81	60.8	6/29/10
				0.80	60.8	6/30/10
				0.78	62.3	10/2/10
				0.79	62.4	10/7/10
				0.81	61.6	10/25/10
				0.77	60.90	10/26/10
142	IEEE/ IEC Head	0.75 (0.71-0.79)	52.7 (50.0-55.3)	0.74	53.4	6/06/10
				0.77	54.1	10/24/10
				0.73	53.6	10/24/10
155	FCC Body	0.80 (0.76-0.84)	61.8 (58.7-64.9)	0.81	60.4	6/06/10
				0.82	60.6	6/07/10
				0.82	62.2	6/09/10
				0.83	60.4	6/26/10
				0.81	60.3	6/28/10
				0.82	60.1	6/29/10
				0.81	60.0	6/30/10
				0.78	61.8	10/2/10
				0.81	61.2	10/25/10
				0.78	60.5	10/26/10
				0.79	60.6	10/27/10

TABLE 9 (continue)

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
155	IEEE/ IEC Head	0.76 (0.72-0.80)	52.1 (49.5-54.7)	0.75	52.5	6/06/10
168	FCC Body	0.81 (0.77-0.85)	61.5 (58.4-64.6)	0.82	59.8	6/06/10
				0.83	60.0	6/07/10
				0.83	61.5	6/09/10
				0.83	60.0	6/29/10
				0.82	62.0	10/3/10
				0.79	60.0	10/26/10
				0.80	60.1	10/27/10
168	IEEE/ IEC Head	0.77 (0.73-0.81)	51.5 (48.9-54.1)	0.76	51.6	6/06/10
300	FCC Body	0.92 (0.87-0.97)	58.2 (55.3-61.1)	0.93	55.8	6/07/10
				0.93	56.5	6/09/10
				0.94	55.8	6/26/10
				0.92	55.3	6/27/10
				0.92	55.7	6/28/10
				0.93	55.6	6/29/10
				0.92	55.5	6/30/10
				0.89	56.8	10/2/10
				0.92	57.6	10/3/10
				0.91	57.1	10/7/10
				0.89	55.9	10/26/10
				0.92	56.8	10/25/10
				0.90	56.0	10/27/10
300	IEEE/ IEC Head	0.87 (0.83-0.91)	45.3 (43.0-47.6)	0.88	45.7	6/06/10
				0.87	46.0	10/24/10
2450	FCC Body	1.95 (1.76-2.15)	52.7 (47.4-60.0)	2.02	53.0	10/3/10
				2.02	51.9	8/29/10
2450	IEEE/ IEC Head	1.80 (1.62-1.98)	39.2 (35.3-43.1)	1.87	37.3	8/31/10
2441	FCC Body	1.95 (1.76-2.15)	52.7 (47.4-60.0)	2.01	53.1	10/3/10
				2.00	52.0	8/29/10
2441	IEEE/ IEC Head	1.79 (1.62-1.98)	39.2 (35.3-43.1)	1.86	37.3	8/31/10

10.2 System Check Test Results:

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

TABLE 10

Probe Serial #	Tissue Type	Probe Cal Date	Dipole Kit / Serial #	Reference SAR @ 1W (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3185	IEEE/ IEC Head	11/23/2009	SPEAG D300V2 /1001	2.77 +/- 10%	2.85	6/06/10
3185	FCC Body	11/23/2009	SPEAG D300V2 /1001	2.48 +/- 10%	2.66	6/07/10
					2.68	6/09/10
3185	FCC Body	11/23/2009	SPEAG D300V2 /1002	2.67+/- 10%	2.56	6/26/10
					2.50	6/27/10
					2.52	6/28/10
					2.53	6/29/10
					2.49	6/30/10
3147	FCC Body	2/18/10	SPEAG D300V2/1001	2.53 +/- 10%	2.48	10/2/10
					2.51	10/3/10
					2.51	10/7/10
					2.62	10/25/10
					2.48	10/26/10
					2.57	10/27/10
3147	FCC Body	2/18/10	SPEAG D2450V2/704	55.27 +/- 10%	54.80	10/3/10
					56.20	8/29/10
3147	IEEE/ IEC Head	2/18/10	SPEAG D2450V2/704	57.20 +/- 10%	55.67	8/31/10
3163	IEEE/IEC Head	4/23/10	D300V2/1001	2.62 +/- 10%	2.58	10/24/10

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

TABLE 11

	Target	Measured
Ambient Temperature	18 - 25 ˚C	Range: 20.8 -22.8˚C Avg. 21.8˚C
Relative Humidity	30 - 70 %	Range: 49.3 – 66.6% Avg. 53.9%
Tissue Temperature	NA	Range: 20.0-21.6˚C Avg. 20.9C

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

12.0 DUT Test Methodology

12.1 Measurements

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

12.2 DUT Configuration(s)

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

12.3 DUT Positioning Procedures

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

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 and without the offered audio accessories.

The DUT was positioned with its' front side separated 2.5cm and the back side with DUT or antenna separated 2.5cm from the phantom. Testing at 2.5cm is done to satisfy the conditions noted in the safety section of the manual.

12.3.2 Head:

Not applicable.

12.3.3 Face:

The DUT was positioned with its' front and back side separated 2.5cm from the phantom. Note that this product has two microphones, one on the front and one on the back of the DUT and therefore both sides were assessed.

12.4 DUT Test Channels:

The number of test channels was determined by the following equation.

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

Where
N_c = Number of channels
F_{high} = Upper channel
F_{low} = Lower channel
F_c = Center channel

12.5 DUT Test Plan:

All modes of operation identified in section 6.0 were considered during the development of the test plan. The mode which presented the highest duty cycle, FM mode (CW) utilizing 25 kHz channel spacing, was chosen for SAR assessment.

Tests were performed at the even channels (2, 4, and 6) of the VHF (136 – 174 MHz) band. Depending on the SAR result for each of the test configurations at these channels, the other frequency channels are assessed only for the configuration that indicated highest SAR result or for each of the configurations that indicated SAR results within 70% of the specification limit as recommended by the FCC. If the 70% threshold is not required then the highest SAR configurations from the even channel assessments were tested at all other applicable frequencies. Tests were also performed at the body and face using the highest configurations from the VHF band at the low, mid, and high frequencies of the BT band. Tests at the body without the offered audio accessory for both VHF and BT bands are to satisfy intended use operation with a wireless BT headset. In some cases the initial power listed herein may exceed the reported maximum power due to software step size tuning limitations. However, the initial powers measured are not greater than the allowed 5% of the reported maximum power. BT tests were performed in CW mode and the final results were scaled to the max duty cycle of 76.1% noted in section 6.0.
Note that test results that are outside the relevant FCC frequency allocations are presented herein in blue font.

12.5.1 General Test Flowchart

The following flowcharts identify the general approach to the test sequences for body and face positions.

DUT Body Test Methodology (General flowchart)

Step 1
Test all possible combinations for each of the offered accessories.
@ VHF Even Channel(s).
Carry holder PMLN5709A which is applicable only for model H98KGH9PW7AN (MNUD1006A) was assessed based on step 6.

↓

Step 2
Test all other applicable frequencies if any of the configurations from step 1 are within 70% of the limit.

↓

Step 3
If step 2 is not required test all other applicable channels using the highest SAR configuration from step 1 as well as without an audio accessory attached.

↓

Step 4
2.5cm test using the highest SAR configuration from steps 1-3

↓

Step 5
Test across the BT band using the highest overall SAR configuration from above and test highest frequency without the audio accessory

↓

Step 6
Test the offered carry case accessories without an audio cable attached using the applicable highest SAR configuration.

Flowchart Objectives Body

Step 1 - The objective is to determine the highest SAR configuration at the even channel(s) for all combinations of offered accessories at the body. Refer to sections 12.4 and 12.5 for additional frequency channels test consideration details.

Step 2 – The objective is to determine the highest SAR configurations for all possible combinations of offered accessories. Refer to sections 12.4 and 12.5 for additional frequency channels test consideration details.

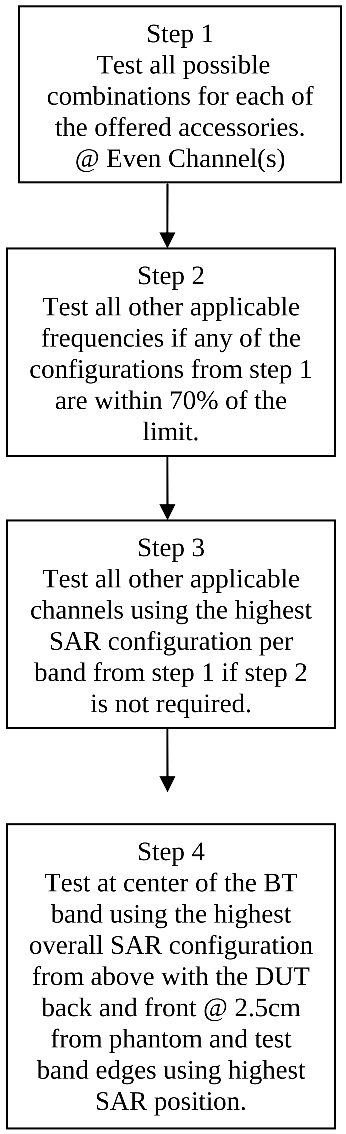
Step 3 - Determine the highest SAR performance across all applicable channels if the SAR results from Step 1 is below the recommended 70% threshold. Refer to section 12.4 and 12.5 for additional frequency channels test consideration details. Tests without an audio accessory are done to account for the intended use with a wireless BT PTT headset.

Step 4 - Determine the highest SAR performance at 2.5cm separation distance to satisfy the safety manuals guidelines for non approved body worn accessories.

Step 5 - Determine the highest SAR performance in the BT band at the body. Test without audio accessory is done to account for the intended use with a wireless BT PTT headset.

Step 6 - Determine the highest SAR performance in the VHF band at the body without an audio cable attached. Test without audio accessory is done to account for the intended use with a wireless BT PTT headset.

DUT Face Test Methodology
(General flowchart)



Flowchart
Objectives Face

Step 1 - The objective is to determine the highest SAR configuration at the even channel(s) for all combinations of offered accessories at the body. Refer to section 12.5 for additional frequency channels test consideration details.

Step 2 – The objective is to determine the highest SAR configurations for all possible combinations of offered accessories. Refer to section 12.5 for additional frequency channels test consideration details.

Step 3 - Determine the highest SAR performance across all applicable channels if the SAR results from Step 2 is below the recommended 70% threshold. Refer to section 12.5 for additional frequency channels test consideration details.

Step 4 - Determine the highest SAR performance in the BT band at the face.

13.0 DUT Test Data

13.1 Assessments at the Body VHF band (CW mode) - belt clip NTN8266B and offered audio accessories:

All possible accessory combinations, belt clip NTN8266B and audio cables PMLN5275A, HMN4104A and RMN5058A were tested with antenna NAR6593A and battery PMNN4403A at the applicable even frequency channels. Refer to section 12.5 for additional frequency channels test consideration details.

The highest SAR results (bolded) from the table below are included in APPENDIX F and G Section 1.0.

TABLE 12

Assessments at the Body (CW mode): belt clip NTN8266B and offered audio accessories											
Antenna	**Battery**	**Carry Case**	**Test position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc.1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
NAR6593A (136-174 / 1575MHz)	PMNN4403A	NTN8266B belt clip	Against phantom	PMLN5275A	136						
					142.3	6.70	-0.496	2.99	1.56	1.68	0.87
					150.8						
					155	6.72	-0.206	1.36	0.788	0.71	0.41
					161.3						
					167.7	6.68	-0.102	2.02	1.11	1.03	0.57
					173.4						
NAR6593A (136-174 / 1575MHz)	PMNN4403A	NTN8266B belt clip	Against phantom	HMN4104A	136						
					142.3	6.64	0.0227	2.38	1.27	1.19	0.64
					150.8						
					155	6.72	-0.26	2.5	1.32	1.33	0.70
					161.3						
					167.7	6.70	-0.0704	2.32	1.25	1.18	0.64
					173.4						
NAR6593A (136-174 / 1575MHz)	PMNN4403A	NTN8266B belt clip	Against phantom	RMN5058A	136						
					142.3	6.67	-0.481	4.94	2.37	**2.76**	1.32
					150.8						
					155	6.73	-0.204	3.20	1.60	**1.68**	0.84
					161.3						
					167.7	6.72	-0.0887	2.66	1.38	1.36	0.70
					173.4						

13.2 Assessments at the Body VHF band (CW mode) - belt clip HLN6875A and offered audio accessories:

All possible accessory combinations, belt clip HLN6875A and audio cables PMLN5275A, HMN4104A and RMN5058A were tested with antenna NAR6593A and battery PMNN4403A at the applicable even frequency channels. Refer to section 12.5 for additional frequency channels test consideration details.

The highest SAR results (bolded) from the table below are included in APPENDIX F and G Section 2.0.

TABLE 13

Assessments at the Body (CW mode): belt clip HLN6875A and offered audio accessories

Antenna	Battery	Carry Case	Test Position	Additional attachments	Test Freq. (MHz)	Initial Power (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)
NAR6593A (136-174 / 1575MHz)	PMNN4403A	HLN6875A belt clip	Against phantom	PMLN5275A	136						
					142.3	6.66	-0.445	1.66	0.802	0.92	0.44
					150.8						
					155	6.68	-0.228	0.802	0.381	0.42	0.20
					161.3						
					167.7	6.69	-0.00222	1.92	0.83	0.96	0.42
					173.4						
NAR6593A (136-174 / 1575MHz)	PMNN4403A	HLN6875A belt clip	Against phantom	HMN4104A	136						
					142.3	6.7	-0.528	3.75	1.57	2.12	0.89
					150.8						
					155	6.73	-0.408	1.8	0.791	**0.99**	0.43
					161.3						
					167.7	6.7	-0.0844	1.77	0.769	0.90	0.39
					173.4						
NAR6593A (136-174 / 1575MHz)	PMNN4403A	HLN6875A belt clip	Against phantom	RMN5058A	136						
					142.3	6.7	-0.490	3.86	1.73	**2.16**	0.97
					150.8						
					155	6.72	-0.477	1.43	0.712	0.80	0.40
					161.3						
					167.7	6.71	-0.184	1.54	0.729	0.80	0.38
					173.4						

13.3 Assessments at the Body VHF band (CW mode) – Other frequency channels:

The DUT was tested at all other applicable frequencies using the highest SAR configuration from tables 12-13. Refer to section 12.5 for additional frequency channels test consideration details.

The highest SAR results from the table below (bolded) are included in APPENDIX F and G Section 3.0.

TABLE 14

Assessments at the Body (CW mode): Other Frequency Channels											
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
NAR6593A (136-174 / 1575MHz)	PMNN4403A	NTN8266B belt clip	Against phantom	RMN5058A	136	6.67	-0.133	8.94	4.30	**4.61**	2.22
					150.8	6.73	-0.665	3.37	1.69	**1.96**	0.98
					161.3	6.81	-0.202	2.71	1.38	1.42	0.72
					173.4	6.78	-0.349	2.49	1.29	1.35	0.70

13.4 Assessment at 2.5cm without body worn accessory VHF band (CW mode):

DUT was tested with a separation distance of 2.5cm (front & back) from the phantom using the highest SAR configurations from table 12-14.

The highest SAR result (bolded) from the table below is provided in APPENDIX F and G Section 4.0

Note: The 2.5cm assessments included the following configurations:

- Back of the device facing the phantom, positioned at 2.5cm from the phantom surface. Results for this test configuration may or may not be included depending on the location of the hot spot. If the peak SAR is located on the antenna then SAR result for this configuration would be lower due to increased separation distance.
- Back of the device facing the phantom, the antenna at 2.5cm from the phantom surface. Results for this test configuration may or may not be included depending on the location of the hot spot. This test position would not be applicable for cases where the peak is located on the DUT body and not the antenna.
- Front of the device facing the phantom, at 2.5cm from the phantom surface.

TABLE 15

Assessment at 2.5cm without body worn accessory (CW mode)											
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
NAR6593A (136-174 / 1575MHz)	PMNN4403A	None	Back - Antenna at 2.5cm	RMN5058A	150.8	6.7	-0.764	1.62	1.24	**0.97**	0.74
NAR6593A (136-174 / 1575MHz)	PMNN4403A	None	Front of DUT at 2.5cm	RMN5058A	150.8	6.73	-0.955	0.942	0.735	0.59	0.46
NAR6593A (136-174 / 1575MHz)	PMNN4403A	None	Back - Antenna at 2.5cm	RMN5058A	136	6.72	-0.178	3.66	2.8	**1.91**	1.46
NAR6593A (136-174 / 1575MHz)	PMNN4403A	None	Front of DUT at 2.5cm	RMN5058A	136	6.69	-0.987	1.71	1.34	1.07	0.84

13.5 Assessments at the Face VHF band (CW mode):

The DUT was tested with antenna NAR6593A with the offered battery PMNN4403A at the applicable even frequency channels (2, 4, and 6) with the DUT front and back sides separated 2.5cm from the phantom. Refer to section 12.5 for additional frequency channels test consideration details.

The highest SAR result from the table below (bolded) is included in APPENDIX F and G Section 5.0

TABLE 16

Assessments at the Face (CW mode)										
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc.1g-SAR (W/kg)**	**Max Calc.10g-SAR (W/kg)**
NAR6593A (136-174 / 1575MHz)	PMNN4403A	None	Front of DUT at 2.5cm	None	136						
					142.3	6.67	-0.643	1.618	1.252	**0.94**	0.73
					150.8						
					155	6.69	-0.436	1.014	0.786	0.56	0.43
					161.3						
					167.7	6.65	-0.15	1.104	0.845	**0.57**	0.44
					173.4						
NAR6593A (136-174 / 1575MHz)	PMNN4403A	None	Back of DUT at 2.5cm	None	136						
					142.3	6.67	-0.612	1.437	1.122	0.83	0.65
					150.8						
					155	6.69	-0.535	0.834	0.65	0.47	0.37
					161.3						
					167.7	6.65	-0.164	0.837	0.648	0.43	0.34
					173.4						

13.6 Assessments at the Face VHF band (CW mode) – Other frequency channels:

The DUT was tested at all other applicable frequencies using the highest SAR configuration from table 16. Refer to section 12.5 for additional frequency channels test consideration details.

The highest SAR results from the table below (bolded) are included in APPENDIX F and G Section 6.0.

TABLE 17

Assessments at the Face (CW mode) Other Frequency Channels											
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc.1g-SAR (W/kg)**	**Max Calc.10g-SAR (W/kg)**
NAR6593A (136-174 / 1575MHz)	PMNN4403A	None	Front of DUT at 2.5cm	None	136	6.60	-0.348	2.69	2.10	**1.46**	1.14
					150.8	6.79	-0.841	1.075	0.834	0.65	0.51
					161.3	6.8	-0.309	1.175	0.91	0.63	0.49
					173.4	6.78	-0.189	1.354	1.041	**0.71**	0.54

13.7 Assessments at the Body Bluetooth:

The DUT was tested across the BT band using the highest overall SAR configuration from tables 12 through 14. Test without the offered audio accessory using the highest configuration across the band reflects other intended user configuration.
The highest SAR results from the table below (bolded) are included in APPENDIX F Section 7.0.

TABLE 18

Assessments at the Body (76.1% DC)											
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc.1g-SAR (W/kg)**	**Max Calc.10g-SAR (W/kg)**
84009370001 (Internal)	PMNN4403A	NTN8266B	Against Phantom	RMN5058A	2402.00	0.00924	3.700	0.00169	0.00067	0.0014	0.0006
84009370001 (Internal)	PMNN4403A	NTN8266B	Against Phantom	RMN5058A	2441.00	0.00969	3.340	0.00168	0.00064	0.0013	0.0005
84009370001 (Internal)	PMNN4403A	NTN8266B	Against Phantom	RMN5058A	2480.00	0.00979	-0.143	0.00105	0.00043	0.0008	0.0003
Test without audio accessory using highest SAR configuration above.											
84009370001 (Internal)	PMNN4403A	NTN8266B	Against Phantom	None	2402.00	0.00924	-0.737	0.0021	0.0008	**0.0021**	0.0008

13.8 Assessments at the Face Bluetooth:

The DUT was tested in the BT band using the highest overall SAR configuration from tables 16 & 17. The front and back positions of the device were tested at the BT center frequency and the highest SAR position from this assessment was then tested at the other applicable frequencies.
The highest SAR results from the table below (bolded) are included in APPENDIX F Section 8.0.

TABLE 19

Assessments at the Face (76.1% DC)											
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc.1g-SAR (W/kg)**	**Max Calc.10g-SAR (W/kg)**
84009370001 (Internal)	PMNN4403A	None	DUT Front 2.5cm	None	2441.00	0.00969	-1.67	0.0211	0.0124	**0.0240**	0.0140
84009370001 (Internal)	PMNN4403A	None	DUT Back 2.5cm	None	2441.00	0.00969	0.883	0.0014	0.0005	0.001	0.0004
Band edge test using highest SAR test position											
84009370001 (Internal)	PMNN4403A	None	DUT Front 2.5cm	None	2402.00	0.00924	-0.955	0.0177	0.0105	0.0186	0.0111
84009370001 (Internal)	PMNN4403A	None	DUT Front 2.5cm	None	2480.00	0.00979	0.0016	0.0179	0.0105	0.0139	0.0082

13.9 Assessments at the Body VHF band with belt clip NTN8266B without audio accessory:

The DUT was tested across all applicable frequencies in the VHF band using the highest overall SAR configuration from above (table 14) without an audio accessory attached. Test without the offered audio accessory reflects intended user configuration. The highest SAR results from the table below (bolded) are included in APPENDIX F and G Section 9.0.

TABLE 20

Assessments at the Body (CW mode) without audio accessory											
Antenna	Battery	Carry Case	Test Position	Additional attachments	Test Freq. (MHz)	Initial Power (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc.1g-SAR (W/kg)	Max Calc.10g-SAR (W/kg)
NAR6593A (136-174 / 1575MHz)	PMNN4403A	NTN8266B	Against Phantom	None	136.00	6.59	-0.0949	6.27	3.21	**3.21**	1.64
					142.30	6.50	-0.626	3.04	1.59	1.78	0.93
					150.80	6.61	-0.241	2.55	1.34	**1.35**	0.71
					155.00	6.65	-0.170	2.21	1.21	1.15	0.63
					161.30	6.70	-0.155	2.05	1.12	1.06	0.58
					167.70	6.65	-0.0735	2.34	1.29	1.19	0.66
					173.40	6.67	-0.545	1.78	1.00	1.01	0.57

13.10 Assessments at the Body VHF band with belt clip HLN6875A without audio accessory:

The DUT was tested across all applicable frequencies in the VHF band using the highest overall SAR configuration from above (table 13) without an audio accessory attached. Test without the offered audio accessory reflects intended user configuration. The highest SAR results from the table below (bolded) are included in APPENDIX F and G Section 10.0.

TABLE 21

Assessments at the Body (CW mode) without audio accessory											
Antenna	Battery	Carry Case	Test Position	Additional attachments	Test Freq. (MHz)	Initial Power (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc.1g-SAR (W/kg)	Max Calc.10g-SAR (W/kg)
NAR6593A (136-174 / 1575MHz)	PMNN4403A	HLN6875A	Against Phantom	None	136.00	6.63	-0.474	9.17	3.75	**5.11**	2.09
					142.30	6.55	-0.605	4.75	1.97	2.75	1.14
					150.80	6.71	-0.633	3.98	1.54	**2.30**	0.89
					155.00	6.75	-0.624	3.06	1.25	1.77	0.72
					161.30	6.68	-0.267	3.05	1.16	1.62	0.62
					167.70	6.69	-0.130	3.07	1.2	1.58	0.62
					173.40	6.61	-0.629	2.75	1.02	1.59	0.59

13.11 Assessments at the Body VHF band with belt clip HLN6875A and carry holder PMLN5709A without audio accessory:

The DUT was tested across all applicable frequencies in the VHF band using the highest overall SAR configuration from above (table 13) with the belt clip attached to the offered carry holder PMLN5709A without an audio accessory attached. Test without the offered audio accessory reflects intended user configuration. The highest SAR results from the table below (bolded) are included in APPENDIX F and G Section 11.0.

TABLE 22

Assessments at the Body (CW mode) without audio accessory											
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc.1g-SAR (W/kg)**	**Max Calc.10g-SAR (W/kg)**
NAR6593A (136-174 / 1575MHz)	PMNN4403A	HLN6875A w/ PMLN5709A holder	Against Phantom	None	136.00	6.65	-0.352	9.90	4.36	**5.37**	2.36
					142.30	6.62	-0.481	5.10	2.42	2.85	1.35
					150.80	6.71	-0.675	4.31	1.75	**2.52**	1.02
					155.00	6.74	-0.243	3.33	1.48	1.76	0.78
					161.30	6.76	-0.094	2.36	1.14	1.21	0.58
					167.40	6.78	-0.018	2.08	1.02	1.04	0.51
					173.40	6.80	-0.666	2.14	0.96	1.25	0.56

13.12 Shorten Scan Assessment

Short scan assessment: A "shortened" scan was performed to validate the SAR drift of the full DASY4™ coarse and 5x5x7 zoom scans. Note that the shortened scan represents the zoom scan performance result; this is obtained by first running a coarse scan to find the peak area and then, using a newly charged battery, a 5x5x7 zoom scan only was performed. The results of the shortened cube scan presented in APPENDIX E demonstrate that the scaling methodology used to determine the calculated SAR results presented herein are valid. Both SAR results from the table below are provided in APPENDIX E.

TABLE 23

Shorten scan Assessment											
Antenna	**Battery**	**Carry Case**	**Test Position**	**Additional attachments**	**Test Freq. (MHz)**	**Initial Power (W)**	**SAR Drift (dB)**	**Meas. 1g-SAR (W/kg)**	**Meas. 10g-SAR (W/kg)**	**Max Calc. 1g-SAR (W/kg)**	**Max Calc. 10g-SAR (W/kg)**
Full scan											
NAR6593A (136-174 / 1575MHz)	PMNN4403A	NTN8266B belt clip	Against phantom	RMN5058A	150.8	6.73	-0.665	3.37	1.69	**1.96**	0.98
Shorten scan											
NAR6593A (136-174 / 1575MHz)	PMNN4403A	NTN8266B belt clip	Against phantom	RMN5058A	150.8	6.74	-0.182	3.61	1.81	1.88	0.94

14.0 Simultaneous Transmission Exclusion:

Simultaneous Transmission applies. See section 15.0.

15.0 Conclusion:

The highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing: Models H98KGD9PW5AN (MNUD1001A), H98KGD9PW5AN (MNUD1002A) and H98KGH9PW7AN (MNUD1006A):

FCC Part 90 (150.8-173.4MHz)

TABLE 24

Frequency Range (MHz)	Max Calc at Body (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
150.8 – 173.4	2.52	1.02	2.52	1.02

Table 25

Frequency Range (MHz)	Max Calc at Face (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
150.8 – 173.4	0.71	0.54	0.75	0.58

RF Exposure Results (136-174 MHz)

TABLE 26

Frequency Range (MHz)	Max Calc at Body (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
136 - 174	5.37	2.36	5.37	2.36

TABLE 27

Frequency Range (MHz)	Max Calc at Face (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
136 - 174	1.46	1.14	1.48	1.15

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of **8 W/kg** per the requirements of 47 CFR 2.1093(d).

APPENDIX A
Measurement Uncertainty

The Measurement Uncertainty tables indicated in this APPENDIX are applicable to the DUT test frequencies ranging from 100MHz to 800MHz, 800MHz to 3GHz and for Dipole test frequencies ranging from 300MHz to 800MHz and 800MHZ to 3GHz. Therefore, the highest tolerance for the probe calibration uncertainty is indicated.

Table A1:

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

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

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Table A2:
Uncertainty Budget for System Validation (dipole & flat phantom) for 300 MHz to 800 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**
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
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				22	22

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

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

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

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

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Notes for Tables 1, 2, 3 and 4
a) Column headings *a*-*k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

APPENDIX B
Probe Calibration Certificates

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

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

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

Accreditation No.: **SCS 108**

Client **Motorola CGISS**

Certificate No: **ES3-3185_Nov09**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3185
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	November 23, 2009

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: November 23, 2009

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
Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3185

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

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3185

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

[B] Numerical linearization parameter: uncertainty not required.

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

DASY - Parameters of Probe: ES3DV3 SN:3185

Calibration Parameter Determined in Head Tissue Simulating Media

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

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

DASY - Parameters of Probe: ES3DV3 SN:3185

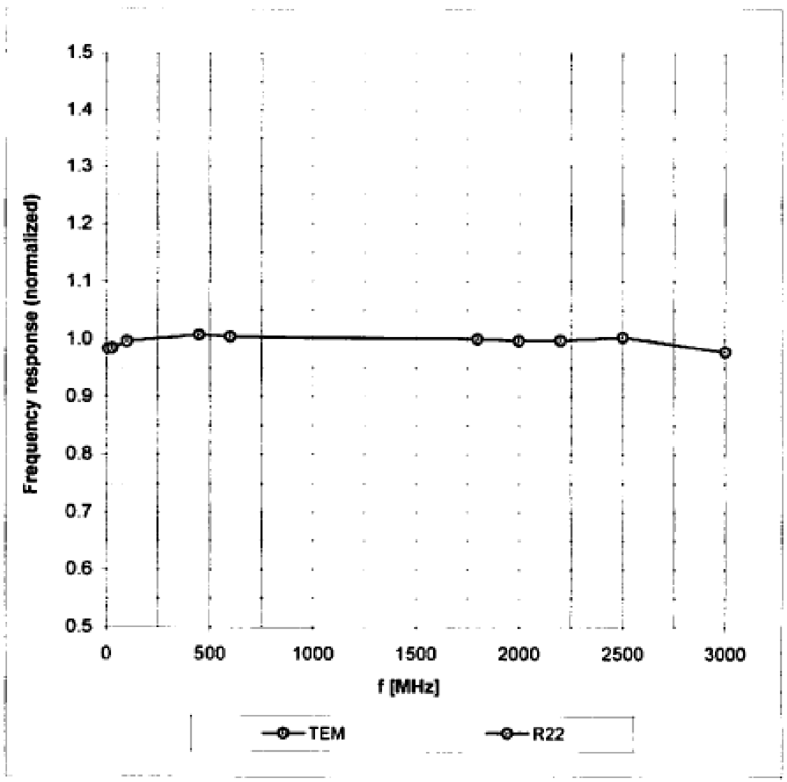
Calibration Parameter Determined in Body Tissue Simulating Media

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

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

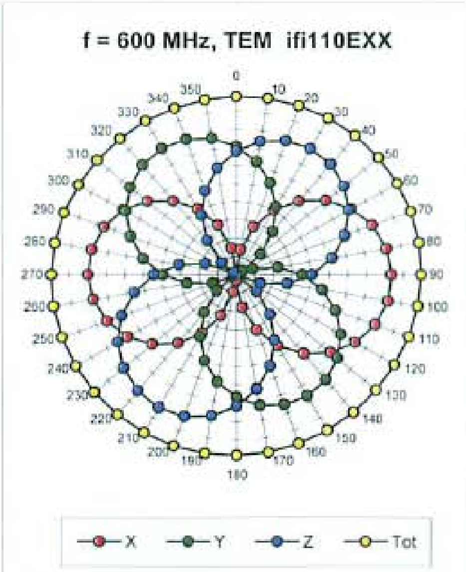
Frequency Response of E-Field

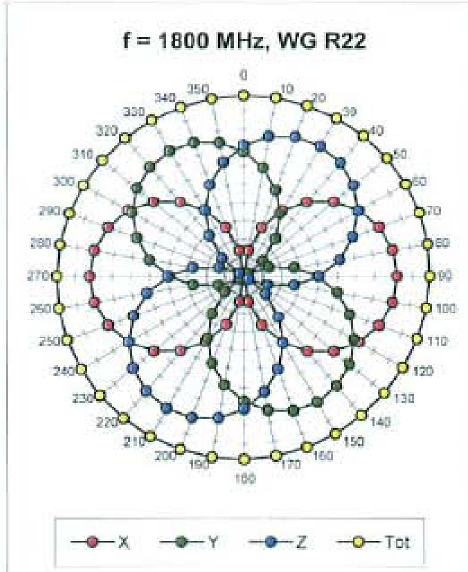
(TEM-Cell:ifi110 EXX, Waveguide: R22)

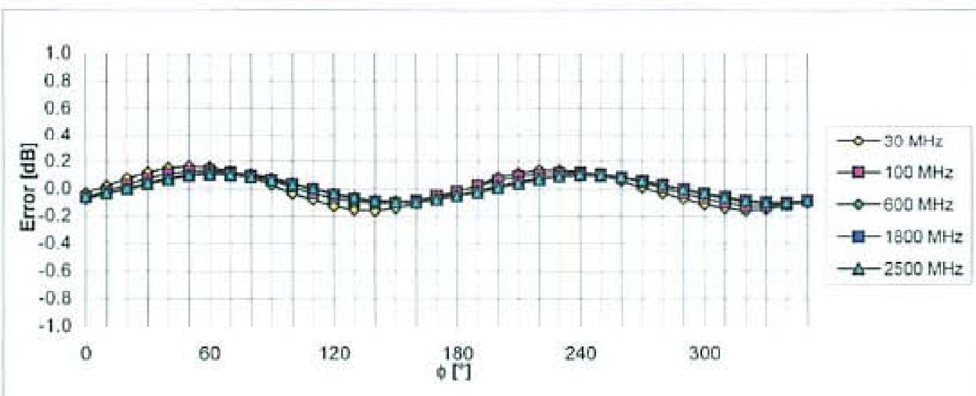


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

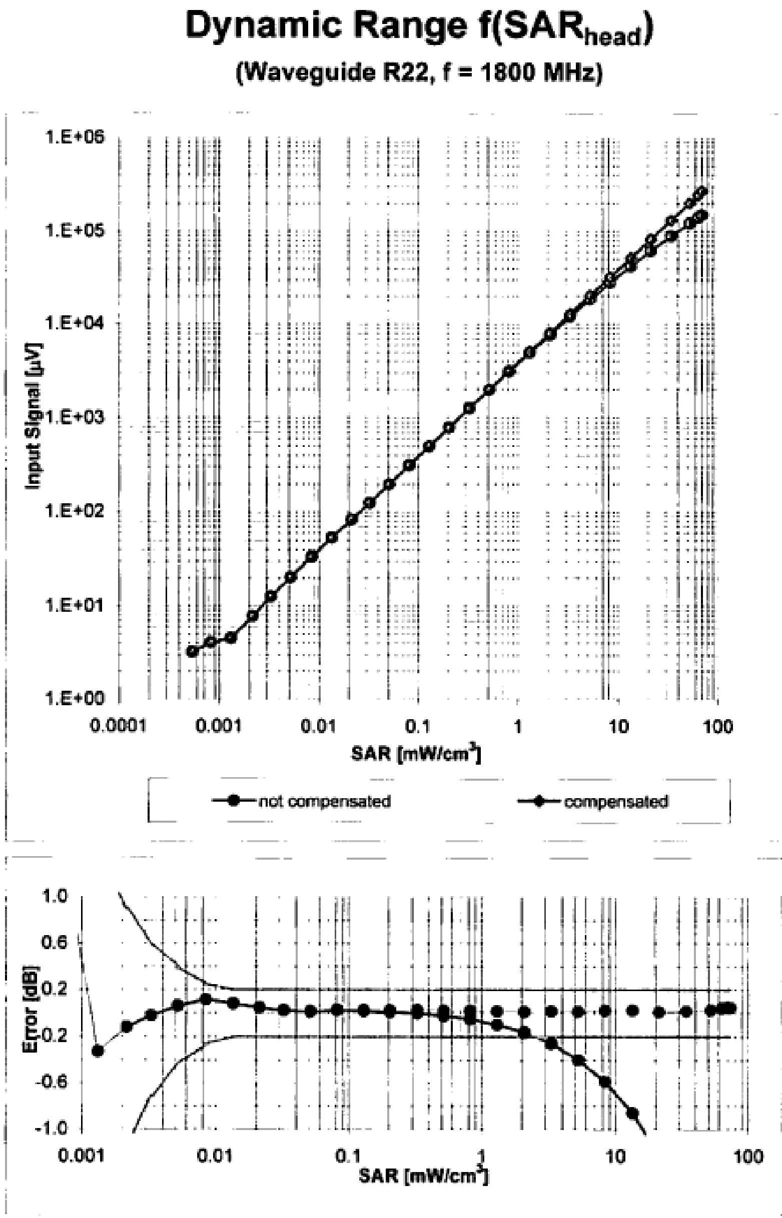
Receiving Pattern (ϕ), $\vartheta = 0°$





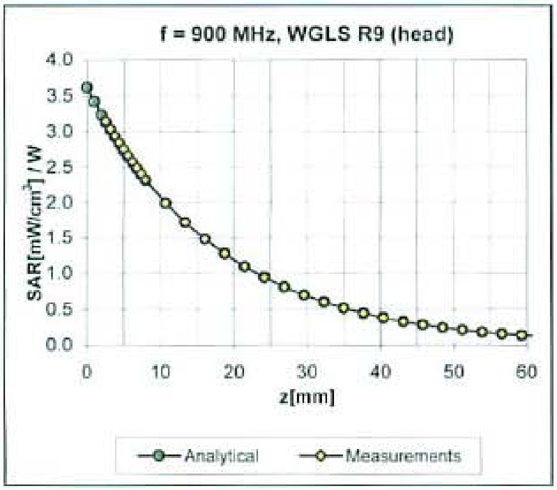


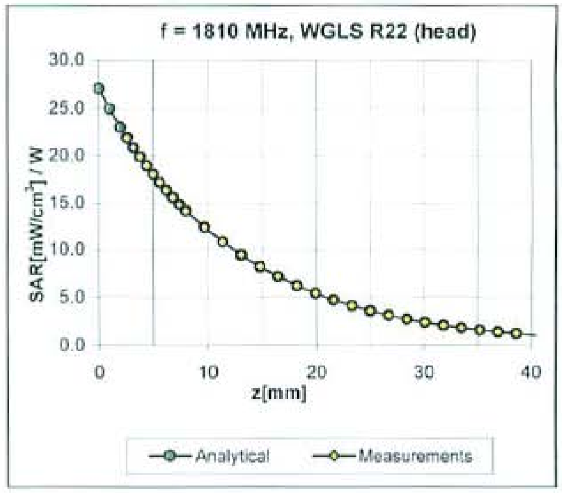
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)



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

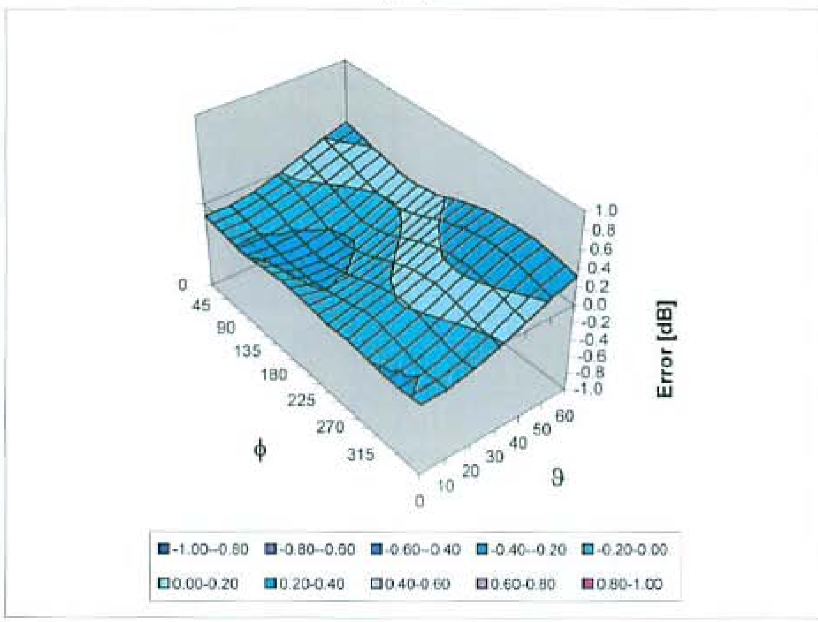
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

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

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Additional Conversion Factors

for Dosimetric E-Field Probe

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

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

Assessed by:

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Dosimetric E-Field Probe ES3DV3 SN:3185

Conversion factor (± standard deviation)

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

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

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Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3147_Feb10**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3147
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	February 18, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

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

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

Issued: February 19, 2010

Calibration Laboratory of
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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3147

Manufactured:	July 12, 2007
Last calibrated:	February 13, 2009
Recalibrated:	February 18, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3147

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.25	1.22	1.20	± 10.1%
DCP (mV)[B]	90.7	94.9	92.9	

Modulation Calibration Parameters

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

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

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

[B] Numerical linearization parameter: uncertainty not required.

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

DASY - Parameters of Probe: ES3DV3 SN:3147

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
300	± 50 / ± 100	45.3 ± 5%	0.87 ± 5%	6.79	6.79	6.79	0.23	0.86 ± 13.3%
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	6.43	6.43	6.43	0.23	1.45 ± 13.3%
750	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.24	6.24	6.24	0.64	1.19 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	5.85	5.85	5.85	0.70	1.14 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.06	5.06	5.06	0.42	1.80 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.81	4.81	4.81	0.44	1.69 ± 11.0%
2300	± 50 / ± 100	39.5 ± 5%	1.67 ± 5%	4.68	4.68	4.68	0.40	1.85 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.42	4.42	4.42	0.40	2.06 ± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	4.29	4.29	4.29	0.48	1.71 ± 11.0%
3500	± 50 / ± 100	37.9 ± 5%	2.91 ± 5%	4.09	4.09	4.09	1.00	1.23 ± 13.1%
3700	± 50 / ± 100	37.7 ± 5%	3.12 ± 5%	3.68	3.68	3.68	1.00	1.30 ± 13.1%

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

DASY - Parameters of Probe: ES3DV3 SN:3147

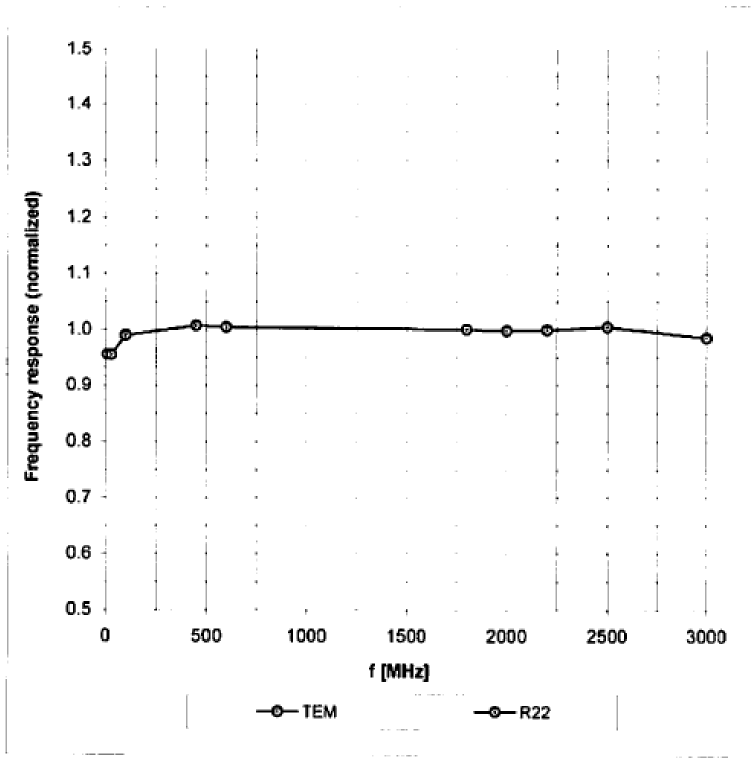
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	6.82	6.82	6.82	0.10	2.74 ± 13.3%
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	5.95	5.95	5.95	0.78	1.14 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	5.81	5.81	5.81	0.88	1.13 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.90	4.90	4.90	0.28	2.75 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.75	4.75	4.75	0.42	1.98 ± 11.0%
2300	± 50 / ± 100	52.8 ± 5%	1.85 ± 5%	4.33	4.33	4.33	0.45	1.82 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.18	4.18	4.18	0.70	1.29 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	4.07	4.07	4.07	0.87	1.15 ± 11.0%
3500	± 50 / ± 100	51.3 ± 5%	3.31 ± 5%	3.50	3.50	3.50	1.00	1.38 ± 13.1%
3700	± 50 / ± 100	51.0 ± 5%	3.55 ± 5%	3.38	3.38	3.38	0.64	1.93 ± 13.1%

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

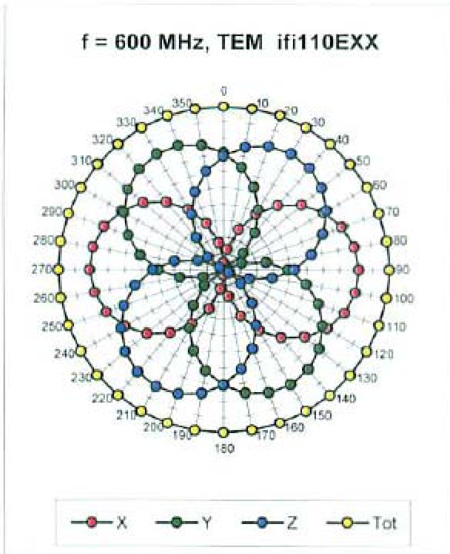
Frequency Response of E-Field

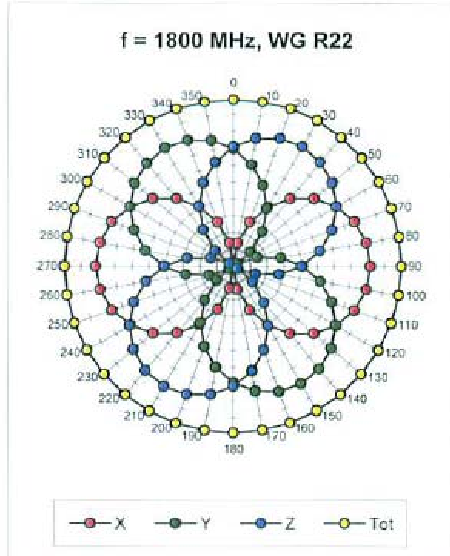
(TEM-Cell:ifi110 EXX, Waveguide: R22)

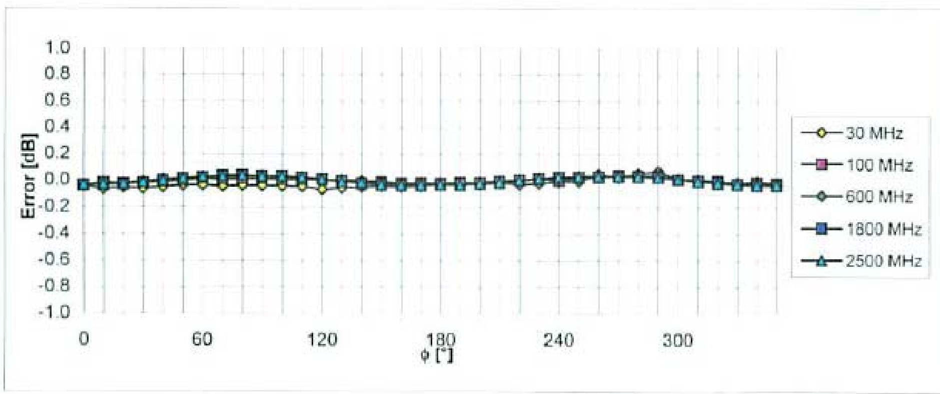


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$



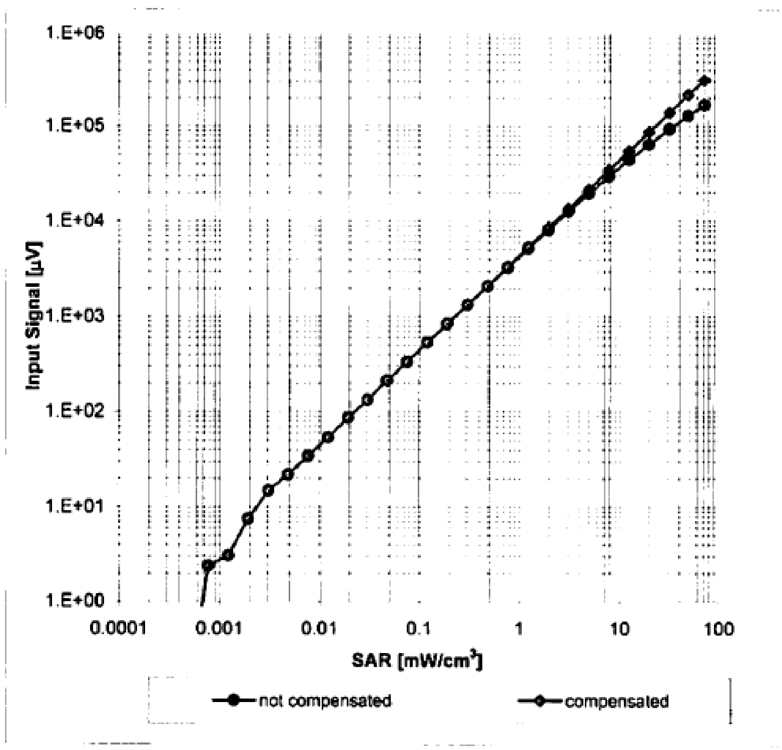


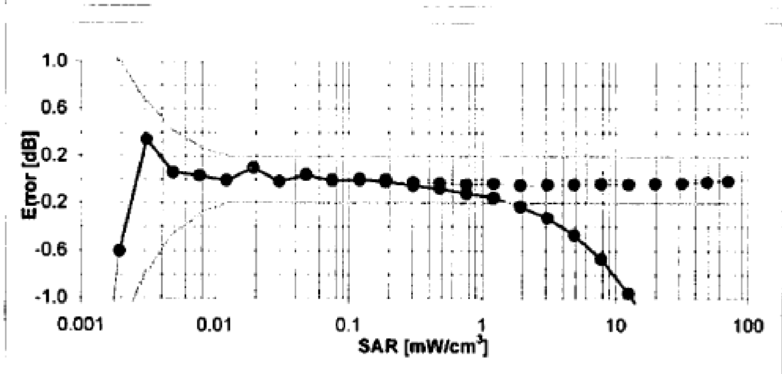


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

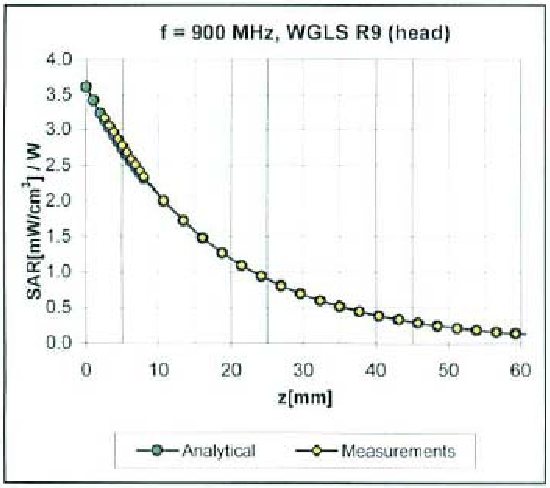
(Waveguide R22, f = 1800 MHz)

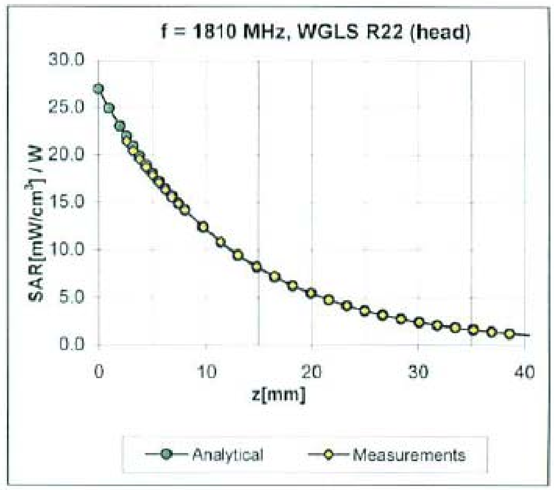




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

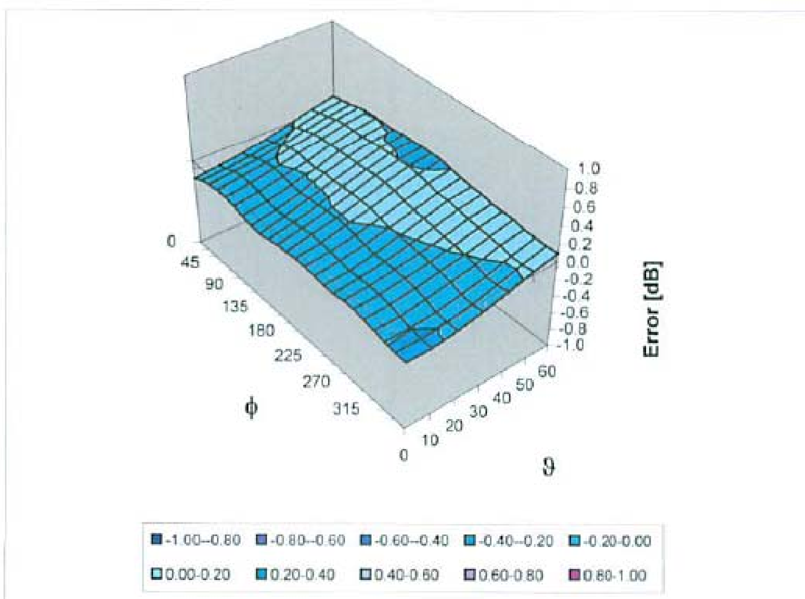
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

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

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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3147**
Place of Assessment:	**Zurich**
Date of Assessment:	**February 22, 2010**
Probe Calibration Date:	**February 18, 2010**

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

Assessed by:

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Dosimetric E-Field Probe ES3DV3 SN:3147

Conversion factor (± standard deviation)

150 MHz	*ConvF*	**8.0 ± 10%**	ε_r = 52.3 σ = 0.76 mho/m (head tissue)
250 MHz	*ConvF*	**7.2 ± 10%**	ε_r = 47.6 σ = 0.83 mho/m (head tissue)
150 MHz	*ConvF*	**7.7± 10%**	ε_r = 61.9 σ = 0.80 mho/m (body tissue)
250 MHz	*ConvF*	**7.3 ± 10%**	ε_r = 59.4 σ = 0.88 mho/m (body tissue)
300 MHz	*ConvF*	**7.1 ± 9%**	ε_r = 58.2 σ = 0.92 mho/m (body tissue)

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

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Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3163_Apr10**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3163
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	April 23, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: April 27, 2010

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3163

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

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3163

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

[B] Numerical linearization parameter: uncertainty not required.

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

DASY - Parameters of Probe: ES3DV3 SN:3163

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	6.37	6.37	6.37	0.14	1.67 ± 13.3%
750	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.30	6.30	6.30	0.99	1.03 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	5.93	5.93	5.93	0.90	1.08 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.01	5.01	5.01	0.46	1.54 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.83	4.83	4.83	0.36	1.76 ± 11.0%
2300	± 50 / ± 100	39.5 ± 5%	1.67 ± 5%	4.65	4.65	4.65	0.45	1.69 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.38	4.38	4.38	0.39	1.88 ± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	4.29	4.29	4.29	0.47	1.72 ± 11.0%
3500	± 50 / ± 100	37.9 ± 5%	2.91 ± 5%	4.00	4.00	4.00	0.90	1.19 ± 13.1%
3700	± 50 / ± 100	37.7 ± 5%	3.12 ± 5%	3.58	3.58	3.58	0.90	1.50 ± 13.1%

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

DASY - Parameters of Probe: ES3DV3 SN:3163

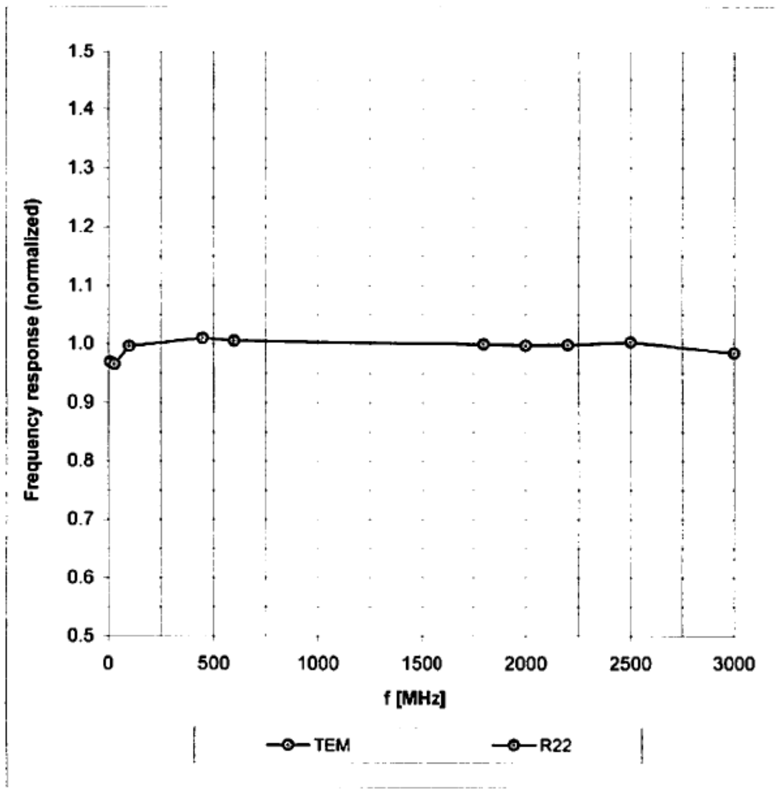
Calibration Parameter Determined in Body Tissue Simulating Media

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

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

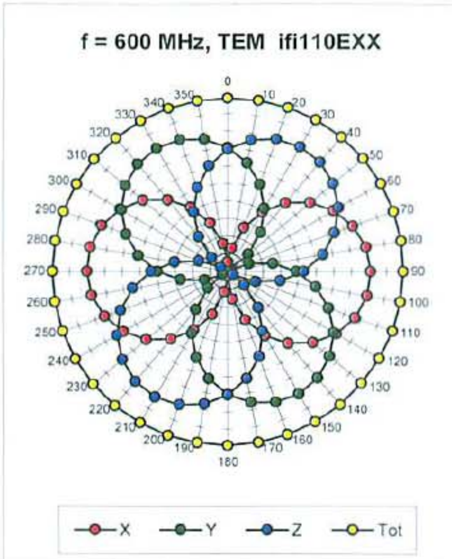
Frequency Response of E-Field

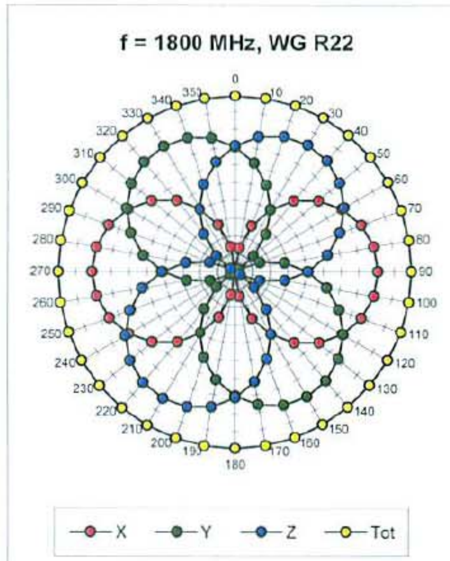
(TEM-Cell:ifi110 EXX, Waveguide: R22)

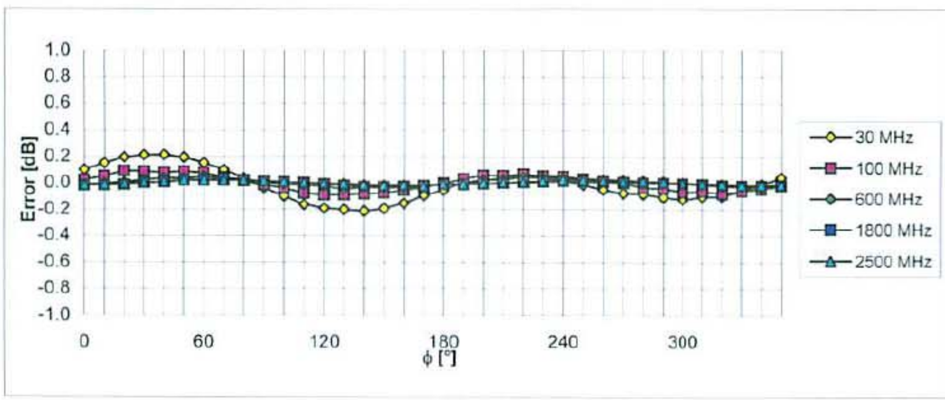


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$



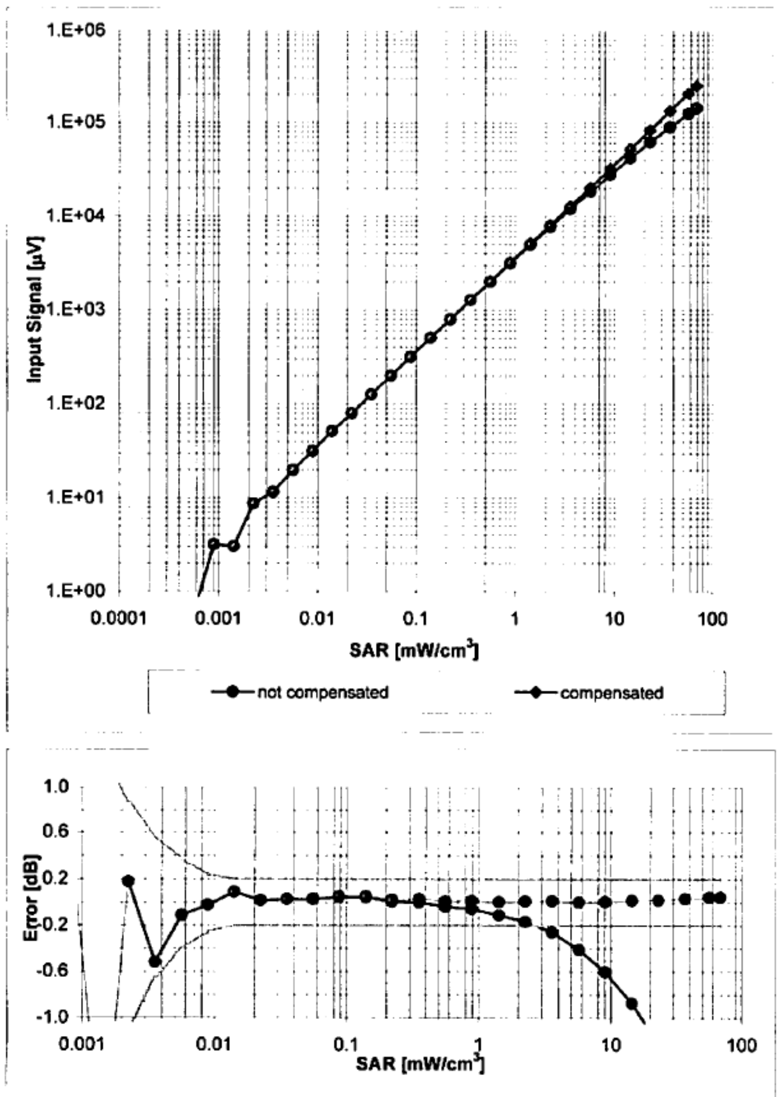




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

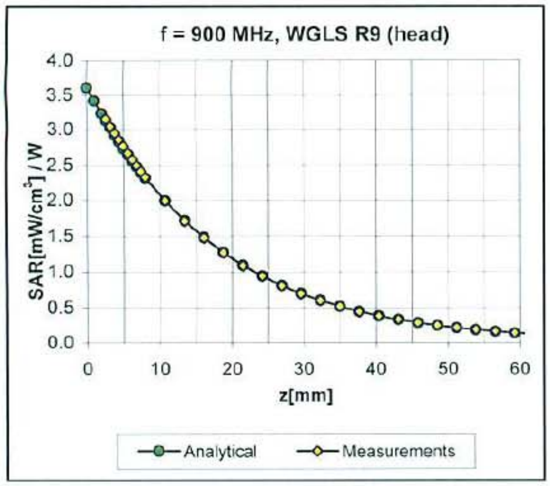
Dynamic Range f(SAR_{head})

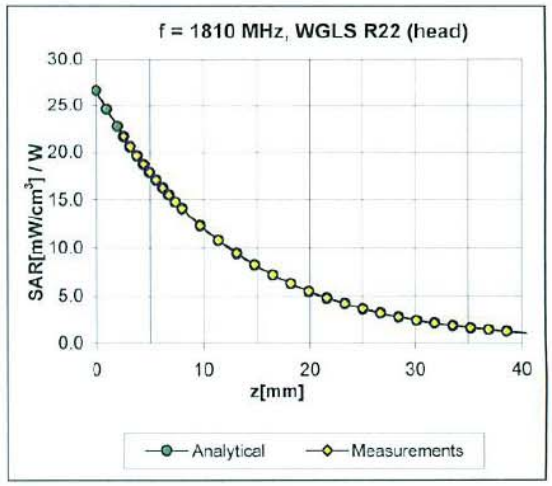
(Waveguide R22, f = 1800 MHz)



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

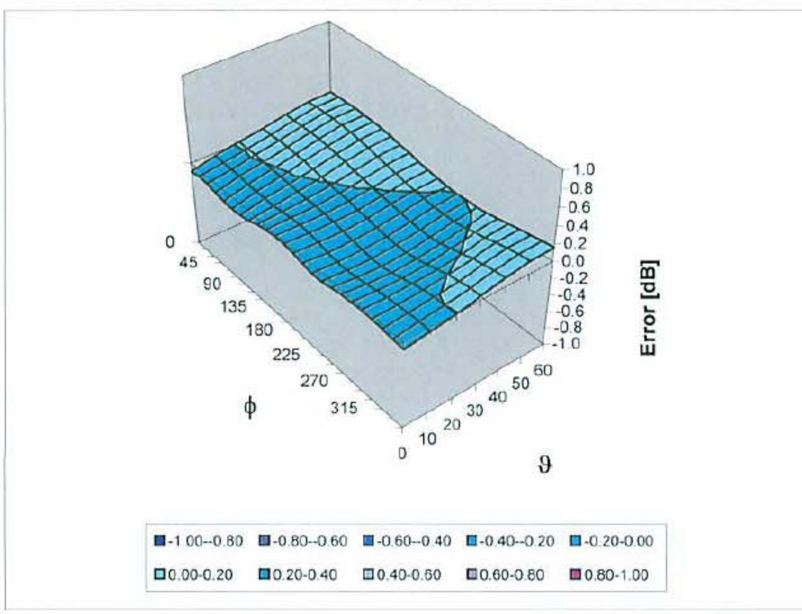
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

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

Schmid & Partner Engineering AG

s p e a g

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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 28, 2010**
Probe Calibration Date:	**April 23, 2010**

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

Assessed by:

Schmid & Partner Engineering AG

s p e a g

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

Dosimetric E-Field Probe ES3DV3 SN:3163

Conversion factor (± standard deviation)

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

Important Note:

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

Please see also Section 4.7 of the DASY4 Manual.

APPENDIX C
Dipole Calibration Certificates

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

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Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Client **Motorola CGISS**

Certificate No: **D300V2-1001_Jul08**

CALIBRATION CERTIFICATE

Object	D300V2 - SN: 1001
Calibration procedure(s)	QA CAL-15.v5 Calibration Procedure for dipole validation kits below 800 MHz
Calibration date:	July 23, 2008
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	01-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	01-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	01-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Mar-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ET3DV6 (LF)	SN: 1507	27-Jun-08 (No. ET3-1507_Jun08)	Jun-09
DAE4	SN: 601	14-Mar-08 (No. DAE4-601_Mar08)	Mar-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	19-Oct-01 (in house check Oct-07)	In house check: Oct-08

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

Issued: July 23, 2008

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

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

Calibration is Performed According to the Following Standards:

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

d) 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	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom V4.4	Shell thickness: 6 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	45.3	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	44.3 ± 6 %	0.84 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	398 mW input power	1.17 mW / g
SAR normalized	normalized to 1W	2.94 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**2.95 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	0.78 mW / g
SAR normalized	normalized to 1W	1.96 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**1.95 mW / g ± 17.6 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.3 Ω - 8.3 jΩ
Return Loss	- 20.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.749 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	August 26, 2002

DASY4 Validation Report for Head TSL

Date/Time: 23.07.2008 11:28:09

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 300 MHz; Type: D300V2; Serial: D300V2 - SN:1001

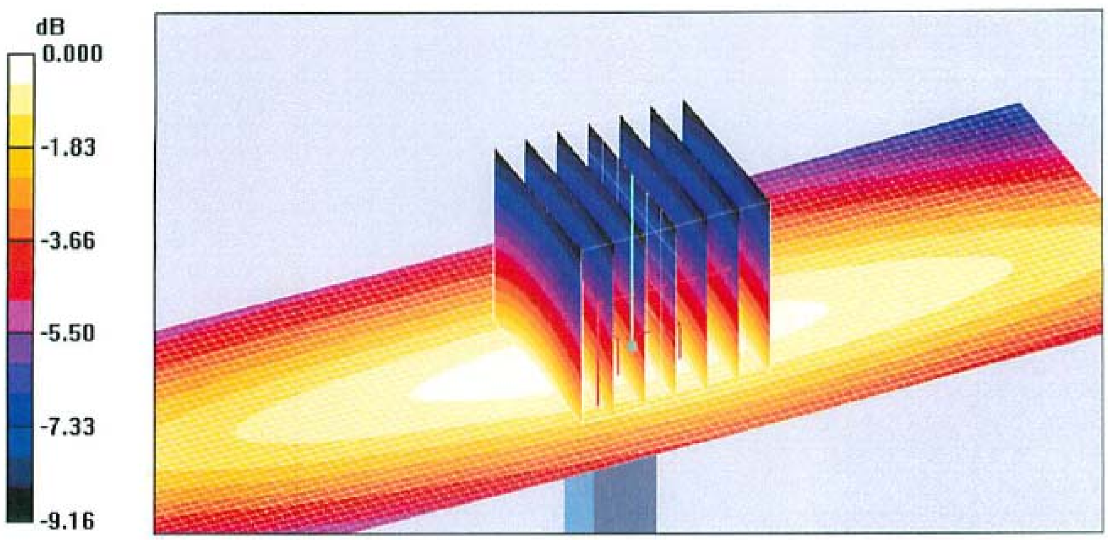
Communication System: CW; Frequency: 300 MHz; Duty Cycle: 1:1
Medium: HSL300;
Medium parameters used: f = 300 MHz; σ = 0.84 mho/m; ε_r = 44.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(7.51, 7.51, 7.51); Calibrated: 27.06.2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; ;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

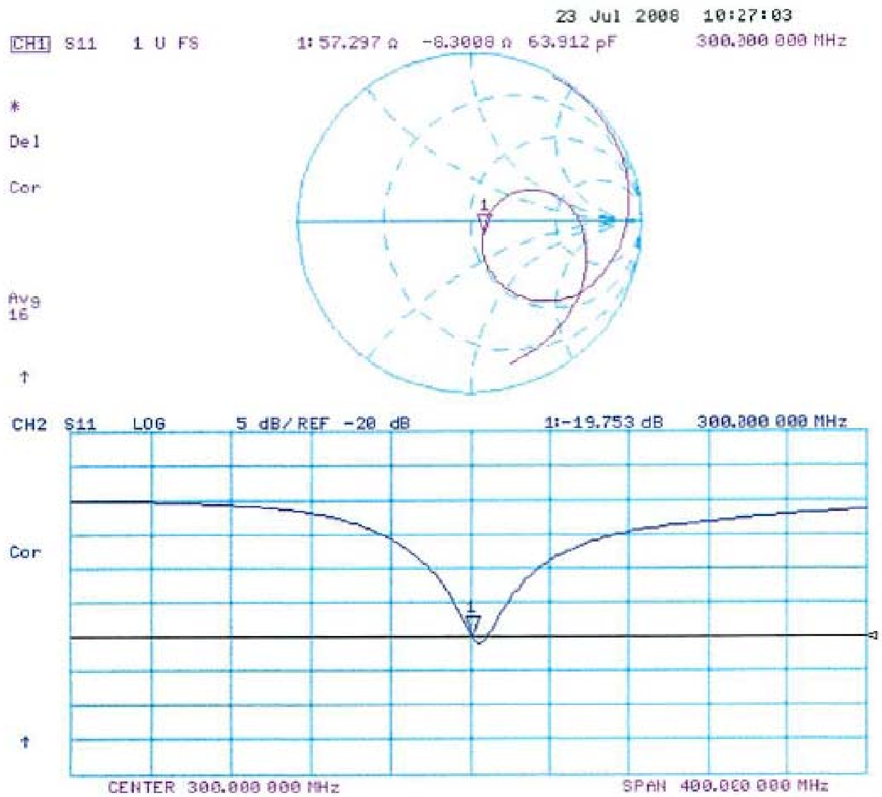
d=15mm, Pin=398mW/Area Scan (41x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.22 mW/g

d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.0 V/m; Power Drift = -0.022 dB
Peak SAR (extrapolated) = 1.84 W/kg
SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.780 mW/g
Maximum value of SAR (measured) = 1.24 mW/g



0 dB = 1.24mW/g

Impedance Measurement Plot for Head TSL



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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D300V2-1001_Jul10**

CALIBRATION CERTIFICATE

Object	D300V2 - SN: 1001
Calibration procedure(s)	QA CAL-15.v5 Calibration Procedure for dipole validation kits below 800 MHz
Calibration date:	July 13, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Type-N mismatch combination	SN: 5047.3 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ET3DV6	SN: 1507	30-Apr-10 (No. ET3-1507_Apr10)	Apr-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	04-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-09)	In house check: Oct-10

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

Issued: July 14, 2010

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S Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

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

d) 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	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom V4.4	Shell thickness: 6 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	45.3	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	0.88 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	398 mW input power	1.26 mW / g
SAR normalized	normalized to 1W	3.17 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**3.15 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	0.83 mW / g
SAR normalized	normalized to 1W	2.08 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**2.07 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω - 9.2 jΩ
Return Loss	- 20.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.747 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	August 26, 2002

DASY5 Validation Report for Head TSL

Date/Time: 13.07.2010 10:35:28

Test Laboratory: SPEAG

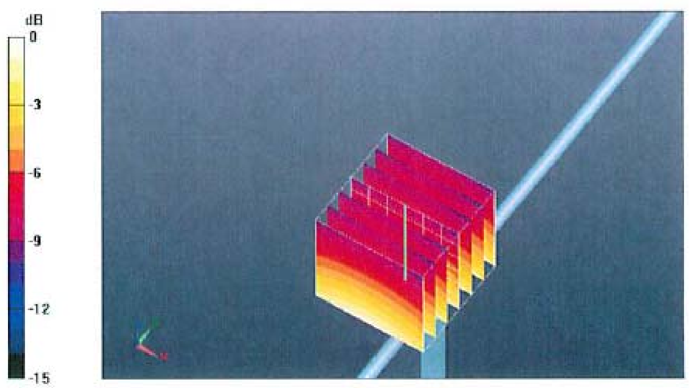
DUT: Dipole 300 MHz; Type: D300V2; Serial: D300V2 - SN:1001

Communication System: CW; Frequency: 300 MHz; Duty Cycle: 1:1
Medium: HSL300
Medium parameters used: f = 300 MHz; σ = 0.88 mho/m; ε_r = 46.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.39, 7.39, 7.39); Calibrated: 30.04.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 23.04.2010
- Phantom: Flat Phantom 4.4 ; Type: Flat Phantom 4.4; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0; Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2Version 14.2.2 (1685)

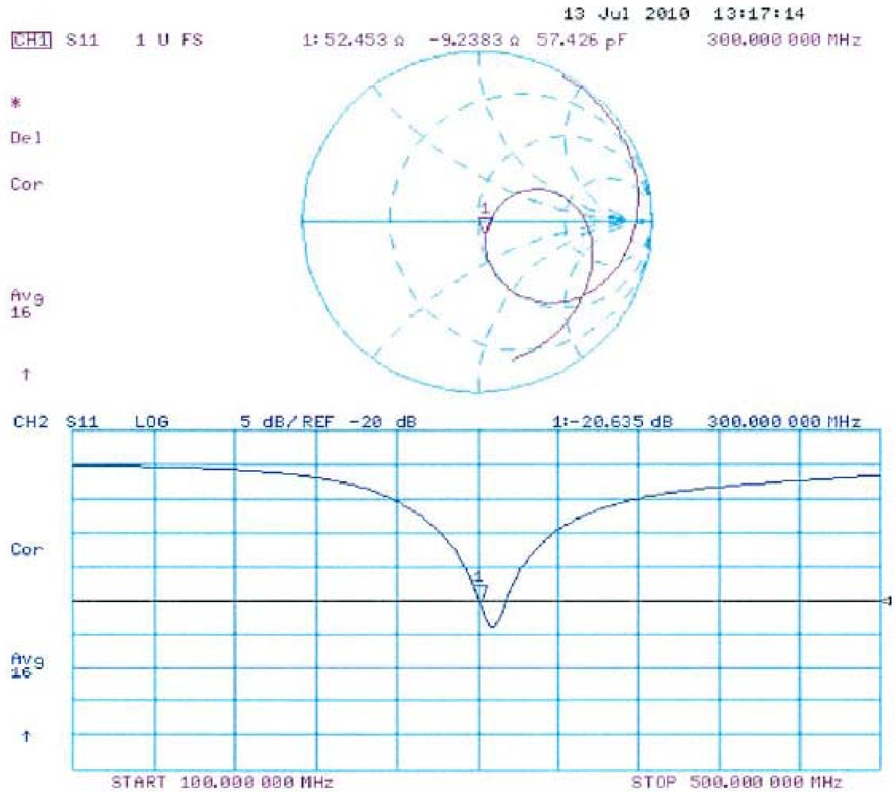
Pin=398mW/d=15mm, Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.1 V/m; Power Drift = -0.034 dB
Peak SAR (extrapolated) = 2.09 W/kg
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.827 mW/g
Maximum value of SAR (measured) = 1.34 mW/g



0 dB = 1.34mW/g

Certificate No: D300V2-1001_Jul10 Page 5 of 6

Impedance Measurement Plot for Head TSL



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Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D300V2-1002_Jan10**

CALIBRATION CERTIFICATE

Object: D300V2 - SN: 1002

Calibration procedure(s): QA CAL-15.v5
Calibration Procedure for dipole validation kits below 800 MHz

Calibration date: January 25, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ET3DV6 (LF)	SN: 1507	03-Jul-09 (No. ET3-1507_Jul09)	Jul-10
DAE4	SN: 654	04-May-09 (No. DAE4-654_May09)	May-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-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-09)	In house check: Oct-10

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

Issued: January 25, 2010

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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:

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

d) 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	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom V4.4	Shell thickness: 6 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	45.3	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	45.8 ± 6 %	0.84 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	398 mW input power	1.19 mW / g
SAR normalized	normalized to 1W	2.99 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**3.08 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	0.79 mW / g
SAR normalized	normalized to 1W	1.99 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**2.04 mW /g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	59.1 Ω - 3.6 jΩ
Return Loss	- 20.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.735 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	August 26, 2002

DASY5 Validation Report for Head TSL

Date/Time: 1/25/2010 12:03:24 PM

DUT: Dipole 300 MHz; Type: D300V2; Serial: D300V2 - SN:1002

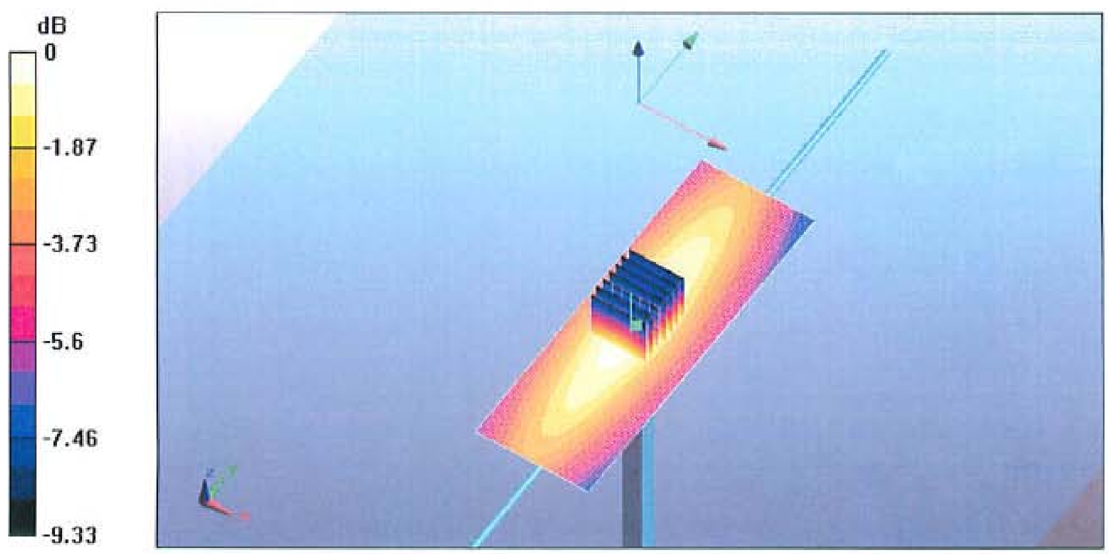
Communication System: CW; Frequency: 300 MHz; Duty Cycle: 1:1
Medium: HSL300
Medium parameters used: f = 300 MHz; σ = 0.84 mho/m; ε_r = 45.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(7.5, 7.5, 7.5); Calibrated: 7/3/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 5/4/2009
- Phantom: Flat Phantom 4.4 ; Type: Flat Phantom 4.4; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 57

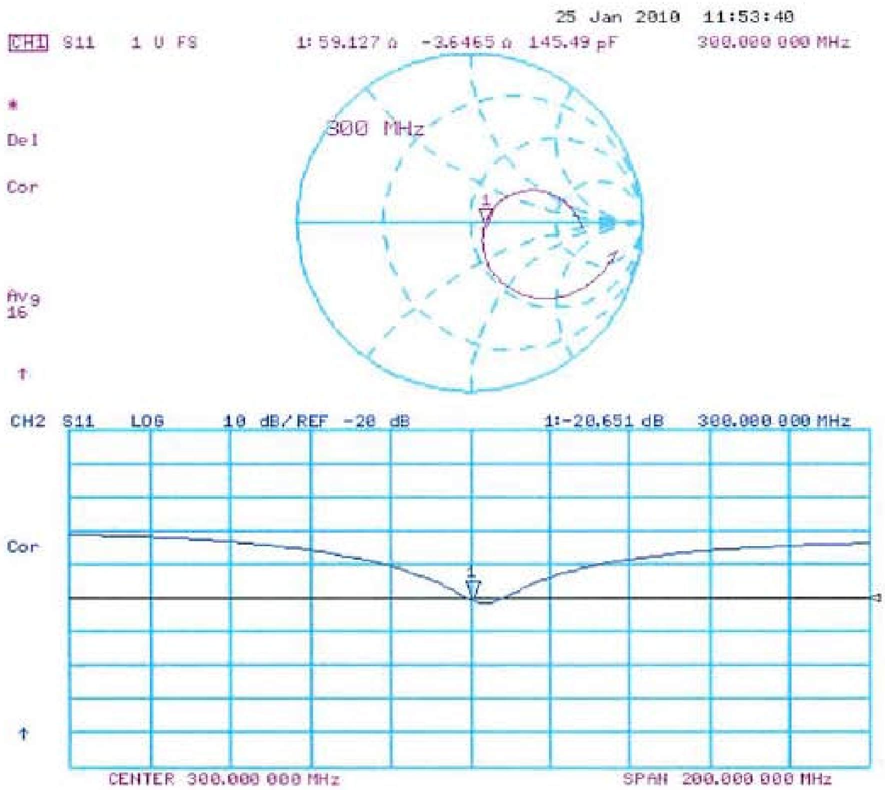
Head/d=15mm, Pin=398mW/Area Scan (41x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.25 mW/g

Head/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.2 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 1.94 W/kg
SAR(1 g) = 1.19 mW/g; SAR(10 g) = 0.791 mW/g
Maximum value of SAR (measured) = 1.27 mW/g



0 dB = 1.27mW/g

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 108

Client **Motorola CGISS**

Certificate No: **D2450V2-704_Nov08**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 704
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	November 18, 2008
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 (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-07 (No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: S5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	14-Mar-08 (No. DAE4-601_Mar08)	Mar-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 18, 2008

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

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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:

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

d) 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	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 mW / g
SAR normalized	normalized to 1W	54.0 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**52.9 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.30 mW / g
SAR normalized	normalized to 1W	25.2 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**24.9 mW /g ± 16.5 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω + 0.8 jΩ
Return Loss	- 28.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 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	March 22, 2001

DASY5 Validation Report for Head TSL

Date/Time: 18.11.2008 12:27:36

Test Laboratory: SPEAG, Zurich, Switzerland

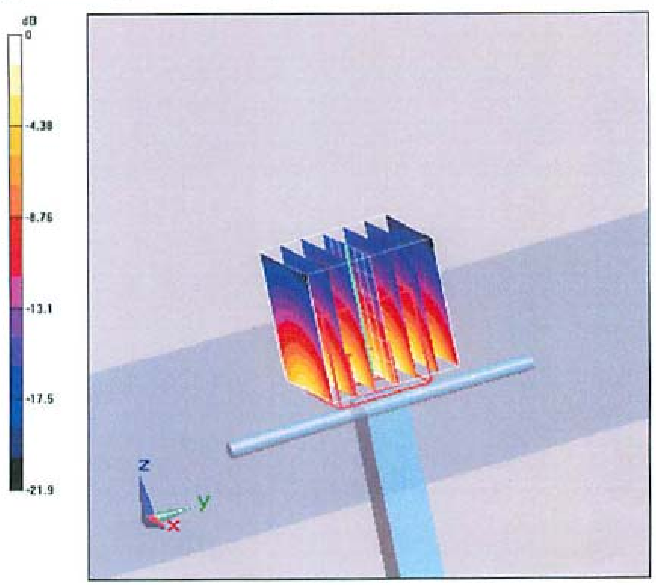
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN704

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB
Medium parameters used: f = 2450 MHz; $\sigma = 1.84$ mho/m; $\varepsilon_r = 38.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.3 V/m; Power Drift = 0.028 dB
Peak SAR (extrapolated) = 28.4 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.3 mW/g
Maximum value of SAR (measured) = 16.3 mW/g



0 dB = 16.3mW/g

Impedance Measurement Plot for Head TSL