MOTOROLA SOLUTIONS

ACCREDITED
TESTING CERT # 2518.05

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

Enterprise Mobility Solutions
EME Test Laboratory
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Date of Report:	**05/07/2013**
Report Revision:	**O**
Report ID:	**SR11252_PMUE4186A Rev O 130507**

Responsible Engineer:	Veeramani Veerapan (Sr.EME Engineer)
Report Author:	Veeramani Veerapan (Sr.EME Engineer)
Date/s Tested:	03/18/13-04/01/13
Manufacturer/Location:	Motorola, Penang
Sector/Group/Div.:	PCR
Date submitted for test:	02/20/13
DUT Description:	403-527 MHz 4W NKP GPS BT /GPS BT GOB
Test TX mode(s):	CW (PTT) for UHF; CW (77 % duty cycle for Bluetooth)
Max. Power output:	4.8 W for UHF; 10 mW for Bluetooth
Nominal Power:	4.0 W for UHF; 2.5 mW for Bluetooth
Tx Frequency Bands:	403-527 MHz, 2.402-2.480 GHz (Bluetooth)
Signaling type:	FM (UHF); FHSS (Bluetooth)
Model(s) Tested:	PMUE4186A
Model(s) Certified:	PMUE4186A
Serial Number(s):	105TPB0013
Classification:	Occupational/Controlled
FCC ID:	AZ489FT4914; Rule Part 90 (406.1-512 MHz)); Rule Part 15 (2402-2480 MHz). Results outside FCC bands are not applicable for FCC compliance demonstration.
IC:	109U-89FT4914; (406.1-430 and 450-470 MHz); Rule Part 15 (2402-2480 MHz).

* 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. Results outside FCC bands are not applicable for FCC compliance demonstration. 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 Solutions Inc EME Laboratory.
I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements. This reporting format is consistent with the suggested guidelines of the TIA TSB-150 December 2004. The results and statements contained in this report pertain only to the device(s) evaluated.

Zakharia Deanna-EDC015

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Approval Date: 5/9/2013

Certification Date: 5/9/2013

Certification No.: L1130407P

Part 1 of 2

APPENDICES

Part 2 of 2

APPENDICES

Report Revision History

Date	Revision	Comments
05/07/2013	O	Initial release

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the Motorola Solutions Inc. EME Test Laboratory for model number PMUE4186A.

2.0 Abbreviations / Definitions

CNR: Calibration Not Required
EME: Electromagnetic Energy
CW: Continuous Wave
DUT: Device Under Test
DC: Duty Cycle
FM: Frequency Modulation/Factory Mutual
NA: Not Applicable
PTT: Push to Talk
RSM: Remote Speaker Microphone
SAR: Specific Absorption Rate
RF: Radio Frequency
NKP: Non-Keypad
FHSS: Frequency Hopping Spread Spectrum
BT: Bluetooth
PI/4DQPSK: Π/4 Differential Quadrature Phase Shift Keying
GFSK: Gaussian Frequency Shift Keying

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 (2009), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2003)
- ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio frequency range between 9 kHz and 300 GHz." and “Attachment to resolution # 303 from July 2, 2002”
- IEC62209-2 Edition 1.0 2010-03, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).

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

4.0 SAR Limits

TABLE 1

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

5.0 SAR Result Scaling Methodology

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

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

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

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

Additional SAR scaling was applied using the methodologies outlined in FCC KDB450824 using tissue sensitivity values. SAR was scaled for conditions where the tissue permittivity was measured above the nominal target and for tissue conductivity that was measured below the nominal target. Negative or reduced SAR scaling is not permitted.

6.0 Description of Device Under Test (DUT)

This device operates using analog frequency modulation (FM) signaling incorporating traditional simplex two-way radio transmission protocol. This device is also wireless BT compatible.

This device also incorporate a Class 1 Bluetooth device which is a Frequency Hopping Spread Spectrum (FHSS) technology. The Bluetooth radio modem is used to wireless link audio accessories. The maximum actual transmission duty cycle is imposed by the Bluetooth standard. Bluetooth v1.1, 1.2, 2.0, and 2.1 packet types of varying duty cycles: 1-slot, 3-slot and 5-slot packets. A 5-slot packet type receives on 1-slot and transmits on 5-slots, and thus is the worst-case. The maximum duty cycle for Bluetooth is 77%.

The model represented under this filing utilizes removable antennas for the 403-527 MHz (UHF) band and fixed internal antenna for 2402-2480 MHz (Bluetooth) band. The nominal output powers are 4.0 watts (UHF), with maximum output powers of 4.8 watts. The nominal BT output power is 0.025 watts and the maximum output power is 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 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 per the guidelines outlined in "SAR Test Reduction Considerations for Occupational PTT Radios" FCC KDB 643646 D01 dated 4/4/11 to assess compliance of this device. The following sections identify the test criteria and details for each accessory category. Refer to Exhibit 7B for antenna separation distances.

7.1 Antennas

There are three UHF antennas and one BT internal antenna offered for this product. The table below lists their descriptions.

TABLE 2

Antenna Models	Description	Selected for test	Tested
PMAE4069A	UHF Stubby Antenna, 403-450 MHz, ¼ wave, -1dBi gain	Yes	Yes
PMAE4070A	UHF Stubby Antenna, 440-490 MHz, ¼ wave, -1dBi gain	Yes	Yes
PMAE4071A	UHF Stubby Antenna, 470-527 MHz, ¼ wave, -1dBi gain	Yes	Yes
0104039J80	IFA Bluetooth Antenna, 2400-2480 MHz, ¼ wave, 0dBi gain	Yes	Yes

7.2 Battery

There is one battery offered for this product. The table below lists its description.

TABLE 3

Battery Models	Description	Selected for test	Tested	Comments
PMNN4440A	BATT STD IP67 LIION1600M1700T	Yes	Yes	

7.3 Body worn Accessory

There is one body worn offered for this product. The table below lists its description.

TABLE 4

Body worn Models	Description	Selected for test	Tested	Comments
PMLN6545A	Plastic Carry Case with Belt Clip	Yes	Yes	

7.4 Audio Accessories

All audio accessories were considered. The table below lists the offered audio accessories and their descriptions. Exhibit 7B illustrates photos of the tested audio accessories.

TABLE 5

Audio Acc. Models	Description	Selected for test	Tested	Comments
NNTN8189C	Non-Secure Wireless Headset & Push-to-Talk Device with Push-to-Talk Audio, 12-Inch Cable	No	No	BT Device
GMTN6356A	Non-Secure Wireless Headset & Push-to-Talk Device with Push-to-Talk Audio, 9-Inch Cable with Euro/UK	No	No	BT Device
PMMN4071A	IMPRES RSM Large, Noise Cancelling with 3.5mm Jack	Yes	No	Per KDB provisions test not required. Intended for test with MDRLN4885B
PMMN4073A	IMPRES RSM Small, with 3.5mm Jack	Yes	No	Per KDB provisions test not required. Intended for test with MDRLN4885B
PMMN4075A	RSM Small, No Emergency, IP57	Yes	No	Per KDB provisions test not required.
PMMN4076A	RSM Small with 3.5mm Jack	Yes	No	Per KDB provisions test not required. Intended for test with MDRLN4885B
MDRLN4885B	Receive-Only Covered Earbud with Coiled Cord, for RSM	Yes	No	Per KDB provisions test not required. Intended for test with PMMN4076A, PMMN4071A & PMMN4073A
MDRLN4941A	Receiver-Only Earpiece with Translucent Tube and Rubber Eartip for RSM	No	No	By similarity to MDRLN4885B
WADN4190B	Receive-Only Flexible Earpiece for RSM	No	No	By similarity to MDRLN4885B
PMLN4620B	D-Shell Receive Only Earpiece for RSM	No	No	By similarity to MDRLN4885B
PMLN5731A	Heavy Duty Headset, Noise Cancelling with In-Line PTT	Yes	No	Per KDB provisions test not required
PMLN5732A	Earset with Boom Microphone, MagOne	Yes	No	Per KDB provisions test not required
PMLN5724A	2-Wire Surveillance Kit, Black	Yes	No	Per KDB provisions test not required
PMLN5726A	2-Wire Surveillance Kit, Beige	No	No	By similarity to PMLN5724A
PMLN5727A	Earpiece In-Line Mic/PTT Swivel, MagOne	Yes	Yes	
PMLN5733A	Earbud with In-Line Mic/PTT, MagOne	No	No	By similarity to PMLN5727A
NNTN8125B	Operations Critical Wireless Earpiece with 12 inch cable	No	No	BT Device
NNTN8126B	Operations Critical Wireless Earpiece with 9.5 inch cable	No	No	BT Device
NNTN8127B	Operations Critical Wireless with Push-To-Talk Pod	No	No	BT Device
89409N	HK200 Bluetooth Earpiece	No	No	BT Device
NNTN8294A	Operations Critical Wireless Earbud with 11.5 inch cable	No	No	Replacement kit
NNTN8295A	Operations Critical Wireless Earbud with 45 inch cable	No	No	Replacement kit
NTN2575A	Replacement Wireless Earpiece 9.5 inch cable	No	No	Replacement kit
NTN8821A	Wireless Earpice Maintenance Kit	No	No	Maintenance Kit
NTN8988A	W10 Ear Strap for Comport Earpiece	No	No	Replacement kit
RLN5037A	W10 Eartubes for Comport Earpiece	No	No	Replacement kit
NNTN8316A	Replacement Ear Tips Kit for Wireless Ear Buds	No	No	Replacement kit
NTN2572A	Replacement Wireless Earpiece 12 inch cable	No	No	Replacement kit
NNTN8191C	Bluetooth POD	No	No	BT Device
NNTN8143C	Wireless POD (piece part of wireless accessory kit# NNTN8125A and NNTN8126A)	No	No	BT Device

8.0 Description of Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

TABLE 6

Dosimetric System type	System version	DAE type	Probe Type
Schmid & Partner Engineering AG SPEAG DASY 5	52.8.2.969	DAE4	ES3DV3 (E-Field)
Schmid & Partner Engineering AG SPEAG DASY 4	4.7 build 80	DAE4	ES3DV3 (E-Field)

The DASY5™ and DASY4™ system is operated per the instructions in the DASY5™ and 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)

TABLE 7

Phantom type	Phantom ID (s)	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
Dual Flat	NA	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190	2mm +/- 0.2mm	Wood	< 0.05
SAM	NA					
Elliptical	ELI4 1050 ELI4 1037 ELI5 1147					

8.3 Description of Simulated Tissue

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 8 below for 450 MHz and 2450 MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Simulated Tissue Composition (by mass)

TABLE 8

Reference Standards	% of listed ingredients	450MHz		2450MHz	
		Head	Body	Head	Body
FCC Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 91-01) IEEE 1528-2003 IEC62209-1 (2005) CENELEC – EN62209-1 (2006)	Sugar	56.0	46.5	0	0
	Diacetin	0	0	51	34.5
	De ionized – Water	39.1	50.53	48.75	65.20
	Salt	3.8	1.87	0.15	0.20
	HEC	1.0	1.0	0	0
	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 9

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Power Meter	E4418B	MY45100739	7/12/2012	7/12/2013
Power Sensor	8481B	SG41090258	6/26/2012	6/26/2013
Power Meter	E4418B	MY45101014	10/31/2012	10/31/2013
Power Sensor	8481B	SG41090248	11/6/2012	11/6/2013
Power Meter	E4418B	MY45100532	11/14/2012	11/14/2013
Power Sensor	8481B	MY41091170	11/6/2012	11/6/2013
Power Meter	E4416A	MY50001037	2/27/2013	2/27/2014
Power Sensor	N8481B	MY51450002	2/26/2013	2/26/2014
Power Meter	E4418B	MY45100911	6/25/2012	6/25/2013
Power Sensor	8481B	MY41091243	6/26/2012	6/26/2013
Bi-Directional Coupler (NARDA)	3020A	41935	8/24/2012	8/24/2013
Bi-Directional Coupler (NARDA)	3022	81639	7/31/2012	7/31/2013
Signal Generator (Agilent)	E4438C	MY45091014	11/2/2012	11/2/2014
Thermometer	HH202A	35882	7/24/2012	7/24/2013
Thermometer	HH202A	35881	12/18/2012	12/18/2013
Therm. Probe	80PK-22	8765	12/18/2012	12/18/2013
Amplifier	10W1000C	312858	CNR*	CNR*
Amplifier	5S1G4	312988	CNR*	CNR*
Dickson Temp & RH Data Logger	TM320	06153216	7/6/2012	7/6/2013
Agilent PNA-L Network Analyzer	E5071B	MY42403147	11/1/2012	11/1/2013
Dielectric Probe Kit (HP)	85070E	MY44300183	CNR*	CNR*
Speag DAE	DAE4	684	12/17/2012	12/17/2013
Speag DAE	DAE4	1294	11/13/2012	11/13/2013
Speag Probe	ES3DV3	3274	11/13/2012	11/13/2012
Speag Probe	ES3DV3	3096	11/13/2012	11/13/2012
Speag Dipole	D2450V2	782	Head-11/22/2011 Body-5/15/2012	Head-11/22/2013 Body-5/15/2014
Speag Dipole	D450V3	1054	11/21/2011 (Body--5/21/2012)	11/21/2013 (Body--5/21/2014)

***Calibration is not required by the OEM. The dielectric probe kit is used in conjunction with a calibrated network analyzer. The dielectric probe kit is calibrated for short, open, and load using the calibrated network analyzer. A saline solution is routinely measured as an additional check point.**

10.0 SAR Measurement System Verification

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.

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 10

Frequency (MHz)	Tissue Type	Conductivity Target & Range (S/m)	Dielectric Constant Target & Range	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
403	FCC Body	0.93 (0.88 -0.97)	57.2 (54.34-60.06)	0.89	55.90	04/01/13
	IEEE / IEC Head	0.87 (0.83-0.91)	44.1 (41.89-46.31)	0.83	44.70	03/19/13
406	FCC Body	0.93 (0.88-0.98)	57.1 (54.25-59.96)	0.89	56.50	03/18/13
	IEEE / IEC Head	0.87 (0.83-0.91)	44.0 (41.8-46.2)	0.84	44.60	03/18/13
440	FCC Body	0.94 (0.89-0.99)	56.8 (53.96-59.64)	0.92	56.00	03/18/13
	IEEE / IEC Head	0.87 (0.83-0.91)	43.62 (41.44-45.80)	0.86	43.90	03/18/13
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.9-59.54)	0.93	55.80	03/18/13
				0.95	55.60	03/29/13
				0.93	55.20	04/01/13
	IEEE / IEC Head	0.87 (0.83-0.91)	43.5 (41.33-45.68)	0.87	43.60	03/18/13
				0.87	43.70	03/19/13
470	IEEE / IEC Head	0.87 (0.83-0.91)	43.4 (41.23-45.57)	0.89	43.20	03/18/13
496	FCC Body	0.94 (0.89-0.99)	56.5 (53.68-59.33)	0.97	55.10	03/18/13
				0.98	54.80	03/29/13
				0.96	54.50	04/01/13
	IEEE / IEC Head	0.87 (0.83-0.91)	43.3 (41.14-45.47)	0.91	42.60	03/18/13
527	FCC Body	0.95 (0.90-0.99)	56.40 (53.58-59.22)	0.99	54.10	04/01/13
	IEEE / IEC Head	0.88 (0.84-0.92)	43.1 (40.95-45.26)	0.91	42.20	03/19/13
2450	FCC Body	1.95 (1.76-2.15)	52.7 (47.4-60.0)	2.04	47.50	03/29/13
2441	FCC Body	1.94 (1.75-2.13)	52.7 (47.4-60.0)	2.02	47.60	03/29/13

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 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 11

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Reference SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3096	FCC Body	SPEAG D450V3 / 1054	4.49 +/- 10%	1.09	4.38	03/18/13
	IEEE /IEC Head	SPEAG D450V3 / 1054	4.75 +/- 10%	1.15	4.60	03/18/13
				1.15	4.61	03/19/13
3274	FCC Body	SPEAG D2450V2 / 782	50.60 +/- 10%	13.40	53.60	03/29/13
		SPEAG D450V3 / 1054	4.49 +/- 10%	1.09	4.36	03/29/13
				1.09	4.36	04/01/13

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 12

	Target	Measured
Ambient Temperature	18 – 25 ˚C	Range: 20.6 – 23.3˚C Avg. 21.4 ˚C
Relative Humidity	30 – 70 %	Range: 27.2 – 69.7 % Avg. 49.3 %
Tissue Temperature	NA	Range: 19.9-20.6˚C Avg. 20.3˚C

Relative humidity target range is a recommended target

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

12.0 DUT Test Methodology

12.1 Measurements

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

12.2 DUT Configuration(s)

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were considered when implementing the guidelines specified in KDB 643646 D01.

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 as applicable.

12.3.2 Head

Not applicable.

12.3.3 Face

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

12.4 DUT Test Channels

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

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

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

12.5 DUT Test Plan

The guidelines and requirements outlined in "SAR Test Reduction Considerations for Occupational PTT Radios" FCC KDB 643646 D01 dated 4/4/11 for head (face) and body were used to assess compliance of this device. All modes of operation identified in section 6.0 were considered during the development of the test plan. All tests were performed in 100% CW mode and then 50% duty cycle was applied to the final results. The initial power measured are within range of 95% to 100% of the max power.

13.0 DUT Test Data

13.1 Assessments at the Body

The battery PMNN4440A was selected as the default battery for assessments at the Body since it is the only battery offered (refers to Exhibit 7B for the dimension of the battery). The conducted power measurement for all test channels within Part 90 frequency range (406.1-512 MHz) using the default battery PMNN4440A is indicated in Table 13. The channel with the highest conducted power will be identified as the default channel per KDB 643646 D01 SAR Test for PTT Radios v01r01. SAR plots of the highest results per table (bolded) are presented in APPENDICES E-G.

TABLE 13

Test Freq (MHz)	Power (W)
406.125	4.79
417.5	4.75
425.5	4.72
436	4.79
440	4.74
450	4.70
458	4.67
465	4.67
470	4.68
475	4.68
484	4.67
490	4.72
496	4.75
512	4.74

13.2 Assessments at the Body with Body worn PMLN6545A

Assessment of the offered antennas with the default battery and body worn PMLN6545A per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 14

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4069A	PMNN4440A	PMLN6545A	PMLN5727A	406.125	4.80	-0.255	4.864	3.572	2.58	1.89	Lee-AB-130318-03
				417.500							
				425.500							
				436.000							
				450.000							
PMAE4070A	PMNN4440A	PMLN6545A	PMLN5727A	440.000	4.74	-0.080	4.938	3.600	2.55	1.86	Lee-AB-130318-05
				450.000							
				458.000							
				465.000							
				475.000							
				490.000							
PMAE4071A	PMNN4440A	PMLN6545A	PMLN5727A	470.000							
				484.000							
				490.000							
				496.000	4.76	-0.541	5.910	4.280	**3.38**	**2.44**	Lee-AB-130318-06
				512.000							

13.3 Assessments at the Body with other audio accessories

Assessment per "KDB 643646 D01 Body SAR Test Consideration for Audio Accessories without Built-in Antenna; Sec 1, A. when overall < 4.0 W/kg, SAR tested for that audio accessory is not necessary." This was applicable to all remaining accessories.

13.4 Assessments of wireless BT configuration

Assessment using the overall highest SAR configuration at the body from above without an audio accessory attached.

TABLE 15

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4071A	PMNN4440A	PMLN6545A	NONE	470.000							
				484.000							
				490.000							
				496.000	4.79	-0.570	7.100	5.150	**4.06**	**2.94**	PS-AB-130329-06
				512.000							

13.5 Assessments outside FCC Part 90 at the Body

Assessment using highest SAR configuration from Part 90 assessment above Run# PS-AB-130329-06, Table 15) across the offered antennas (if applicable).

TABLE 16

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4069A	PMNN4440A	PMLN6545A	NONE	403.000	4.71	-0.350	6.000	4.440	3.31	2.45	Lee-AB-130401-05
PMAE4071A	PMNN4440A	PMLN6545A	NONE	527.000	4.79	-0.770	6.350	4.610	**3.80**	**2.76**	Lee-AB-130401-06

13.6 Assessments at the Face

The battery PMNN4440A was selected as the default battery for assessments at the Face since it is the only battery offered (refers to Exhibit 7B for the dimension of the battery). The conducted power measurement for all test channels within Part 90 frequency range (406.1-512 MHz) using the default battery PMNN4440A is indicated in Table 17. The channel with the highest conducted power will be identified as the default channel per KDB 643646 D01 SAR Test for PTT Radios v01r01. SAR plots of the highest results per table (bolded) are presented in APPENDICES E-G.

TABLE 17

Test Freq (MHz)	Power (W)
406.125	4.79
417.5	4.75
425.5	4.72
436	4.79
440	4.74
450	4.70
458	4.67
465	4.67
470	4.68
475	4.68
484	4.67
490	4.72
496	4.75
512	4.74

Assessment of the offered antennas with the default battery PMNN4440A, front of DUT facing phantom per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Head SAR Test Considerations. Refer to Table 17 for highest output power channel.

TABLE 18

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4069A	PMNN4440A	NONE	NONE	406.125	4.80	-0.371	5.440	4.033	2.96	2.20	Lee-FACE-130318-08
				417.500							
				425.500							
				436.000							
				450.000							
PMAE4070A	PMNN4440A	NONE	NONE	440.000	4.73	-0.020	4.061	3.004	2.07	1.53	Lee-FACE-130318-09
				450.000							
				458.000							

				465.000							
				475.000							
				490.000							

(Continued) TABLE 18

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4071A	PMNN4440A	NONE	NONE	470.000	4.71	0.050	7.210	5.330	3.67	2.72	Lee-FACE-130318-11
				484.000							
				490.000							
				496.000	4.78	-0.536	6.620	4.870	**3.76**	**2.77**	Lee-FACE-130318-10
				512.000							

13.7 Assessments outside FCC Part 90 at the Face

Assessment using highest SAR configuration from Part 90 assessment above Run# HvH-Face-130311-04, Table 26) across the offered antennas (if applicable).

TABLE 19

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4069A	PMNN4440A	NONE	NONE	403.000	4.70	-0.336	5.088	3.779	2.81	2.08	PS-FACE-130319-11
PMAE4071A	PMNN4440A	NONE	NONE	527.000	4.79	-0.349	6.420	4.720	**3.49**	**2.56**	PS-FACE-130319-13

13.8 Assessments for Industry Canada

Based on the assessment results for body and face per KDB643646 D01, additional tests were not required for the Industry Canada frequency range (406.1-430 MHz) and (450-470 MHz) as the testing performed is in compliance with Industry Canada frequency range.

13.9 Assessment of BT band

Assessment of Bluetooth band at center frequency using the overall worst case configuration from body herein. The max calc SAR is added to the overall highest SAR result of the primary transmitter to obtain the simultaneous result in section 15.0.

TABLE 20

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#

0104039J80 (2400-2480 MHz)	PMNN4440A	PMLN6545A	NONE	2441.000	0.01	-0.240	0.00640	0.00305	**0.005**	**0.002**	Lee-AB-130329-09

13.10 Shortened Scan Assessment

A “shortened” scan using the highest SAR configuration overall from the Part 90 was performed to validate the SAR drift of the full DASY5™ coarse and 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 zoom scan only was performed. The results of the shortened cube scan presented in APPENDIX E demonstrate that the scaling methodology used to determine the calculated SAR results presented herein are valid. The SAR results from the table below is provided in APPENDIX E.

TABLE 21

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
Full scan											
PMAE4071A	PMNN4440A	PMLN6545A	NONE	496.000	4.79	-0.570	7.100	5.150	4.06	2.94	PS-AB-130329-06
Shorten scan											
PMAE4071A	PMNN4440A	PMLN6545A	NONE	496.000	4.79	-0.380	7.430	5.430	4.06	2.97	Lee-AB-130401-07

13.11 Variability Assessment

The test configuration(s) with test results >4.0mW/g were assessed per KDB 865664 D01 (10/24/2012). The below table includes test results of the original measurement(s), the repeated measurement(s), and the ratio (SAR_{high}/SAR_{low}) for the applicable test configuration(s).

TABLE 22

Run#	Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq. (MHz)	Adj Calc. 1g-SAR (W/kg)	Ratio	Comments
PS-AB-130329-06 (Table 21, full scan)	PMAE4071A	PMNN4440 A	PMLN6545A	NONE	496.000	4.06	1.00	No additional repeated scans is required due to the Ratio (SAR_{high}/SAR_{low}) < 1.10
Lee-AB-130401-07 (Table 21, shorten scan)						4.06		

14.0 Simultaneous Transmission Exclusion

Simultaneous Transmission applies. Please see section 15.0.

15.0 Conclusion

Based on the test guidelines from KDB 643646 and satisfying frequencies within the FCC band to be in compliance with Industry Canada frequency range, the highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing:

TABLE 23

Designator	Frequency band (MHz)	BODY				FACE	
		Max Calc (mW/g)		Simultaneous Calc (mW/g)		Max Calc (mW/g)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR	1g-SAR	10g-SAR
Overall	403-527	4.06	2.97	4.07	2.97	3.76	2.77
FCC	406.1-512	4.06	2.97	4.07	2.97	3.76	2.77
Industry Canada	406.1-430 & 450-470	2.58	1.89	NA	NA	3.67	2.72

All results are scaled to the maximum output power

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.

APPENDIX A
Measurement Uncertainty

The Measurement Uncertainty tables indicated in this APPENDIX are applicable to the DUT test frequencies ranging from 300MHz to 550MHz, 800MHz to 3GHz and for Dipole test frequencies ranging from 300MHz to 550MHz and 800MHz to 3GHz. Therefore, the highest tolerance for the probe calibration uncertainty is indicated.

Table 1

Uncertainty Budget for Device Under Test, for 300 MHz to 550 MHz

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	6.7	N	1.00	1	1	6.7	6.7	∞
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				12	11	482
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k* =2				23	23	

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Table 2

Uncertainty Budget for System Verification (dipole & flat phantom) for 300 MHz to 550 MHz

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	6.7	N	1.00	1	1	6.7	6.7	∞
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	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				10	9	9999 9
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				19	19	

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Table 3
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	6.0	N	1.00	1	1	6.6	6.6	∞
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	472
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				23	22	

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Table 4
Uncertainty Budget for System Verification (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	6.0	N	1.00	1	1	6.6	6.6	∞
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	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				10	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				19	18	

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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 MY**

Certificate No: **ES3-3274_Nov12**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3274
Calibration procedure(s)	QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	November 13, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: November 14, 2012

Certificate No: ES3-3274_Nov12 Page 1 of 11

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

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Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
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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 affect 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.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *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:3274

Manufactured: February 25, 2010
Calibrated: November 13, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3274

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.22	1.13	1.19	± 10.1 %
DCP (mV)[B]	99.7	99.3	100.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.0	0.0	1.0	151.5	±3.8 %
			Y	0.0	0.0	1.0	148.1	
			Z	0.0	0.0	1.0	152.3	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3274

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	45.3	0.87	7.05	7.05	7.05	0.26	1.08	± 13.4 %
450	43.5	0.87	6.50	6.50	6.50	0.16	1.89	± 13.4 %
750	41.9	0.89	6.39	6.39	6.39	0.30	1.97	± 12.0 %
900	41.5	0.97	6.13	6.13	6.13	0.63	1.27	± 12.0 %
1810	40.0	1.40	5.20	5.20	5.20	0.45	1.51	± 12.0 %
1950	40.0	1.40	4.98	4.98	4.98	0.51	1.52	± 12.0 %
2300	39.5	1.67	4.81	4.81	4.81	0.80	1.19	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.62	1.47	± 12.0 %
2600	39.0	1.96	4.32	4.32	4.32	0.79	1.32	± 12.0 %

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3274

Calibration Parameter Determined in Body Tissue Simulating Media

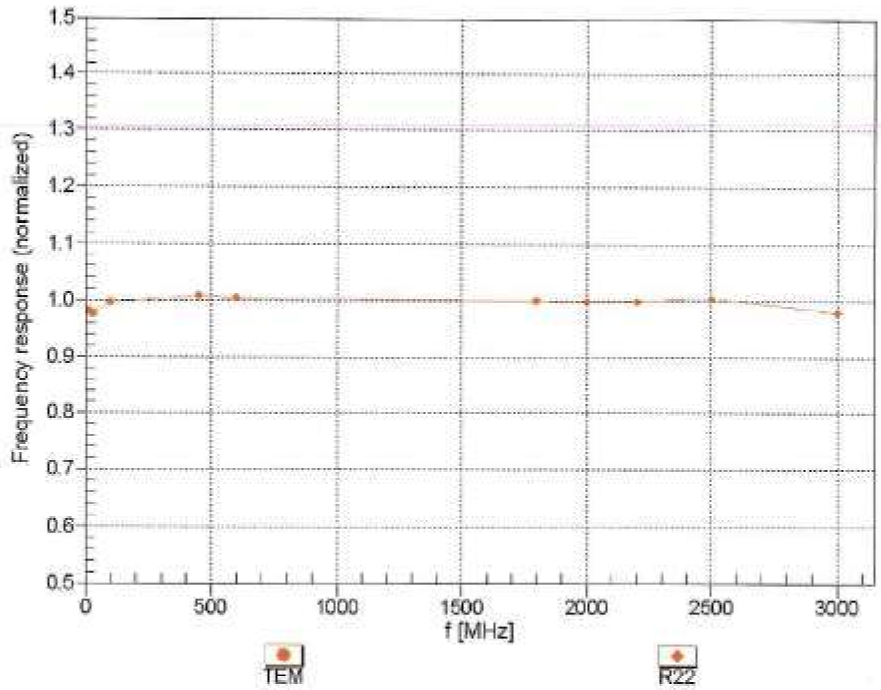
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	6.72	6.72	6.72	0.22	1.77	± 13.4 %
450	56.7	0.94	7.02	7.02	7.02	0.10	1.15	± 13.4 %
750	55.5	0.96	6.13	6.13	6.13	0.80	1.15	± 12.0 %
900	55.0	1.05	5.98	5.98	5.98	0.44	1.66	± 12.0 %
1810	53.3	1.52	4.89	4.89	4.89	0.52	1.51	± 12.0 %
1950	53.3	1.52	4.82	4.82	4.82	0.45	1.72	± 12.0 %
2300	52.9	1.81	4.44	4.44	4.44	0.76	1.29	± 12.0 %
2450	52.7	1.95	4.27	4.27	4.27	0.80	1.14	± 12.0 %
2600	52.5	2.16	4.05	4.05	4.05	0.80	1.07	± 12.0 %

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

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

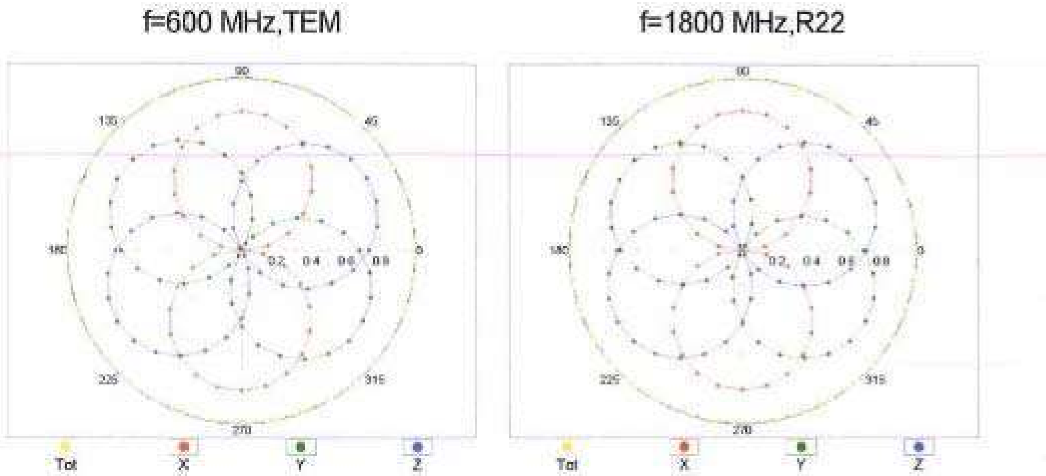
ES3DV3– SN:3274 November 13, 2012

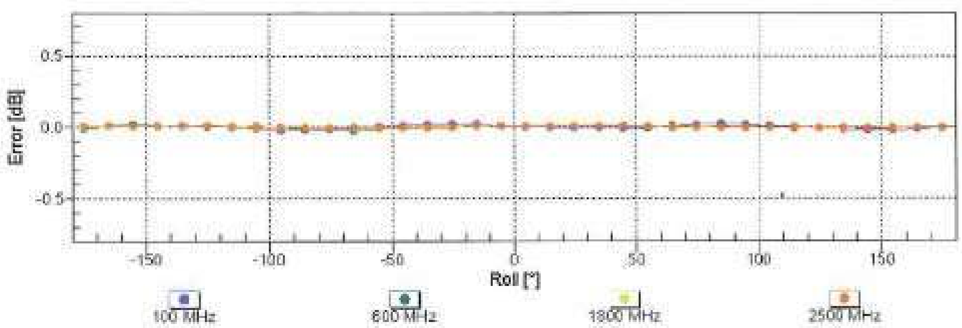
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

Receiving Pattern (ϕ), ϑ = 0°

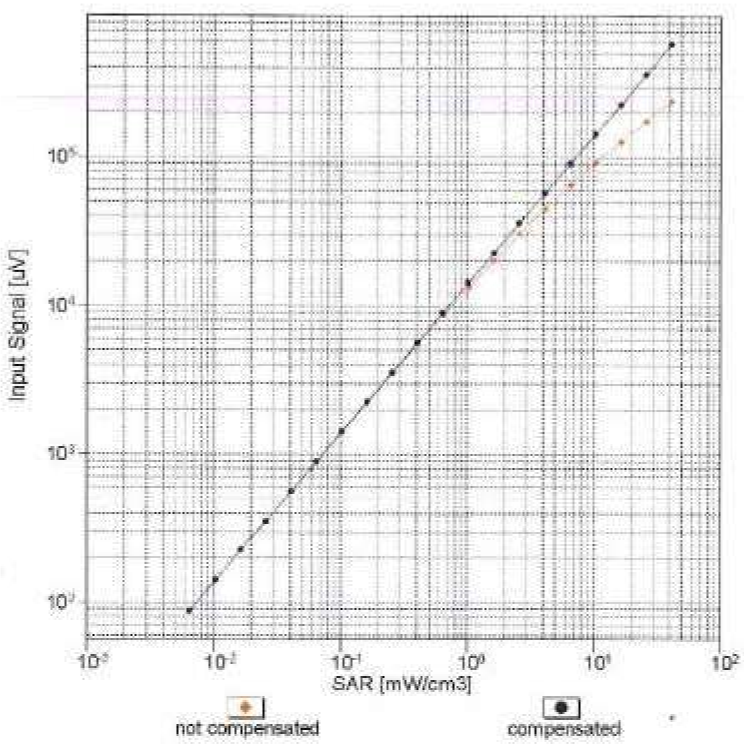


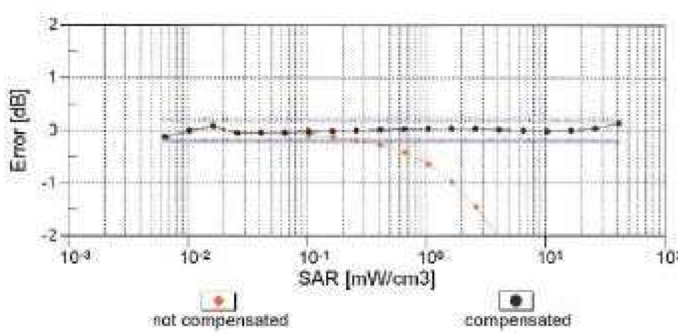


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ES3DV3– SN:3274 November 13, 2012

Dynamic Range f(SAR$_{head}$)
(TEM cell , f = 900 MHz)



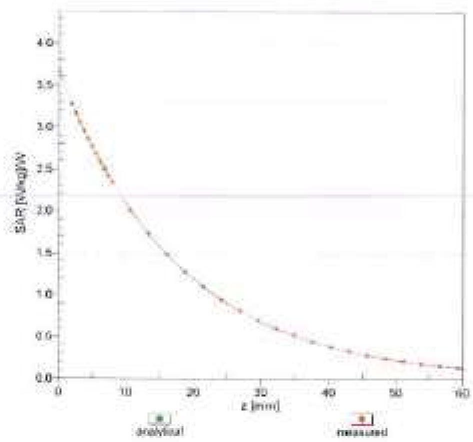


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

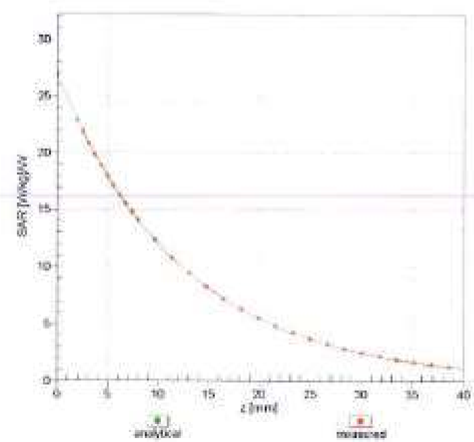
ES3DV3– SN:3274 November 13, 2012

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

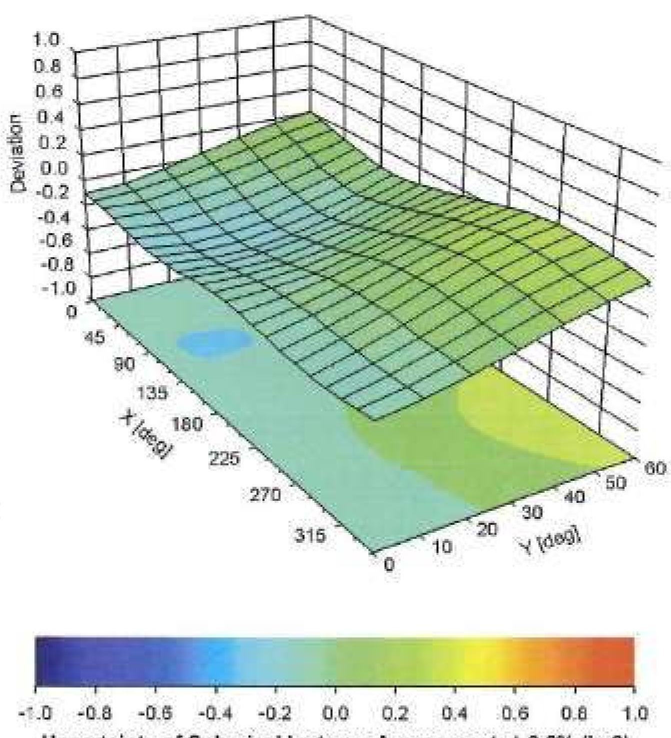


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3274

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	54.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Schmid & Partner Engineering AG **s p e a g**

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Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3274**
Place of Assessment:	**Zurich**
Date of Assessment:	**November 15, 2012**
Probe Calibration Date:	**November 13, 2012**

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 450, 900 and at 1810 MHz.

Assessed by:

Schmid & Partner Engineering AG

s p e a g

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Dosimetric E-Field Probe ES3DV3 SN:3274

Conversion factor (± standard deviation)

150 ± 50 MHz	*ConvF*	**8.3 ± 10%**	**ε_r = 52.3 ±5%** **σ = 0.76 ±5%mho/m** (head tissue)
150 ± 50 MHz	*ConvF*	**8.0 ± 10%**	**ε_r = 61.9 ±5%** **σ = 0.80 ±5%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 DASY Manual.

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Accreditation No.: **SCS 108**

Client **Motorola MY**

Certificate No: **ES3-3096_Nov12**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3096

Calibration procedure(s): QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: November 13, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
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Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: November 14, 2012

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

Certificate No: ES3-3096_Nov12 Page 1 of 11

Calibration Laboratory of
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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 affect 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.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *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:3096

Manufactured: July 12, 2005
Calibrated: November 13, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)²)[A]	1.27	1.03	1.23	± 10.1 %
DCP (mV)[B]	100.2	99.4	100.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.0	0.0	1.0	156.4	±3.5 %
			Y	0.0	0.0	1.0	141.0	
			Z	0.0	0.0	1.0	156.6	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	45.3	0.87	6.75	6.75	6.75	0.25	1.04	± 13.4 %
450	43.5	0.87	6.31	6.31	6.31	0.17	1.93	± 13.4 %
750	41.9	0.89	6.18	6.18	6.18	0.78	1.15	± 12.0 %
900	41.5	0.97	5.90	5.90	5.90	0.40	1.55	± 12.0 %
1810	40.0	1.40	4.83	4.83	4.83	0.80	1.13	± 12.0 %
1950	40.0	1.40	4.60	4.60	4.60	0.62	1.33	± 12.0 %
2300	39.5	1.67	4.47	4.47	4.47	0.55	1.39	± 12.0 %
2450	39.2	1.80	4.26	4.26	4.26	0.79	1.24	± 12.0 %
2600	39.0	1.96	4.10	4.10	4.10	0.80	1.25	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	6.56	6.56	6.56	0.22	1.78	± 13.4 %
450	56.7	0.94	6.79	6.79	6.79	0.11	1.15	± 13.4 %
750	55.5	0.96	5.91	5.91	5.91	0.46	1.45	± 12.0 %
900	55.0	1.05	5.82	5.82	5.82	0.77	1.17	± 12.0 %
1810	53.3	1.52	4.70	4.70	4.70	0.67	1.34	± 12.0 %
1950	53.3	1.52	4.66	4.66	4.66	0.43	1.79	± 12.0 %
2300	52.9	1.81	4.26	4.26	4.26	0.61	1.47	± 12.0 %
2450	52.7	1.95	4.12	4.12	4.12	0.64	1.18	± 12.0 %
2600	52.5	2.16	3.92	3.92	3.92	0.80	1.01	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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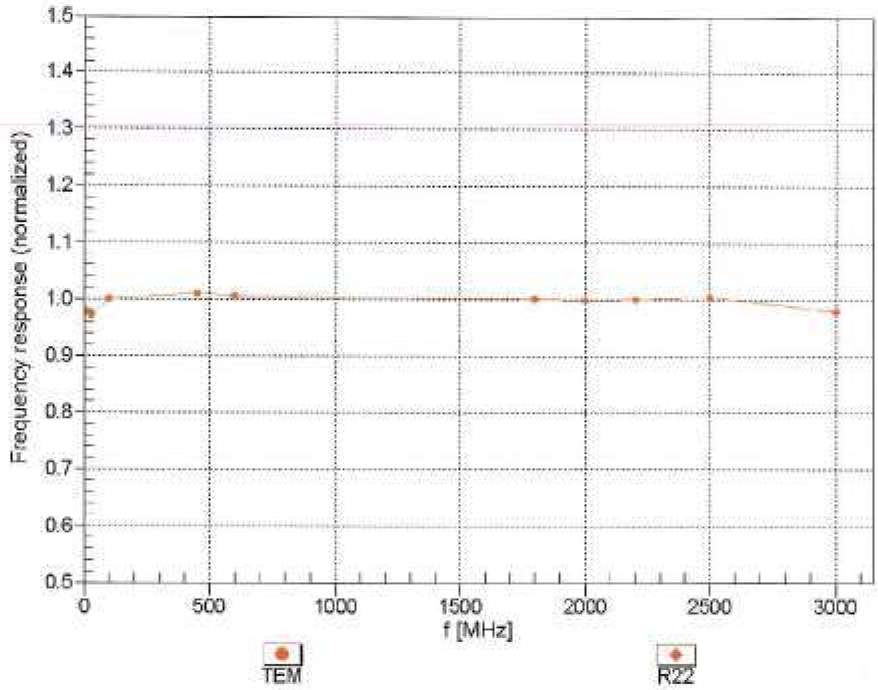
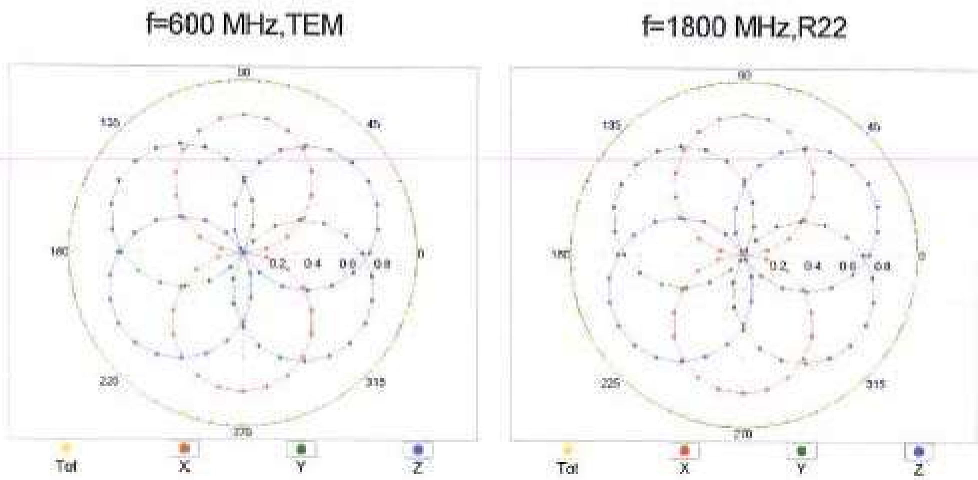
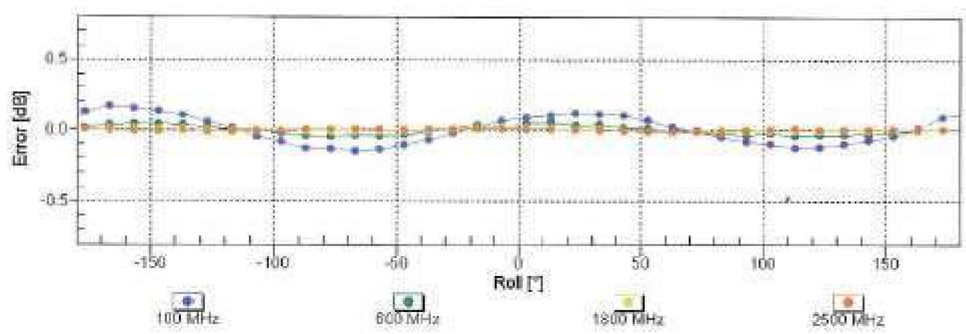
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

Receiving Pattern (ϕ), ϑ = 0°

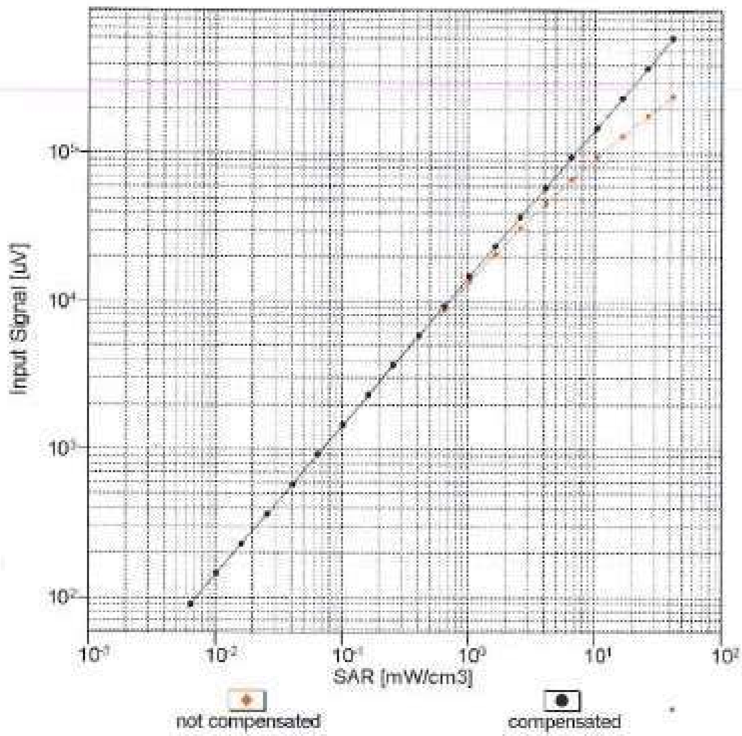


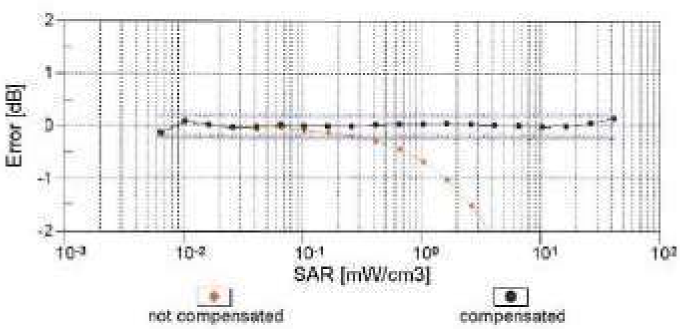


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

(TEM cell , f = 900 MHz)

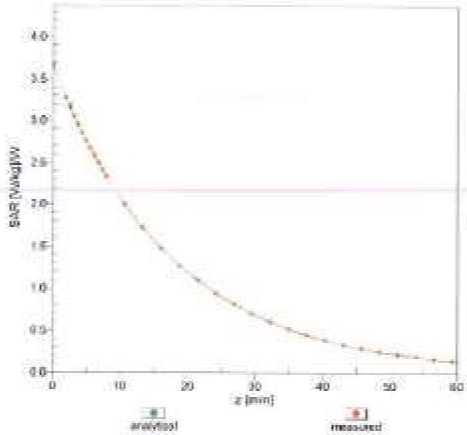




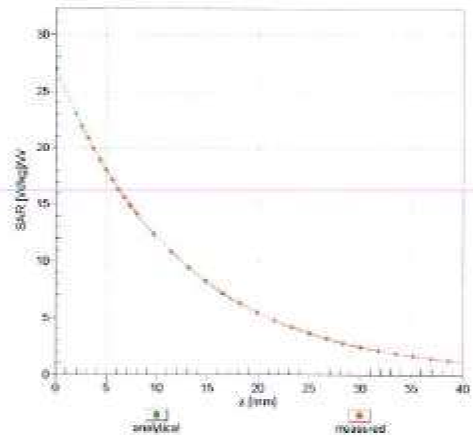
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

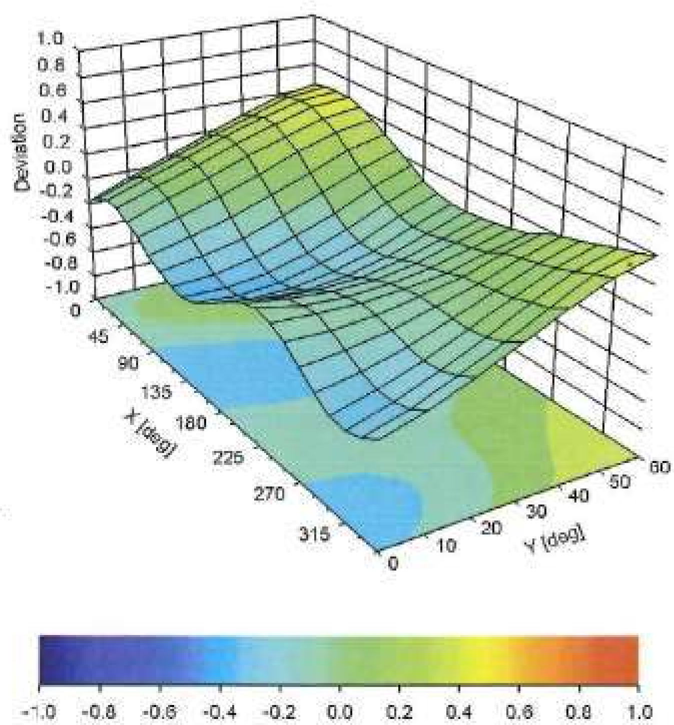


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	43.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3096**
Place of Assessment:	**Zurich**
Date of Assessment:	**November 15, 2012**
Probe Calibration Date:	**November 13, 2012**

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 450, 900 and at 1810 MHz.

Assessed by:

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Dosimetric E-Field Probe ES3DV3 SN:3096

Conversion factor (± standard deviation)

150 ± 50 MHz	*ConvF*	**8.0 ± 10%**	ε_r = **52.3 ±5%** σ = **0.76 ±5%mho/m** (head tissue)
150 ± 50 MHz	*ConvF*	**7.7 ± 10%**	ε_r = **61.9 ±5%** σ = **0.80 ±5%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 DASY Manual.