



**DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2**

**Motorola Solutions Inc.**  
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**Report ID:** SR10604 APX3000 7/800 Rev A 121016

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**Date/s Tested:** 7/23/2012- 10/15/2012  
**Manufacturer/Location:** Motorola, Penang  
**Sector/Group/Div.:** AESS – Astro Engineering Subscriber Solutions  
**Date submitted for test:** 7/11/2012  
**DUT Description:** 764-775 MHz and 794-805 MHz at 2.5 W, 806 -824 MHz and 851-870 MHz at 3 W, 6.25kHz/12.5kHz/25kHz, Capable of digital and analog FM transmission. Also capable of TDMA transmission. This radio is Bluetooth equipped.  
**Test TX mode(s):** CW (PTT); CW (Bluetooth)  
**Max. Power output:** 2.99 W (764MHz – 805 MHz); 3.6 W (806-870 MHz); 10 mW (Bluetooth)  
**Nominal Power:** 2.5 W (764MHz – 805 MHz); 3.0 W (806-870 MHz); 10 mW (Bluetooth)  
**Tx Frequency Bands:** 764-775 MHz , 794-805 MHz ; 806 -824 MHz; 851-870 MHz ; 2.402-2.480 GHz (Bluetooth)  
**Signaling type:** FM, TDMA, FHSS (Bluetooth)  
**Model(s) Tested:** H59UCD9PW4AN (MUF1611)  
**Model(s) Certified:** H59UCD9PW4AN (MUF1611)  
**Serial Number(s):** 536TNM0184  
**Classification:** Occupational/Controlled  
**FCC ID:** AZ489FT5860; Rule Part 90 (764-869MHz); Rule Part 15 (2402 – 2480 MHz) Results outside FCC bands are not applicable for FCC compliance demonstration.  
**IC:** 109U-89FT5860

\* 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 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.

**Deanna Zakharia**  
 EMS EME Lab Senior Resource Manager,  
 Laboratory Director  
 Approval Date: 10/17/2012

**Certification Date:** 10/17/2012

**Certification No.:** L1121010P

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**Report Revision History**

Date	Revision	Comments
9/27/2012	O	Initial release
10/16/2012	A	Removed non applicable test information

## 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 H59UCD9PW4AN (MUF1611).

## 2.0 Abbreviations / Definitions

CNR: Calibration Not Required  
EME: Electromagnetic Energy  
CQPSK: Compatible Quadrature Phase-Shift Keying  
FHSS: Frequency Hopping Spread Spectrum  
BT: Bluetooth  
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  
TDMA: Time Division Multiple Access  
RF: Radio Frequency  
C4FM: Compatible 4-level Frequency Modulation  
DSP: Digital Signal Processor

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:

$$Max\_Calc = SAR\_meas \cdot 10^{\frac{-Drift}{10}} \cdot \frac{P\_max}{P\_int} \cdot DC$$

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

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

The model represented under this filing utilizes removable antennas and an internal fixed antenna (Bluetooth) capable of transmitting in the 764-870 MHz and 2.402-2.480 GHz (Bluetooth) bands respectively. The nominal output powers are 2.5 W (764-805 MHz) and

3.0 W (806-870 MHz) with maximum output powers of 2.99 W (764-805 MHz) and 3.6 W (806-870 MHz). The nominal BT output power is 0.010 W and the maximum output power is 0.010 W as defined by upper limit of the production line final test station. The intended operating positions are “at the body” by means of the offered body worn accessories. Body worn audio 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. This device is not intended for operations at the face.

**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. Note that per the thresholds outlined in the KDB not all offered accessories selected for test were tested. 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 removable 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
NAF5085A	7/800 MHz/GPS antenna; 764-870/1575 MHz ¼ wave	Yes	Yes
NAR6595A	7/800 MHz/GPS stubby antenna; 764-870/1575 MHz ¼ wave	Yes	Yes
84009370001	internal speaker/mic/flex Bluetooth; 2402-2481 MHz ¼ wave	Yes	NA

**7.2 Batteries**

There are four batteries offered for this product. The table below lists the batteries, and battery description.

**TABLE 3**

Battery Models	Description	Selected for test	Tested	Comments
NNTN8128B	IMPRES Li Ion Slim Battery Non FM 1900mAh	Yes	Yes	
NNTN8129A	IMPRES Li Ion High Cap Battery FM, 2300 mAh	Yes	Yes	
PMNN4424A	IMPRES Li Ion High Cap Battery non FM, 2300 mAh	No	No	Similar to NNTN8129A
NNTN8305A	IMPRES Li Ion Ultra Slim battery	Yes	Yes	

All batteries applicable to both standard and covert applications

### 7.3 Body worn Accessories

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

**TABLE 4**

Body worn Models	Description	Selected for test	Tested	Comments
PMLN6327A	Belt mounted carry holster w/swivel clip	Yes	Yes	Applicable only to NNTN8305A battery
PMLN4651A	2" belt clip	Yes	Yes	Not applicable to NNTN8305A battery
PMLN7008A	2.5" belt clip	Yes	Yes	Not applicable to NNTN8305A battery

### 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
HMN4104B	IMPRES Display Submersible RSM w/jack & Ch. Selector	Yes	Yes	
HMN4101B	Model D-IMPRES no display submersible RSM w/ jack, no chnl	No	No	Similar to HMN4104B – same cable length and connector pins
HMN4103B	Model B-IMPRES no display submersible RSM w/ jack, no chnl	No	No	Similar to HMN4104B – same cable length and connector pins
RMN5116A	Rx/Tx boomless bone conductive temple transducer for DRSM	Yes	No	Intended for test with HMN4104B
RLN6424A	Rx-Only earpiece with translucent tube and rubber eartip	No	No	Similar to RMN5116A – connects to RSM
PMLN5275B	Core H/D headset	Yes	No	
PMLN5111A	Plus 3-wire – Black – One programmable button	Yes	No	
RMN5116A	Temple transducer headset	Yes	No	Secondary audio for HMN4104B
PMMN4062A	Large Plus Noise cancelling RSM IP55 3.5MM jack	Yes	No	
PMMN4069A	Large RSM with audio jack	No	No	Similar to PMMN4062A
PMMN4025A	Small RSM IP54 with 3.5mm jack Rx only	No	No	Similar to PMMN4062A – same cable length and connector pins
PMMN4065A	Standard Large IP57 RSM	Yes	No	
PMMN4024A	Small Core RSMIP54 with 3.5mm jack Rx only	Yes	No	
PMLN5102A	Core Ultra-lite headset	Yes	No	
PMLN5101A	IMPRES Temple Transducer	Yes	No	
RMN5058A	Core L/W Headset	Yes	No	
RLN5883A	Plus 2 wire with translucent tube – Beige – One programmable button	Yes	No	
RLN5882A	Plus 2 wire with translucent tube – Black – One programmable button	No	No	Similar to RLN5883A
RLN5881A	Plus 2 wire. Beige - one programmable button	No	No	Similar to RLN5883A
RLN5880A	Plus 2 wire. Black - one programmable button	Yes	No	

TABLE 5 (Continued)

Audio Acc. Models	Description	Selected for test	Tested	Comments
PMMN4040A	IMPRES IP57 submersible RSM	Yes	No	
PMMN4046A	IMPRES Speaker Mic w/ vol IP57	Yes	No	
PMMN4050A	IMPRES RSM, NC	No	No	Similar to PMMN4046A
PMLN5096B	Core Earset D-Shell	Yes	No	
PMLN5097A	IMPRES 3 wire surveillance –BLK	Yes	No	
PMLN5653A	IMPRES Ear Mic System	Yes	No	
RLN4922A	Complete discrete earpiece kit	Yes	No	BDN6729A, BDN6730A, BDN6731A and BDN6783A
BDN6667A	Earpiece with Microphone and Push-to-Talk Combined (2-Wire), Beige	Yes	No	Similar to BDN6729A
BDN6729A	Earpiece with Microphone and Push-to-Talk Combined (2-Wire), Black	No	No	Similar to BDN6667A
BDN6669A	Extra Loud Earpiece with Microphone and Push-to-Talk Combined (2-Wire), Beige	Yes	No	Similar to BDN6731A
BDN6731A	Extra Loud Earpiece with Microphone and Push-to-Talk Combined (2-Wire), Black	No	No	Similar to BDN6669A
BDN6668A	Earpiece with Microphone and Push-to-Talk Separate (3-Wire), Beige	Yes	No	Similar to BDN6730A
BDN6730A	Earpiece with Microphone and Push-to-Talk Separate (3-Wire), Black	No	No	
BDN6783A	3.5 mm audio adapter	Yes	No	Intended for tested with BDN6729A, BDN6730A, BDN6731A, BDN6729A, BDN6730A, BDN6731A, BDN6783A and RLN4922A
BDN6727A	Receive-Only Earpiece with Standard Earphone (1-Wire), Black	No	No	Receive only
BDN6728A	Extra Loud Receive-Only Earpiece with Standard Earphone (1-Wire), Black	No	No	Receive only
NTN2574B	Wireless accessory, near field pairing	Yes	Yes	Used for BT functionality
BDN6665A	Extra Loud Receive-Only Earpiece with Standard Earphone (1-Wire), Beige	No	No	Receive only
BDN6664A	Receive-Only Earpiece with Standard Earphone (1-Wire), Beige	No	No	Receive only
RLN5878A	Core 1 wire – Black	No	No	Receive only
RLN5879A	Core 1 wire- Beige	No	No	Receive only
RLN4941A	3.5mm RX ONLY EARPIECE W/TRANSLUCENT TUBE-Short coiled cbl	No	No	Receive only
AARLN4885B	3.5mm RX ONLY EARBUD FOR REM SPK MIC short coiled cbl	No	No	Receive only
WADN4190B	3.5mm EAR RCVR W/COIL CBL-Short cbl	No	No	Receive only

## 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	DAE3	ES3DV3 (E-Field)

The DASY5™ system is operated per the instructions in the DASY5™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME SAR compliance was calibrated according to ISO/IEC 17025 A2LA guidelines. Section 9.0 presents additional test equipment information. Appendices B and C present the applicable calibration certificates. The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

**8.2 Description of Phantom(s)**

**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	OVAL1021 OVAL1016					

**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 835MHz. 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	835MHz	
		Head	Body
FCC Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 91-01)	Sugar	57.0	44.9
IEEE 1528-2003	Diacetin	NA	NA
IEC62209-1 (2005)	De ionized – Water	40.45	53.06
CENELEC – EN62209-1 (2006)	Salt	1.45	0.94
	HEC	1	1
	Bact.	0.1	0.1

Reference section 10.1 for target parameters

## 9.0 Additional Test Equipment

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

**TABLE 9**

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Power Meter (Agilent)	E4419B	MY45103725	3/30/2012	3/30/2013
Power Meter (Agilent)	E4418B	GB40206553	3/30/2012	3/30/2013
Power Meter (Agilent)	E4418B	US39251266	2/3/2012	2/3/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50280001	8/8/2011	8/8/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50290001	8/8/2011	8/8/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50280001	8/3/2012	8/3/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50290001	8/3/2012	8/3/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495730	4/3/2012	4/3/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495733	4/3/2012	4/3/2013
Power Sensor (Agilent)	8482B	3318A06773	5/7/2012	5/7/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495594	2/6/2012	2/6/2013
Bi-Directional Coupler (NARDA)	3020A	40296	2/9/2012	2/9/2014
Signal Generator (Agilent)	E4428C	MY47381119	6/24/2011	6/24/2013
AMP (Amplifier Research)	10WD1000	28782	*CNR	*CNR
Dickson Temperature Recorder	TM325	12121144	5/18/2012	5/18/2013
Omega Digital Thermometer with J Type TC Probe	HH200A	20857	10/28/2011	10/28/2012
Omega Digital Thermometer with J Type TC Probe	HH202A	18800	2/22/2012	2/22/2013
Omega Digital Thermometer with J Type TC Probe	HH202A	18801	5/23/2012	5/23/2013
Omega Digital Thermometer with J Type TC Probe	HH202A	18812	6/25/2012	6/25/2013
Agilent PNA-L Network Analyzer	N5230A	MY45001092	6/4/2012	6/4/2013
Dielectric Probe Kit (HP)	85070C	US99360076	*CNR	*CNR
SPEAG Probe	ES3DV3	3163	4/25/12	4/25/13
SPEAG Dipole	D835V2	435	2/24/2012	2/24/2014

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

## 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 (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
835	FCC Body	0.97 (0.92-1.02)	55.2 (52.4-58.0)	1.01	54.4	7/23/12
				1.01	53.9	7/24/12
				1.01	53.8	7/25/12
				0.99	54.2	7/26/12
				1.01	54.2	9/12/12
				0.97	54.1	9/14/12
				0.94	53.1	9/19/12
				0.99	55.3	10/15/12
775	FCC Body	0.97 (0.92-1.01)	55.4 (52.7-58.2)	0.94	55.0	7/23/12
				0.95	54.5	7/24/12
				0.95	54.8	9/12/12
809	FCC Body	0.97 (0.92-1.02)	55.3 (52.5-58.1)	0.98	54.7	7/23/12
				0.99	54.2	7/24/12
				0.99	54.1	7/25/12
				0.97	55.6	10/15/12
861	FCC Body	1.00 (0.95-1.05)	55.1 (52.4-57.9)	1.03	53.6	7/24/12
				1.02	53.5	7/25/12
870	FCC Body	1.01 (0.96-1.06)	55.1 (52.3-57.9)	1.03	52.4	9/19/12

**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
3163	835 MHz FCC Body	D835V2/ 435	*9.45 +/- 10%	2.48	9.92	7/23/12
				2.43	9.72	7/24/12
				2.46	9.84	7/25/12
				2.59	10.36	7/26/12
				2.42	9.68	9/12/12
				2.30	9.20	9/14/12
				2.28	9.12	9/19/12
				2.28	9.12	10/15/12

\*Dipole manufacture's reference target

**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°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**

	<b>Target</b>	<b>Measured</b>
<b>Ambient Temperature</b>	18 – 25 °C	Range: 20.8 – 23.1°C Avg. 21.6 °C
<b>Relative Humidity</b>	30 – 70 %	Range: 47.8 – 73.8% Avg. 54.3%
<b>Tissue Temperature</b>	NA	Range: 20.0-21.4°C Avg. 20.6°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 testing.

**12.2 DUT Configuration(s)**

The DUT is a portable device operational at the body 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

Not applicable.

## 12.4 DUT Test Channels

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

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

Where

$N_c$  = Number of channels

$F_{high}$  = Upper channel

$F_{low}$  = Lower channel

$F_c$  = Center channel

## 12.5 DUT Test Plan

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/shoulder 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. 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.

**13.0 DUT Test Data**

**13.1 Assessment at the body for 764-775 MHz band**

The battery NNTN8128B was selected as the default battery for assessments at the Body since it is the thinnest battery (refer to Exhibit 7B for the dimension of the battery). The conducted power measurement for all test channels within Part 90 frequency range using the default battery NNTN8128B 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-F.

**TABLE 13**

Test Freq (MHz)	Power (W)
764.0125	3.02
770.000	3.02
775.000	3.04

**Assessment at the body with body worn PMLN4651A**

Assessment of each of the applicable offered antennas with the default battery, body worn PMLN4651A and applicable additional offered batteries 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#
NAR6595A	NNTN8128B	PMLN4651A	HMN4104B	764.0125							
				770.000							
				775.000	3.09	-0.270	4.83	3.61	2.57	1.92	JsT-Ab-120723-02
NAF5085A	NNTN8128B	PMLN4651A	HMN4104B	764.0125							
				770.000							
				775.000	3.09	-0.270	2.02	1.51	1.07	0.80	JsT-Ab-120723-05
<b>Assessment of the additional offered battery</b>											
NAR6595A	NNTN8129A	PMLN4651A	HMN4104B	764.0125							
				770.000							
				775.000	3.04	-0.200	4.48	3.32	<b>2.35</b>	1.74	ErC-Ab-120725-07

**Assessment at the body with body worn PMLN7008A**

Assessment of each of the applicable offered antennas with the default battery, body worn PMLN7008A and applicable additional offered batteries 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 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#	
NAR6595A	NNTN8128B	PMLN7008A	HMN4104B	764.0125								
				770.000								
				775.000	3.05	-0.300	4.97	3.71	<b>2.66</b>	1.99	CM-Ab-120723-07	
NAF5085A	NNTN8128B	PMLN7008A	HMN4104B	764.0125								
				770.000								
				775.000	3.04	-0.120	1.95	1.46	1.00	0.75	CM-Ab-120723-08	
<b>Assessment of the additional offered battery</b>												
NAR6595A	NNTN8129A	PMLN7008A	HMN4104B	764.0125								
				770.000								
				775.000	3.05	-0.090	4.51	3.32	2.30	1.69	CM-Ab-120723-09	

**Assessment at the body with body worn PMLN6327A**

Assessment of each of the applicable offered antennas with battery body worn PMLN6327A and applicable battery NNTN8305A 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 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#
NAR6595A	NNTN8305A	PMLN6327A	HMN4104B	764.0125							
				770.000							
				775.000	3.06	-0.230	3.66	2.76	<b>1.93</b>	1.46	ErC-Ab-120724-11
NAF5085A	NNTN8305A	PMLN6327A	HMN4104B	764.0125							
				770.000							
				775.000	3.09	-0.230	1.73	1.30	0.91	0.69	ErC-Ab-120724-12

**Assessment of other audio accessories at the body**

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.

**13.2 Assessment of wireless BT configuration**

Assessment using the overall highest SAR configuration at the body from above using previously approved applicable BT pod NTN2574B for wireless operation.

**TABLE 17**

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#
NAR6595A	NNTN8128B	PMLN7008A	None	764.0125							
				770.000							
				775.000	3.08	-0.29	8.28	6.17	<b>3.10</b>	3.10	ErC-Ab-120912-04

**13.3 Assessment at the body for 794-824 MHz band**

The battery NNTN8128B was selected as the default battery for assessments at the Body since it is the thinnest battery (refer to Exhibit 7B for the dimension of the battery). The conducted power measurement for all test channels within Part 90 frequency range using the default battery is indicated in Table 18. 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-F.

**TABLE 18**

Test Freq (MHz)	Power (W)
794.0125	3.02
809.000	3.66
823.9875	3.66

**Assessment at the body with body worn PMLN4651A**

Assessment of each of the applicable offered antennas with the default battery, body worn PMLN4651A, and applicable additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 18 for highest output power channel.

**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#
NAR6595A	NNTN8128B	PMLN4651A	HMN4104B	794.0125							
				809.000	3.70	-0.280	4.94	3.68	<b>2.63</b>	1.96	CM-Ab-120723-10
				823.9875							
NAF5085A	NNTN8128B	PMLN4651A	HMN4104B	794.0125							
				809.000	3.69	-0.030	1.69	1.27	0.85	0.64	CM-Ab-120723-11
				823.9875							
<b>Assessment of the additional offered battery</b>											
NAR6595A	NNTN8129A	PMLN4651A	HMN4104B	794.0125							
				809.000	3.65	0.020	5.01	3.67	2.51	1.84	CM-Ab-120723-12
				823.9875							

**Assessment at the body with body worn PMLN7008A**

Assessment of each of the applicable offered antennas with the default battery, body worn PMLN7008A, and applicable additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 18 for highest output power channel.

**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#
NAR6595A	NNTN8128B	PMLN7008A	HMN4104B	794.0125							
				809.000	3.70	-0.150	4.34	3.26	2.25	1.69	CM-Ab-120723-13
				823.9875							
NAF5085A	NNTN8128B	PMLN7008A	HMN4104B	794.0125							
				809.000	3.71	-0.230	1.68	1.26	0.89	0.66	ErC-Ab-120724-02
				823.9875							
<b>Assessment of the additional offered battery</b>											
NAR6595A	NNTN8129A	PMLN7008A	HMN4104B	794.0125							
				809.000	3.69	-0.240	5.01	3.67	<b>2.65</b>	1.94	ErC-Ab-120724-03
				823.9875							

**Assessment at the body with body worn PMLN6327A**

Assessment of each of the applicable offered antennas with battery body worn PMLN6327A and applicable battery NNTN8305A per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 18 for highest output power channel.

**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#
NAR6595A	NNTN8305A	PMLN6327A	HMN4104B	794.0125							
				809.000	3.68	-0.090	3.96	2.97	<b>2.02</b>	1.52	ErC-Ab-120725-03
				823.9875							
NAF5085A	NNTN8305A	PMLN6327A	HMN4104B	794.0125							
				809.000	3.64	-0.050	1.19	0.89	0.60	0.45	ErC-Ab-120725-04
				823.9875							

**Assessment of other audio accessories at the body**

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 Assessment of wireless BT configuration**

Assessment using the overall highest SAR configuration at the body from above using previously approved applicable BT pod NTN2574B for wireless operation.

**TABLE 22**

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#
NAR6595A	NNTN8129A	PMLN7008A	None	794.0125							
				809.000	3.71	-0.110	8.90	6.52	<b>4.56</b>	3.34	ErC-Ab-120725-09
				823.9875							

**13.5 Assessment at the body for 851-869MHz band**

The battery NNTN8128B was selected as the default battery for assessments at the Body since it is the thinnest battery (refers to Exhibit 7B for the dimension of the battery). The conducted power measurement for all test channels within Part 90 frequency range using the default battery is indicated in Table 23. 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-F.

**TABLE 23**

Test Freq (MHz)	Power (W)
851.000	3.71
860.500	3.74
869.000	3.73

**Assessment at the body with body worn PMLN4651A**

Assessment of each of the applicable offered antennas with the default battery, body worn PMLN4651A and applicable additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 23 for highest output power channel.

**TABLE 24**

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#
NAR6595A	NNTN8128B	PMLN4651A	HMN4104B	851.000							
				860.500	3.68	-0.010	3.49	2.59	1.75	1.30	ErC-Ab-120724-04
				869.000							
NAF5085A	NNTN8128B	PMLN4651A	HMN4104B	851.000							
				860.500	3.60	-0.160	3.29	2.44	1.71	1.27	ErC-Ab-120724-05
				869.000							
<b>Assessment of the additional offered battery</b>											
NAR6595A	NNTN8129A	PMLN4651A	HMN4104B	851.000							
				860.500	3.65	-0.040	4.27	3.10	<b>2.15</b>	1.56	ErC-Ab-120724-06
				869.000							

**Assessment at the body with body worn PMLN7008A**

Assessment of each of the applicable offered antennas with the default battery, body worn PMLN7008A and applicable additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 23 for highest output power channel.

**TABLE 25**

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#
NAR6595A	NNTN8128B	PMLN7008A	HMN4104B	851.000							
				860.500	3.70	-0.070	4.31	3.19	<b>2.19</b>	1.62	ErC-Ab-120724-07
				869.000							
NAF5085A	NNTN8129A	PMLN7008A	HMN4104B	851.000							
				860.500	3.65	-0.100	3.63	2.68	1.86	1.37	ErC-Ab-120724-08
				869.000							
<b>Assessment of the additional offered battery</b>											
NAR6595A	NNTN8129A	PMLN7008A	HMN4104B	851.000							
				860.500	3.63	-0.110	3.79	2.75	1.94	1.41	ErC-Ab-120724-09
				869.000							

**Assessment at the body with body worn PMLN6327A**

Assessment of each of the applicable offered antennas with battery body worn PMLN6327A and applicable battery NNTN8305A per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 23 for highest output power channel.

**TABLE 26**

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#
NAR6595A	NNTN8305A	PMLN6327A	HMN4104B	851.000							
				860.500	3.61	-0.040	2.76	2.06	<b>1.39</b>	1.04	ErC-Ab-120725-05
				869.000							
NAF5085A	NNTN8305A	PMLN6327A	HMN4104B	851.000							
				860.500	3.62	-0.050	1.86	1.38	0.94	0.70	ErC-Ab-120725-06
				869.000							

**Assessment of other audio accessories at the body**

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.

**13.6 Assessment of wireless BT configuration**

Assessment using the overall highest SAR configuration at the body from above using previously approved applicable BT pod NTN2574B for wireless operation.

**TABLE 27**

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#
NAR6595A	NNTN8128B	None	None	851.000							
				860.500	3.63	-0.480	7.47	5.57	<b>4.17</b>	3.11	ErC-Ab-120725-10
				869.000							

**13.7 Assessment outside FCC Part 90 at the body (869-870 MHz)**

Assessment outside FCC Part 90 with each of the offered antennas using the highest SAR test configuration from Part 90 assessments above. SAR plots of the highest results per table (bolded) are presented in APPENDIX G.

**Table 28**

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#
NAF5085A	NNTN8129A	None	None, BT pod NTN2574B	869.8875	3.72	-0.050	6.61	4.64	3.34	2.35	CM-Ab-120919-21
NAR6595A	NNTN8129A	None	None, BT pod NTN2574B	869.8875	3.73	-0.130	7.35	5.18	<b>3.79</b>	2.67	CM-Ab-120919-22

**13.8 Shortened Scan Assessment**

A “shortened” scan using the highest SAR configuration overall from above 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 result from the table below is provided in APPENDIX E.

**TABLE 29**

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#
NAR6595A	NNTN8129A	PMLN7008A	None	809.000	3.71	0.00	8.99	6.62	<b>4.50</b>	3.31	ErC-Ab-121015-07

**14.0 Simultaneous Transmission Exclusion**

Per guidelines in KDB 648474 D01 conducted output power for the BT transmitter is ≤ Pref (12mW) and the BT antenna is ≥ 2.5 cm from the other antenna. Refer to exhibit 7B for an illustration. Therefore, simultaneous transmission SAR results are not reported herein.

**15.0 Conclusion**

Based on the test guidelines from KDB 643646, the highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing:

**TABLE 30**

Designator	Frequency band (MHz)	Max Calc at Body (mW/g)		Max Calc at Face (mW/g)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
IC	764-775	3.78	2.43	NA	NA
	794-824	4.56	3.34	NA	NA
	851-869	4.17	3.11	NA	NA
FCC	764-775	3.78	2.43	NA	NA
	794-824	4.56	3.34	NA	NA
	851-869	4.17	3.11	NA	NA
Outside Part 90	869-870	3.79	2.67	NA	NA

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 100MHz to 800MHz and 800MHz to 3GHz as well as for DUT and Dipole test frequencies ranging from 300MHz to 800MHz. Therefore, the highest tolerance for the probe calibration uncertainty is indicated.

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$	<i>k</i>
Uncertainty Component	IEEE 1528 Section	Tol. ( $\pm$ %)	Prob. Dist.	Div.	$c_i$ (1 g)	$c_i$ (10 g)	1 g $u_i$ ( $\pm$ %)	10 g $u_i$ ( $\pm$ %)	$v_i$
<b>Measurement System</b>									
Probe Calibration	E.2.1	10.0	N	1.00	1	1	10.0	10.0	$\infty$
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	$\infty$
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	$\infty$
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	$\infty$
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	$\infty$
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	$\infty$
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	$\infty$
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	$\infty$
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	$\infty$
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	$\infty$
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	$\infty$
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	$\infty$
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	$\infty$
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	$\infty$
<b>Test sample Related</b>									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	$\infty$
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	$\infty$
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	$\infty$
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	$\infty$
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	$\infty$
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	$\infty$
Combined Standard Uncertainty			RSS				14	13	965
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				27	27	

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$
Uncertainty Component	IEEE 1528 section	Tol. ( $\pm$ %)	Prob. Dist.	Div.	$c_i$ (1 g)	$c_i$ (10 g)	1 g $u_i$ ( $\pm$ %)	10 g $u_i$ ( $\pm$ %)
<b>Measurement System</b>								
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	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
<b>Dipole</b>								
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
<b>Phantom and Tissue Parameters</b>								
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9
Combined Standard Uncertainty			RSS				12	12
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				24	24

Notes for uncertainty budget tables:

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

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$	<i>k</i>
Uncertainty Component	IEEE 1528 Section	Tol. ( $\pm$ %)	Prob. Dist.	Div.	$c_i$ (1 g)	$c_i$ (10 g)	1 g $u_i$ ( $\pm$ %)	10 g $u_i$ ( $\pm$ %)	$v_i$
<b>Measurement System</b>									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	$\infty$
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	$\infty$
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	$\infty$
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	$\infty$
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	$\infty$
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	$\infty$
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	$\infty$
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	$\infty$
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	$\infty$
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	$\infty$
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	$\infty$
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	$\infty$
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	$\infty$
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	$\infty$
<b>Test sample Related</b>									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	$\infty$
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	$\infty$
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	$\infty$
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	$\infty$
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	$\infty$
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	$\infty$
<b>Combined Standard Uncertainty</b>			RSS				11	11	419
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			$k=2$				22	22	

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e=f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. ( $\pm$ %)	Prob. Dist.	Div.	$c_i$ (1 g)	$c_i$ (10 g)	1 g $u_i$ ( $\pm$ %)	10 g $u_i$ ( $\pm$ %)	$v_i$
<b>Measurement System</b>									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	$\infty$
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	$\infty$
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	$\infty$
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	$\infty$
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	$\infty$
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	$\infty$
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	$\infty$
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	$\infty$
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	$\infty$
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	$\infty$
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	$\infty$
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	$\infty$
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	$\infty$
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	$\infty$
<b>Dipole</b>									
Dipole Axis to Liquid Distance	8.E.4.2	2.0	R	1.73	1	1	1.2	1.2	$\infty$
Input Power and SAR Drift Measurement	8.6.6.2	5.0	R	1.73	1	1	2.9	2.9	$\infty$
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	$\infty$
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	$\infty$
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	$\infty$
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	$\infty$
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	$\infty$
<b>Combined Standard Uncertainty</b>			RSS				9	9	99999
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			$k=2$				18	18	

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)  $c_i$  - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- g)  $u_i$  – SAR uncertainty
- h)  $v_i$  - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

**APPENDIX B**  
**Probe Calibration Certificates**

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



**S  
C  
S** Schweizerischer Kalibrierdienst  
Service suisse d'étalonnage  
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 EME**

Certificate No: **ES3-3163\_Apr12**

**CALIBRATION CERTIFICATE**

Object: **ES3DV3 - SN:3163**

Calibration procedure(s): **QA CAL-01.v8, QA CAL-12.v7, QA CAL-14.v3, QA CAL-23.v4,  
QA CAL-25.v1  
Calibration procedure for dosimetric E-field probes**

Calibration date: **April 25, 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	28-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	10-Jan-12 (No. DAE4-660_Jan12)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8548C	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-11)	in house check: Oct-12

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

Issued: April 25, 2012

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

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

### Glossary:

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

### Calibration is Performed According to the Following Standards:

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

### Methods Applied and Interpretation of Parameters:

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

ES3DV3 – SN:3163

April 25, 2012

# Probe ES3DV3

## SN:3163

Manufactured: October 8, 2007  
Calibrated: April 25, 2012

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

ES3DV3- SN:3163

April 25, 2012

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

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	1.31	1.13	1.04	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	101.8	101.0	102.5	

### Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	0.00	X	0.00	0.00	1.00	160.8	$\pm 3.0\%$
			Y	0.00	0.00	1.00	149.8	
			Z	0.00	0.00	1.00	149.1	

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

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

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

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

ES3DV3- SN:3163

April 25, 2012

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

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	45.3	0.87	7.37	7.37	7.37	0.24	1.02	± 13.4 %
450	43.5	0.87	6.71	6.71	6.71	0.16	1.81	± 13.4 %
750	41.9	0.89	6.30	6.30	6.30	0.39	1.61	± 12.0 %
900	41.5	0.97	6.00	6.00	6.00	0.26	2.12	± 12.0 %
1810	40.0	1.40	5.28	5.28	5.28	0.51	1.65	± 12.0 %
1950	40.0	1.40	4.98	4.98	4.98	0.43	1.58	± 12.0 %
2300	39.5	1.67	4.75	4.75	4.75	0.62	1.42	± 12.0 %
2450	39.2	1.80	4.44	4.44	4.44	0.80	1.22	± 12.0 %
2600	39.0	1.96	4.27	4.27	4.27	0.80	1.24	± 12.0 %
3500	37.9	2.91	3.91	3.91	3.91	1.00	1.32	± 13.1 %
3700	37.7	3.12	3.73	3.73	3.73	1.00	1.25	± 13.1 %

<sup>C</sup> 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.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) 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 ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

ES3DV3- SN:3163

April 25, 2012

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

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	6.78	6.78	6.78	0.22	1.78	± 13.4 %
450	56.7	0.94	6.97	6.97	6.97	0.08	1.00	± 13.4 %
750	55.5	0.96	6.16	6.16	6.16	0.25	2.12	± 12.0 %
900	55.0	1.05	6.02	6.02	6.02	0.34	1.77	± 12.0 %
1810	53.3	1.52	4.71	4.71	4.71	0.58	1.60	± 12.0 %
1950	53.3	1.52	4.64	4.64	4.64	0.47	1.88	± 12.0 %
2300	52.9	1.81	4.25	4.25	4.25	0.80	1.29	± 12.0 %
2450	52.7	1.95	4.05	4.05	4.05	0.70	1.19	± 12.0 %
2600	52.5	2.16	3.88	3.88	3.88	0.69	1.01	± 12.0 %
3500	51.3	3.31	3.36	3.36	3.36	0.85	1.58	± 13.1 %
3700	51.0	3.55	3.23	3.23	3.23	0.58	2.05	± 13.1 %

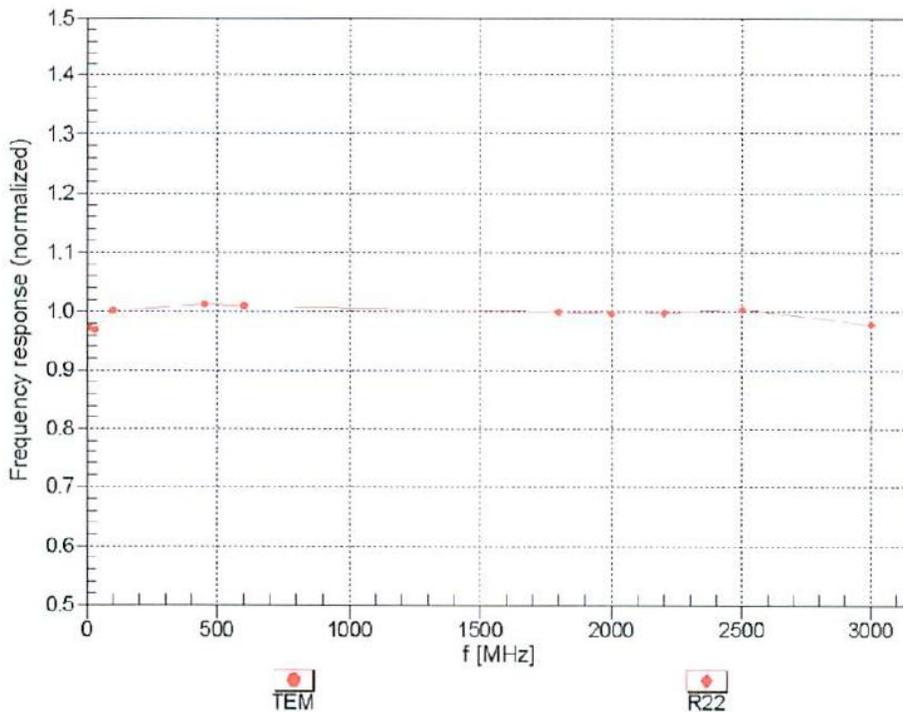
<sup>C</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) 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 ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

ES3DV3– SN:3163

April 25, 2012

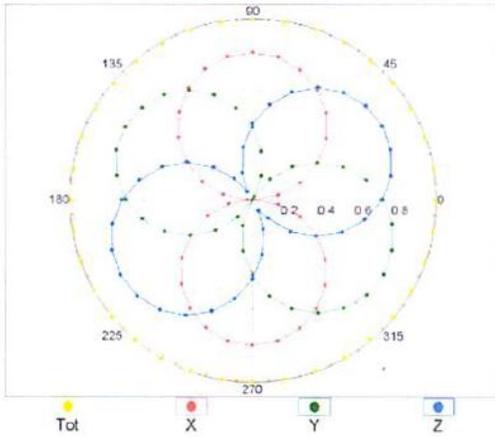
### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



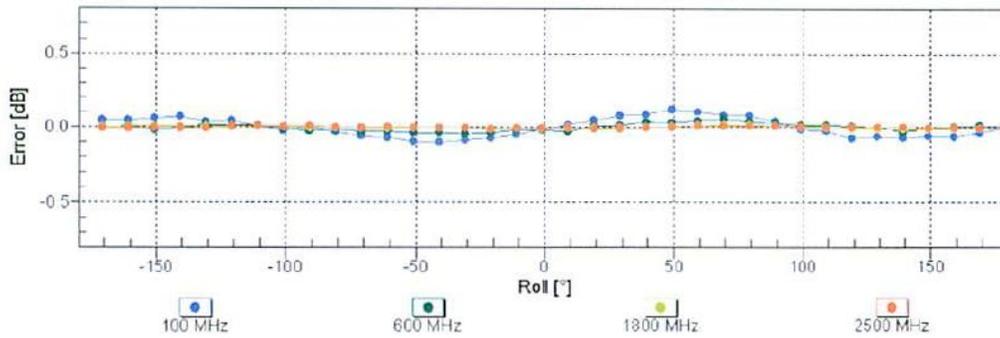
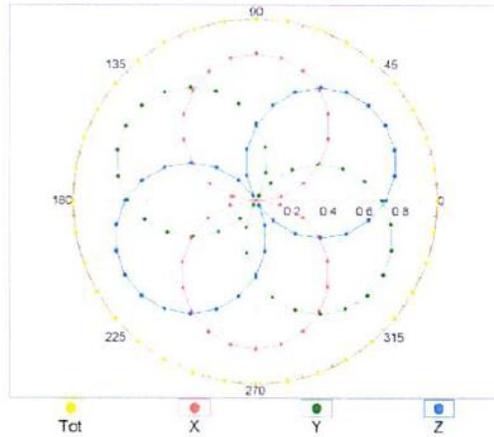
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz, TEM

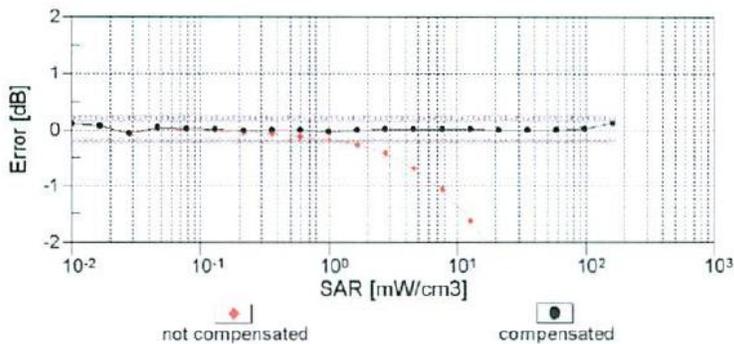
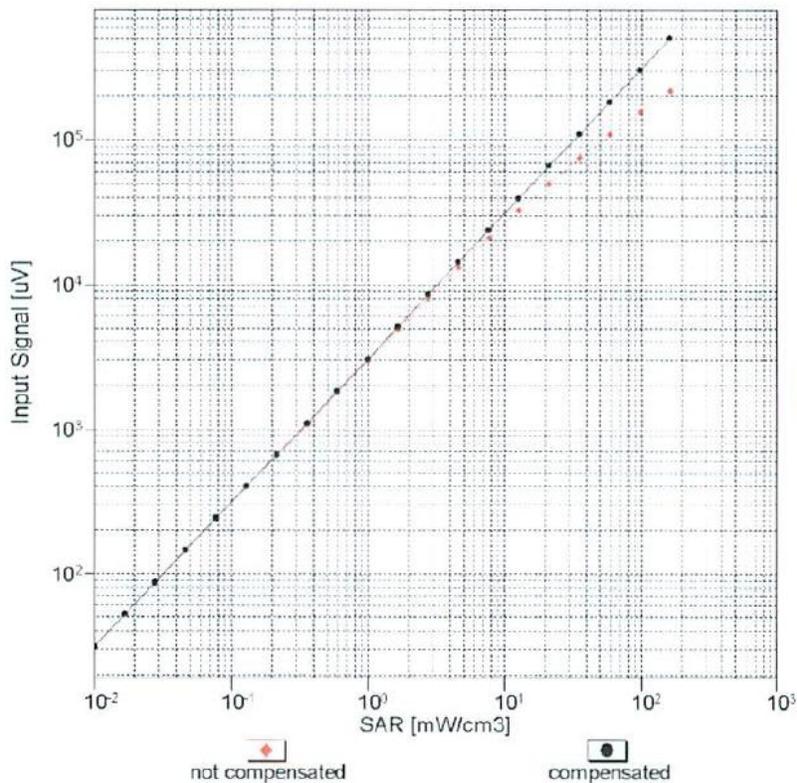


f=1800 MHz, R22



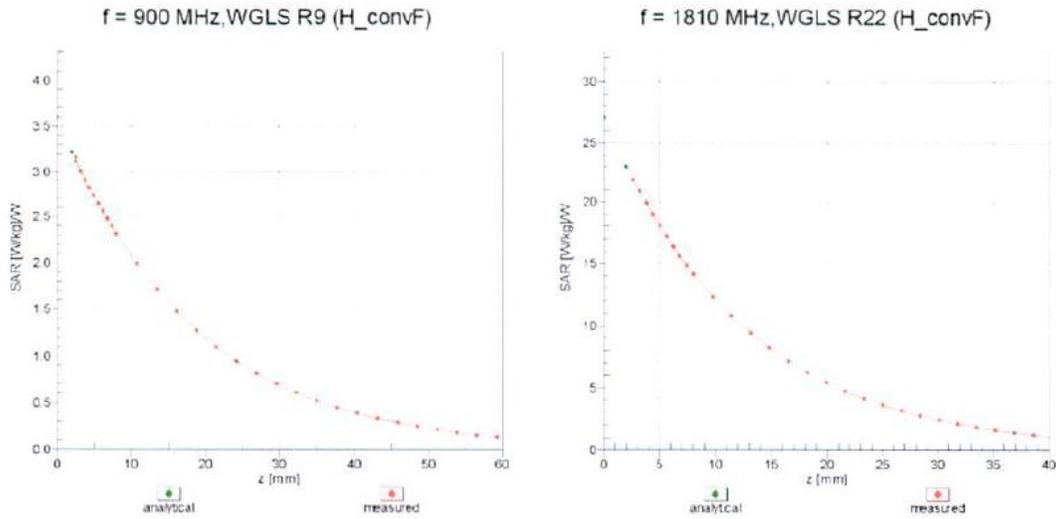
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)



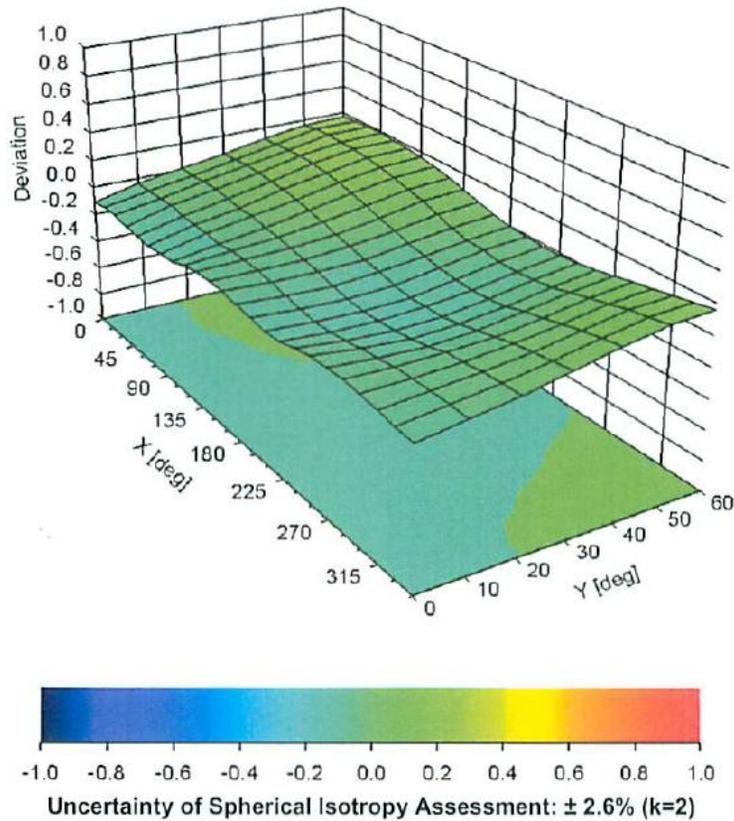
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid

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



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

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-170.9
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

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

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

Type:	<b>ES3DV3</b>
Serial Number:	<b>3163</b>
Place of Assessment:	<b>Zurich</b>
Date of Assessment:	<b>April 26, 2012</b>
Probe Calibration Date:	<b>April 25, 2012</b>

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 450, 900 MHz or 1810 MHz.

Assessed by: 

Schmid & Partner Engineering AG

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

**Dosimetric E-Field Probe ES3DV3 SN:3163**

Conversion factor ( $\pm$  standard deviation)

150  $\pm$  50 MHz      *ConvF*      8.2  $\pm$  10%

$\epsilon_r = 52.3 \pm 5\%$   
 $\sigma = 0.76 \pm 5\%$  mho/m  
 (head tissue)

150  $\pm$  50 MHz      *ConvF*      7.9  $\pm$  10%

$\epsilon_r = 61.9 \pm 5\%$   
 $\sigma = 0.80 \pm 5\%$  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.**

**APPENDIX C**  
**Dipole Calibration Certificates**

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



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

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

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D835V2-435\_Feb12/2**

**CALIBRATION CERTIFICATE (Replacement of No:D835V2-435\_Feb12)**

Object **D835V2 - SN: 435**

Calibration procedure(s) **QA CAL-05.v8  
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **February 24, 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 EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 5, 2012

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

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



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

Accredited by the Swiss 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
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.

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%.

**Measurement Conditions**

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

<b>DASY Version</b>	DASY5	V52.8.0
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	835 MHz ± 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	41.5	0.90 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	41.0 ± 6 %	0.89 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.37 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.15 mW / g ± 16.5 % (k=2)

**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	55.2	0.97 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	55.7 ± 6 %	1.01 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

**SAR result with Body TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.43 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.45 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.22 mW / g ± 16.5 % (k=2)

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	51.3 $\Omega$ - 7.0 $\mu\Omega$
Return Loss	- 23.1 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	45.3 $\Omega$ - 6.8 $\mu\Omega$
Return Loss	- 21.2 dB

**General Antenna Parameters and Design**

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

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	December 15, 2000

**DASY5 Validation Report for Head TSL**

Date: 24.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 435**

Communication System: CW; Frequency: 835 MHz

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.89 \text{ mho/m}$ ;  $\epsilon_r = 41$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**

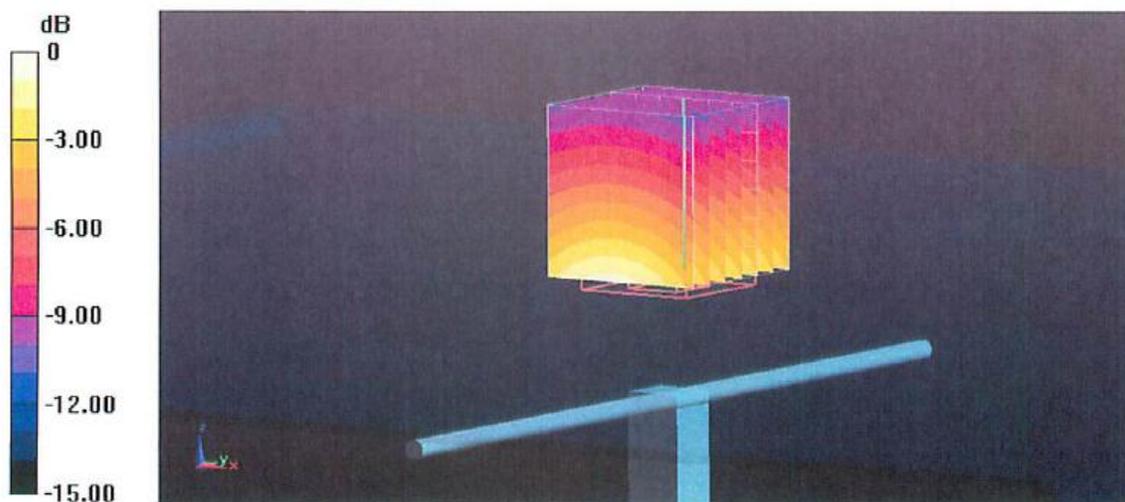
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 56.836 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.4540

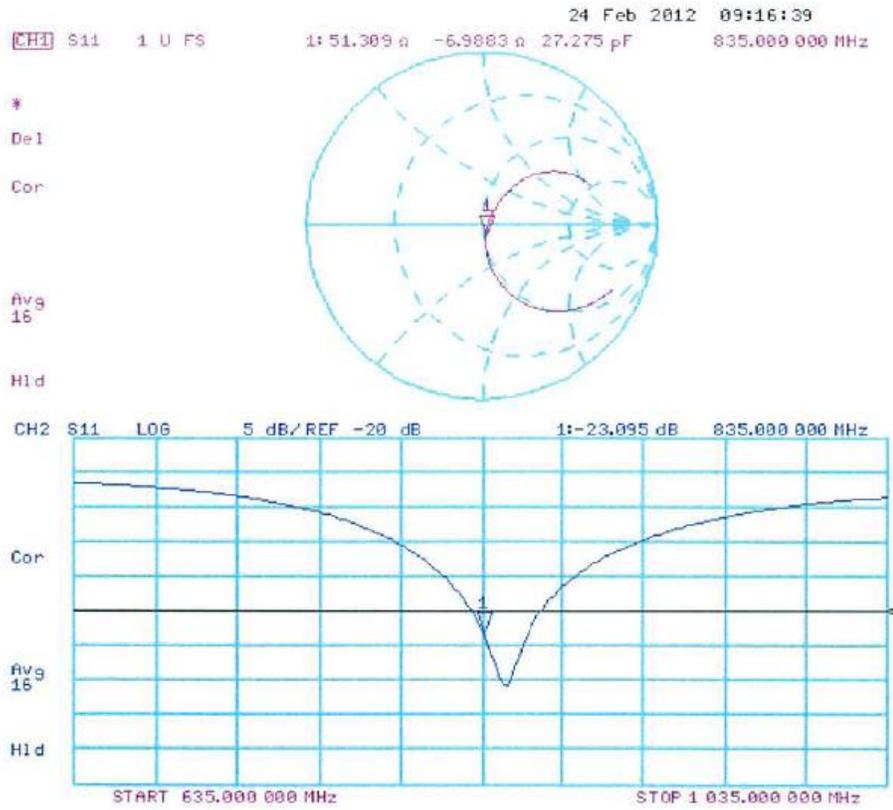
**SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.53 mW/g**

Maximum value of SAR (measured) = 2.706 mW/g



0 dB = 2.710mW/g = 8.66 dB mW/g

### Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 24.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 435**

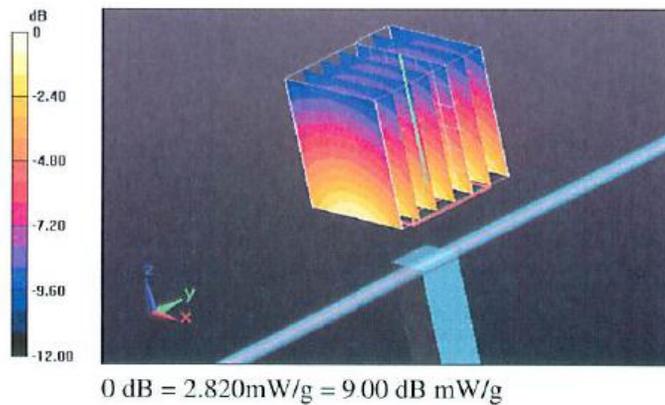
Communication System: CW; Frequency: 835 MHz  
 Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 1.01 \text{ mho/m}$ ;  $\epsilon_r = 55.7$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**

Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$   
 Reference Value = 54.799 V/m; Power Drift = 0.01 dB  
 Peak SAR (extrapolated) = 3.5160  
**SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.59 mW/g**  
 Maximum value of SAR (measured) = 2.819 mW/g



### Impedance Measurement Plot for Body TSL

