



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

**Motorola Solutions Inc.**  
**EME Test Laboratory**  
 8000 West Sunrise Blvd  
 Fort Lauderdale, FL. 33322.

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**Responsible Engineer:** Michael Sailsman (Senior Staff Eng.)  
**Report Author:** Michael Sailsman (Senior Staff Eng.)  
**Date/s Tested:** 7/26/11-11/14/11  
**Manufacturer/Location:** Penang  
**Sector/Group/Div.:** GTDG  
**Date submitted for test:** 7/19/11  
**DUT Description:** 380 - 470MHz 3-5.7W 6.25K/12.5K/25K, Single Display Model full keypad. Capable of digital and analog FM transmission. Also capable of TDMA transmission.

**Test Tx mode(s):** CW (PTT)  
**Max. Power output:** 5.7 W  
**Nominal Power:** 5.0 W  
**Tx Frequency Bands:** 380-470 MHz  
**Signaling type:** FM; TDMA  
**Model(s) Tested:** H51QDH9PW7AN (MUE3775), H51QDH9PW7AN (MUE3779)  
**Model(s) Certified:** H51QDH9PW7AN (MUE3779)  
**Serial Number(s):** 426TMM0405, 426TMM0284  
**Classification:** Occupational/Controlled  
**FCC ID:** AZ489FT4907; Rule part 90 (406.1-470.000 MHz)  
**IC:** 109U-89FT4907

\* 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:** 11/16/2011

**Certification Date:** 9/14/2011

**Certification No.:** L1110906P

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## Report Revision History

Date	Revision	Comments
11/16/11	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 certified model number H51QDH9PW7AN (MUE3779).

## 2.0 Abbreviations / Definitions

CNR: Calibration Not Required

EME: Electromagnetic Energy

CQPSK: Compatible Quadrature Phase-Shift Keying

C4FM: Compatible 4-Level Frequency Modulation

GPS: Global Positioning System

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

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.

## 6.0 Description of Device Under Test (DUT):

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

Time Division Multiple Access (TDMA) is used to allocate portions of the RF signal by dividing time into two slots. Time allocation enables each unit to transmit its voice information without interference from other transmitting units. Transmission from a unit or base station is accommodated during two time-slot lengths of 30 milliseconds with frame length of 60 milliseconds. C4FM CQPSK modulation is used 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.

The model represented under this filing utilizes removable antennas (UHF) capable of transmitting in the 380-470 MHz band. The nominal UHF output power is 5.0 watts with maximum output power of 5.7W 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.

## 7.0 Optional Accessories and Test Criteria:

This device is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required. The following sections identify the test criteria and details for each accessory category.

### 7.1 Antennas:

There are two UHF antennas offered for this product. The table below lists their descriptions.

**TABLE 2**

Antenna Models	Description	*Tested
FAF5259A	UHF/GPS/PSM Whip (380-520MHz; 1575MHz) ¼ wave, -2.0dBd	Yes
PMAE4065A	UHF/GPS/PSM Whip (380-520MHz; 1575MHz) ¼ wave, -10dBd	Yes

\*Refer to Exhibit 7B for antenna separation distances.

### 7.2 Batteries:

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

**TABLE 3**

Battery Models	Description	*Tested	Comments
NNTN8128A	IMPRES Li Ion slim battery (Non FM 1900 mAh)	Yes	
NNTN8129A	IMPRES Hi-Cap Li-Ion FM 2300mAh	Yes	

\*Refer to Exhibit 7B for antenna separation distances.

### 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	*Tested	Comments
PMLN5950A	Leather carry case w/ 2,5" swivel belt loop	Yes	
PMLN7008A	2.5" Belt clip	Yes	
PMLN4651A	2.5" Belt clip	Yes	
NTN5243A	Carry strap	Yes	

\*Refer to Exhibit 7B for antenna separation distances.

## 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	*Tested	Comments
HMN4104B	IMPRES Display Submersible RSM w/jack & Ch. Selector	Yes	Tested with and without RMN5116A
RMN5116A	Temple Transducer Headset	Yes	Tested with HMN4104B
RLN5882A	IMPRES 2-wire Surveillance with acoustic tube- black	Yes	
PMLN5275C	Heavy Duty headset	Yes	
PMLN5111A	IMPRES 3-wire Surveillance with acoustic tube-black	Yes	
PMMN4062A	Large Plus Noise cancelling RSM IP55 3.5MM jack	Yes	
PMMN4065A	Standard Large IP57 RSM	Yes	
PMMN4024A	Remote speaker mic.	Yes	
PMLN5101A	IMPRES Temple Transducer	Yes	
RMN5058A	Core L/W Headset	Yes	
ZMN6031A	SPKR MIC 3 PIECE	Yes	Tested with NNTN7869A
ZMN6032A	SPKR MIC 2 PIECE	Yes	Tested with NNTN7869A
NNTN7869A	Surveillance/Keyloader Accessory Adapter	Yes	Tested with ZMN6031A & ZMN6032A
BDN6731A	Earpiece, Mic and PTT combined with extra loud earpiece BLACK	Yes	Tested with BND6783A
BDN6732A	Earpiece, Mic and PTT separate with extra loud earpiece BLACK	Yes	Tested with BND6783A
BDN6783A	Headset/Earpiece Audio Accessory Adapter	Yes	Tested with BDN6731A, BDN6732A and BDN6780A
BDN6780A	Earbud Single w/ Mic & PTT	Yes	Tested with BND6783A
HMN4101B	Display RSM w/o Display and w/o Channel Knob	No	Similar to HMN4104B
HMN4103B	Display RSM w/o Channel Knob	No	Similar to HMN4104B
RLN6424A	Rx-Only Secondary Audio Accessory for DRSM	No	To be tested with HMN4104B. similar to HMN4104B/ RMN5116A
RLN5879A	Core 1 wire surveillance – beige	No	Receive only
RLN5878A	Core 1 wire surveillance – black	No	Receive only
RLN5881A	IMPRES 2-wire Surveillance-beige	No	Similar to RLN5882A
RLN5880A	IMPRES 2-wire Surveillance - black	No	Similar to RLN5882A
RLN5883A	IMPRES 2-wire Surveillance with acoustic tube- beige	No	Similar to RLN5882A
PMLN5112A	Plus 3 wire - Beige-one programmable button	No	Similar to PMLN5111A
PMMN4025A	IMPRES Remote speaker mic	No	Similar to PMMN4062A
PMMN4069A	APX Basic Smart RSM, IP55	No	Similar to PMMN4062A

TABLE 5 (Continued)

Audio Acc. Models	Description	*Tested	Comments
PMLN5112A	IMPRES 3-wire Surveillance with acoustic tube beige	No	Similar to PMLN5111A
ZMN6039A	SPKR MIC 3 PIECE XL	No	To be tested with NNTN7869A. Similar to ZMN6031/NNTN7869A
ZMN6038A	SPKR MIC 2 PIECE XL	No	To be tested with NNTN7869A. Similar to ZMN6032/NNTN7869A
BDN6667A	Earpiece, Mic & PTT Combo	No	To be tested with BDN6783A. Similar to BDN6731/BDN6783A
BDN6669A	Earpiece, Mic and PTT combined with extra loud earpiece BEIGE	No	To be tested with BDN6783A. Similar to BDN6731/BDN6783A
BDN6729A	Earpiece, Mic and PTT combined BLACK	No	To be tested with BDN6783A. Similar to BDN6731/BDN6783A
BDN6668A	Earpiece, Mic & PTT Separate	No	To be tested with BDN6783A. Similar to BDN6732/BDN6783A
BDN6670A	Earpiece, Mic and PTT separate with extra loud earpiece BEIGE	No	To be tested with BDN6783A. Similar to BDN6732/BDN6783A
BDN6730A	Earpiece, Mic and PTT separate BLACK	No	To be tested with BDN6783A. Similar to BDN6732/BDN6783A
AARLN4885B	Receive only Ear bud	No	Receive only
RLN4760A	Clear comfortable ear piece SR	No	Receive only
RLN4761A	Clear comfortable ear piece MR	No	Receive only
RLN4762A	Clear comfortable ear piece LR	No	Receive only
RLN4763A	Clear comfortable ear piece SL	No	Receive only
RLN4764A	Clear comfortable ear piece ML	No	Receive only
RLN4765A	Clear comfortable ear piece LL	No	Receive only
RLN4941A	Receive only Earpiece w/translucent tube and ear tip - OTTO	No	Receive only
WADN4190B	Over the Ear Receiver for RSM	No	Similar to AARLN4885B
PMLN4620A	D-shell Rx-only earpiece(3.5MM)	No	Receive only
RLN5886A	Surveillance Low Noise Kit	No	Receive only
RLN5887A	Surveillance High Noise Kit	No	Receive only
BDN6664A	Earpiece with standard earpiece BEIGE Tilt / Man Down Switch	No	Receive only
BDN6726A	Earpiece with standard earpiece BLACK	No	Receive only
BDN6665A	Earpiece w/ XL Earphone	No	Receive only
BDN6727A	Earpiece with extra loud earphone BLACK	No	Receive only
BDN6666A	Earpiece w/ Volume Control	No	Receive only
BDN6728A	Earpiece with volume control BLACK	No	Receive only
BDN6728A	Earpiece with volume control BLACK	No	Receive only
BDN6781A	Earbud, single, receive only, black	No	Receive only

## 8.0 Description of Test System:



### 8.1 Descriptions of Robotics/Probes/Readout Electronics:

The laboratory utilizes a Dosimetric Assessment System (DASY5™) SAR measurement system Version 52.6.2.424 manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot, DAE3 and ES3DV3 E-field probe. The DASY5™ system is operated per the instructions in the DASY5™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME SAR compliance was calibrated according to ISO/IEC 17025 A2LA guidelines. Section 9.0 presents additional test equipment information. Appendices B and C present the applicable calibration certificates. The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

## 8.2 Description of Phantom(s)

### 8.2.1 Dual Flat Phantom

Not Applicable

### 8.2.2 SAM Phantom

Not Applicable

### 8.2.3 Elliptical Phantom

**TABLE 6**

Phantom ID (s)	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
OVAL1108 OVAL1090 OVAL1016	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190	2mm +/- 0.2mm	Wood	< 0.05

## 8.3 Description of Simulated Tissue:

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

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

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in table 7 below for 450 MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at 380.000, 393.000, 395.000, 398.000 (outside PT90), 406.100, 422.000, 438.000, 450.000, 454.000, 470.000 MHz frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

## Simulated Tissue Composition (by mass)

**TABLE 7**

% of listed ingredients	450MHz	
	Head	Body
Sugar	56.0	46.5
Diacetin	0	0
De ionized -Water	39.1	50.53
Salt	3.8	1.87
HEC	1.0	1.0
Bact.	0.1	0.1

Reference section 10.1 for target parameters

### 9.0 Additional Test Equipment:

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

**TABLE 8**

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Power Meter (Agilent)	E4419B	MY45103725	4/19/2010	4/19/2011
Power Meter (Agilent)	E4418B	US39251150	4/12/2010	4/12/2011
Power Meter (Agilent)	E4418B	MY50000505	9/6/11	9/6/2012
Power Meter (Agilent)	E4418B	GB40206553	4/6/2011	4/6/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495730	4/13/2010	4/13/2011
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495733	4/13/2010	4/13/2011
E-Series Avg. Power Sensor (Agilent)	E9301B	MY5028001	8/8/2011	8/8/2012
Power Sensor (HP)	8481B	3318A10982	3/5/2010	3/5/2011
Bi-Directional Coupler (NARDA)	3020A	40295	6/3/2010	6/3/2012
Bi-Directional Coupler (NARDA)	3020A	40296	2/5/2010	2/5/2012
Signal Generator (Agilent)	E4428C	MY47381119	1/14/2010	1/14/2012
Signal Generator (Agilent)	E4438C	MY42082269	2/18/2010	2/18/2012
AMP (Amplifier Research)	10WD1000	28782	CNR	CNR
AMP (Amplifier Research)	1WD1000	16625	CNR	CNR
Power Meter (Agilent)	E4419B	MY45103725	4/6/2011	4/6/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495593	2/19/2011	2/19/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495594	2/4/2011	2/4/2012

**TABLE 8 (Continued)**

Bi-Directional Coupler (NARDA)	3020A	40295	6/3/2010	6/3/2012
Bi-Directional Coupler (NARDA)	3022	77115	3/3/2010	3/3/2012
Bi-Directional Coupler (NARDA)	3024	61136	2/21/2011	2/21/2013
Signal Generator (Agilent)	E4428C	MY47381119	6/24/2011	6/24/2013
AMP (ComTech PST)	AR88258-10	N1R1A00-1015	CNR	CNR
Dickson Temperature Recorder	TM125	1195889	2/16/2010	2/16/2011
Dickson Temperature Recorder	TM320	7081356	8/30/2010	8/30/2011
Omega Digital Thermometer with J Type TC Probe	HH200A	20857	9/20/2010	9/20/2011
Omega Digital Thermometer with J Type TC Probe	HH202A	18800	11/17/2010	11/17/2011
Omega Digital Thermometer with J Type TC Probe	HH202A	18801	4/19/2010	4/19/2011
Omega Digital Thermometer with J Type TC Probe	HH202A	18812	3/24/2010	3/24/2011
Agilent PNA-L Network Analyzer	N5230A	MY45001092	6/10/2010	6/10/2011
Dielectric Probe Kit (HP)	85070C	US99360076	CNR	CNR
Speag Dipole	D450V2	1002	4/26/2010	4/26/2012
Speag Dipole	D450V3	1075	8/22/2011	8/22/2013

## 10.0 SAR Measurement System Verification:

The SAR measurements were conducted with probe model/serial number ES3DV3/3291 and ES3DV3/3163. The system performance check was conducted daily and within 24 hours prior to testing. DASY output files of the probe/dipole calibration certificates and system performance test results are included in appendices B, C, D respectively.

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

## 10.1 Equivalent Tissue Test Results:

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

outside FCC Part 90.

**TABLE 9**

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
380	FCC Body	0.93 (0.88-0.98)	57.4 (54.53-60.27)	0.89	57.9	8/10/11
				0.89	57.4	11/14/11
380	IEEE/ IEC Head	0.87 (0.83-0.91)	44.3 (42.09-46.52)	0.83	45.9	8/10/11
393	FCC Body	0.93 (0.88-0.98)	57.3 (54.44-60.17)	0.89	57.4	8/10/11
393	IEEE/ IEC Head	0.87 (0.83-0.91)	44.2 (41.99-46.41)	0.84	45.4	8/10/11
395	FCC Body	0.93 (0.88-0.98)	57.3 (54.44-60.17)	0.90	57.1	11/14/11
406	FCC Body	0.93 (0.88-0.98)	57.1 (54.25-59.96)	0.91	57.3	8/8/11
406	IEEE/ IEC Head	0.87 (0.83-0.91)	44.0 (41.8-46.2)	0.87	45.4	8/9/11
422	FCC Body	0.94 (0.89-0.99)	56.98 (54.13-59.83)	0.92	56.9	8/8/11
				0.92	57.2	8/9/11
438	FCC Body	0.94 (0.89-0.99)	56.82 (53.98-59.66)	0.94	56.6	8/8/11
				0.93	56.8	8/9/11
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.87-59.54)	0.95	56.4	8/8/11
				0.95	56.6	8/9/11
450	IEC/IEEE Head	0.87 (0.83-0.91)	43.5 (41.32-45.68)	0.88	43.7	8/10/11
454	FCC Body	0.94 (0.89-0.99)	56.68 (53.85-59.51)	0.95	56.3	8/8/11
470	FCC Body	0.94 (0.89-0.99)	56.6 (53.77-59.43)	0.97	56.1	8/8/11

## 10.2 System Check Test Results:

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

**TABLE 10**

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Reference SAR @ 1W (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3291	FCC Body	SPEAG D450V3 /1002	4.37 +/- 10%	4.36	8/8/11
				4.36	8/9/11
3291	IEEE/ IEC Head	SPEAG D450V3 /1002	4.69 +/- 10%	4.64	8/10/11
3163	FCC Body	SPEAG D450V3 /1075	4.65 +/- 10%	4.48	11/14/11

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

## 11.0 Environmental Test Conditions:

The EME Laboratory's ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within  $\pm 2^{\circ}\text{C}$  of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was at least 15cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the SAR tests reported herein:

**TABLE 11**

	<b>Target</b>	<b>Measured</b>
<b>Ambient Temperature</b>	18 - 25 °C	Range: 21.4-22.4°C Avg. 22.1°C
<b>Relative Humidity</b>	30 - 70 %	Range: 52.0-62.6% Avg. 56.4%
<b>Tissue Temperature</b>	NA	Range: 20.8-21.7°C Avg. 21.2C

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

## 12.0 DUT Test Methodology

### 12.1 Measurements

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

### 12.2 DUT Configuration(s)

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were considered 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 the offered audio accessories as applicable.

**12.3.2 Head:**

Not applicable.

**12.3.3 Face:**

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

**12.4 DUT Test Channels:**

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

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

Where

$N_c$  = Number of channels

$F_{high}$  = Upper channel

$F_{low}$  = Lower channel

$F_c$  = Center channel

**12.5 DUT Test Plan:**

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. 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.

Note that test results that are outside the relevant FCC frequency allocations are presented herein in blue font. Tests outside Part 90 allocation were performed using the highest configuration from both body and face.

### 13.0 DUT Test Data

#### 13.1 Assessments at the Body:

The battery NNTN8128A was selected as default battery to assess 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 (406.1-470MHz) using the default battery NNTN8128A is indicated in the table 12. The channel with highest conducted power will be identified as 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 12**

Test Freq (MHz)	Power (W)
380.000	5.72
393.000/395.000	5.71
406.100	5.72
422.000	5.73
438.000	5.73
454.000	5.73
470.000	5.73

#### 13.2 Assessments at the Body with Body worn PMLN4651A:

Assessment of offered antennas with the default battery and body worn accessory PMLN4651A per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to table 12 for highest output power channel.

**TABLE 13**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
FAF5259A (380-470MHz)	NNTN8128A	PMLN4651A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000	5.87	0.40	7.17	5.19	3.59	2.60	ErC-Ab-110808-02
				438.000							
				454.000	5.89	-0.64	8.05	5.73	<b>4.66</b>	3.32	ErC-Ab-110808-05
				470.000	5.84	-0.24	4.32	3.10	2.28	1.64	ErC-Ab-110808-06

**Table 13 (Continued)**

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#
PMAE4065A (380-520MHz)	NNTN8128A	PMLN4651A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000	5.86	0.130	6.90	5.02	3.45	2.51	ErC-Ab-110808-07
				438.000							
				454.000							
				470.000							

Assessment of the worst case antenna from above with body worn accessory PMLN4651A with additional offered battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8129A	PMLN4651A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000							
				438.000							
				454.000	5.84	-0.380	5.63	4.04	<b>3.07</b>	2.20	CM-Ab-110808-08
				470.000							

### 13.3 Assessments at the Body with Body worn PMLN7008A:

Assessment of offered antennas with the default battery and body worn accessory PMLN7008A per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to table 12 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#	
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	HMN4104B	380.000								
				393.000								
				406.125	5.87	2.100	4.11	2.97	2.06	1.49	CM-Ab-110808-10	
				422.000	5.90	0.0001	9.75	6.96	4.88	3.48	CM-Ab-110808-09	
				438.000	5.83	-0.120	11.20	8.00	<b>5.76</b>	4.11	CM-Ab-110808-11	
				454.000	5.90	-0.510	8.03	5.69	4.52	3.20	CM-Ab-110808-12	
				470.000	5.88	-0.330	3.87	2.74	2.09	1.48	CM-Ab-110808-13	
PMAE4065A (380-520MHz)	NNTN8128A	PMLN7008A	HMN4104B	380.000								
				393.000								
				406.125								
				422.000	5.86	0.200	6.84	4.92	3.42	2.46	CM-Ab-110808-14	
				438.000								
				454.000								
				470.000								

Assessment of the worst case antenna from above with body worn accessory PMLN7008A with additional offered battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#	
FAF5259A (380-470MHz)	NNTN8129A	PMLN4651A	HMN4104B	380.000								
				393.000								
				406.125								
				422.000								
				438.000	5.85	-0.230	8.88	6.38	<b>4.68</b>	3.36	CM-Ab-110808-15	
				454.000								
				470.000								

#### 13.4 Assessments at the Body with Body worn PMLN5950A:

Assessment of offered antennas with the default battery and body worn accessory PMLN5950A per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to table 12 for highest output power channel.

**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#	
FAF5259A (380-470MHz)	NNTN8128A	PMLN5950A	HMN4104B	380.000								
				393.000								
				406.125								
				422.000	5.88	-0.110	2.41	1.83	<b>1.24</b>	0.94	CM-Ab-110808-16	
				438.000								
				454.000								
				470.000								

**TABLE 17 (Continued)**

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#
PMAE4065A (380-520MHz)	NNTN8128A	PMLN5950A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000	5.86	0.017	1.96	1.49	0.98	0.75	CM-Ab-110808-17
				438.000							
				454.000							
				470.000							

Assessment of the worst case antenna from above with body worn accessory PMLN5950A with additional offered battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8129A	PMLN5950A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000	5.85	-0.660	1.60	1.22	<b>0.93</b>	0.71	ErC-Ab-110809-02
				438.000							
				454.000							
				470.000							

### 13.5 Assessments at the Body with Body worn PMLN5950A/NTN5243A:

Assessment of offered antennas with the default battery and body worn accessory PMLN5950A/NTN5243A per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to table 12 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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN5950A /NTN5243A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000	5.88	0.05	5.13	3.85	<b>2.57</b>	1.93	ErC-Ab-110809-03
				438.000							
				454.000							
				470.000							
PMAE4065A (380-520MHz)	NNTN8128A	PMLN5950A /NTN5243A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000	5.90	0.81	4.20	3.12	2.10	1.56	ErC-Ab-110809-04
				438.000							
				454.000							
				470.000							

Assessment of the worst case antenna from above with body worn accessory  
 PMLN5950A/NTN5243A with additional offered battery per KDB 643646 D01  
 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn  
 Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8129A	PMLN5950A /NTN5243A	HMN4104B	380.000							
				393.000							
				406.125							
				422.000	5.89	-0.64	4.48	3.37	<b>2.60</b>	1.95	ErC-Ab-110809-05
				438.000							
				454.000							
				470.000							

**13.6 Assessments at the Body with Audio HMN4104B/RMN5116A:**

Assessment of offered audio accessories HMN4104B/RMN5116A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	HMN4104B/ RMN5116A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.84	-0.26	10.04	7.12	<b>5.33</b>	3.78	ErC-Ab-110809-06
				454.000							
				470.000							

### 13.7 Assessments at the Body with Audio RLN5882A:

Assessment of offered audio accessories RLN5882A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	RLN5882A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.91	-0.23	8.65	6.17	<b>4.56</b>	3.25	ErC-Ab-110809-07
				454.000							
				470.000							

### 13.8 Assessments at the Body with Audio PMLN5111A

Assessment of offered audio accessories PMLN5111A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**TABLE 23**

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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	PMLN5111A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.89	-0.20	10.95	7.76	<b>5.73</b>	4.06	ErC-Ab-110809-08
				454.000							
				470.000							

### 13.9 Assessments at the Body with Audio PMMN4062A:

Assessment of offered audio accessories PMMN4062A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	PMMN4062A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.90	-0.16	11.15	7.93	<b>5.78</b>	4.11	ErC-Ab-110809-09
				454.000							
				470.000							

### 13.10 Assessments at the Body with Audio PMMN4065A:

Assessment of offered audio accessories PMMN4065A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	PMMN4065A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.82	-0.23	9.94	7.07	<b>5.24</b>	3.73	ErC-Ab-110809-10
				454.000							
				470.000							

### 13.11 Assessments at the Body with Audio PMMN4024A:

Assessment of offered audio accessories PMMN4024A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	PMMN4024A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.88	-0.10	10.45	7.44	<b>5.34</b>	3.80	ErC-Ab-110809-11
				454.000							
				470.000							

### 13.12 Assessments at the Body with Audio PMLN5101A:

Assessment of offered audio accessories PMLN5101A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	PMLN5101A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.89	-0.37	10.02	7.12	<b>5.46</b>	3.88	ErC-Ab-110809-12
				454.000							
				470.000							

### 13.13 Assessments at the Body with Audio PMLN5275C:

Assessment of offered audio accessories PMLN5275C with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	PMLN5275C	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.91	-0.17	10.45	7.43	<b>5.43</b>	3.86	ErC-Ab-110809-13
				454.000							
				470.000							

### 13.14 Assessment at the Body with Audio RMN5058A:

Assessment of offered audio accessories RMN5058A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	RMN5058A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.90	-0.25	11.05	7.81	<b>5.85</b>	4.14	ErC-Ab-110809-14
				454.000							
				470.000							

**13.15 Assessment at the Body with Audio ZMN6031A/NNTN7869A:**

Assessment of offered audio accessories ZMN6031A/NNTN7869A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**TABLE 30**

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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	ZMN6031A/NNTN7869A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.92	-0.18	8.17	5.79	<b>4.26</b>	3.02	CM-Ab-110809-15
				454.000							
				470.000							

**13.16 Assessment at the Body with Audio ZMN6032A/NNTN7869A:**

Assessment of offered audio accessories ZMN6032A/NNTN7869A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**TABLE 31**

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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	ZMN6032A/NNTN7869A	380.000							
				393.000							
				406.125							
				422.000							
				438.000	5.91	-0.28	8.72	6.18	<b>4.65</b>	3.30	CM-Ab-110809-16
				454.000							
				470.000							

### 13.17 Assessment at the Body with Audio BDN6731A/BDN6783A:

Assessment of offered audio accessories BDN6731A/BDN6783A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories..

**TABLE 32**

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#	
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	BDN6731A /BDN6783A	380.000								
				393.000								
				406.125								
				422.000								
				438.000	5.92	-0.14	10.85	7.70	<b>5.60</b>	3.98	CM-Ab-110809-17	
				454.000								
				470.000								

### 13.18 Assessment at the Body with Audio BDN6732A/BDN6783A:

Assessment of offered audio accessories BDN6732A/BDN6783A with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**TABLE 33**

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#	
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	BDN6732A /BDN6783A	380.000								
				393.000								
				406.125								
				422.000								
				438.000	5.90	-0.32	10.14	7.25	<b>5.46</b>	3.90	CM-Ab-110809-18	
				454.000								
				470.000								

### 13.19 Assessment at the Body with Audio BDN6780A/BDN6783A

Assessment of offered audio accessories BDN6780A/BDN6783 with the highest SAR configuration from assessments at the body above (See Table 15) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories.

**TABLE 34**

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#	
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	BDN6780A /BDN6783A	380.000								
				393.000								
				406.125								
				422.000								
				438.000	5.90	-0.20	10.04	7.11	<b>5.26</b>	3.72	CM-Ab-110809-19	
				454.000								
				470.000								

### 13.20 Assessments outside FCC Part 90 at the body:

Assessment using highest SAR configuration from Part 90 assessment above (See Table 29) across the outside Part 90 band width for each antenna.

**TABLE 35**

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#
FAF5259A (380-470MHz)	NNTN8128A	PMLN7008A	RMN5058A	380.000	5.66	-0.160	3.76	2.63	<b>1.96</b>	1.37	CM-Ab-111114-14
				395.000	5.72	-0.730	2.94	2.03	1.74	1.20	CM-Ab-111114-15

TABLE 36

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#
PMAE4065A (380-520MHz)	NNTN8128A	PMLN7008A	RMN5058A	380.000	5.70	-0.120	2.75	1.83	1.41	0.94	CM-Ab-111114-17
				395.000	5.72	-0.590	2.52	1.75	<b>1.44</b>	1.00	CM-Ab-111114-18

### 13.21 Assessments at the Face:

The highest capacity battery NNTN8129A was selected as the default battery. The conducted power measurement for all test channels within Part 90 frequency range (406.1-470MHz) using battery NNTN8129A is listed in the table 37. The channel with highest conducted power was used 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 37

Test Freq (MHz)	Power (W)
380.000	5.76
393.000	5.79
406.100	5.76
422.000	5.76
438.000	5.74
454.000	5.74
470.000	5.76

**13.22 Assessments at the Face with offered antennas**

Assessment of each of the offered antennas with the default battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Head SAR Test Considerations. Refer to table 37 for highest output power channel.

**TABLE 38**

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#	
FAF5259A (380-470MHz)	NNTN8129A	None	None	380.000								
				393.000								
				406.125	5.87	-0.120	5.94	4.45	<b>3.05</b>	2.29	CM-Face-110809-23	
				422.000								
				438.000								
				454.000								
				470.000								

**TABLE 39**

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#	
PMAE4065A (380-520MHz)	NNTN8129A	None	None	380.000								
				393.000								
				406.125	5.88	0.056	6.64	4.97	<b>3.32</b>	2.49	CM-Face-110809-24	
				422.000								
				438.000								
				454.000								
				470.000								

Assessment of other offered battery using the highest SAR antenna from face assessment above (Table 39) per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Head SAR Test Considerations.

**TABLE 40**

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#	
PMAE4065A (380-520MHz)	NNTN8128A	None	None	380.000								
				393.000								
				406.125	5.89	-0.160	4.37	3.28	2.27	1.70	CM-Face-110809-25	
				422.000								
				438.000								
				454.000								
				470.000								

### 13.23 Assessments of outside FCC Part 90 at the face:

Assessment using highest SAR configuration from Part 90 assessment above (Table 39) across the outside Part 90 band width for each offered antenna.

**TABLE 41**

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#
FAF5259A (380-470MHz)	NNTN8129A	None	None	380.000	5.88	0.170	2.58	1.91	1.29	0.96	CM-Face-110810-08
				393.000	5.85	0.085	3.69	2.76	1.85	1.38	CM-Face-110810-09

**TABLE 42**

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#
PMAE4065A (380-520MHz)	NNTN8129A	None	None	380.000	5.88	0.053	3.57	2.66	1.79	1.33	CM-Face-110810-10
				393.000	5.86	0.140	4.80	3.58	2.40	1.79	CM-Face-110810-11

**13.24 SAR scaling methodology verification:**

For this assessment the SAR scaling used to determine the maximum calculated (Max Calc) results presented herein is validated by the power slump measurement performed on a representative sample of the device using the worst case offered battery. The result of the power slump is found in Part 2 of 2 APPENDIX H of this report. The result shows that over a 40 minute period the battery slumped only 1.35%.

**14.0 Simultaneous Transmission Exclusion:**

NA

**15.0 Conclusion:**

The highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing: Model H51QDH9PW7AN (MUE3779).

**Results for FCC Part 90 (406.1-470 MHz)****TABLE 43**

Frequency Range (MHz)	Max Calc at Body (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
406.1-470.000	5.85	4.14	NA	NA

**Table 44**

Frequency Range (MHz)	Max Calc at Face (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
406.1-470.000	3.32	2.49	NA	NA

**Results for 380.0-470 MHz****TABLE 45**

Frequency Range (MHz)	Max Calc at Body (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
380.0-406.1	1.46	1.05	NA	NA

**TABLE 46**

Frequency Range (MHz)	Max Calc at Face (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
380.0-406.1	2.40	1.79	NA	NA

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.

## **APPENDIX A**

### **Measurement Uncertainty**

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

**Table A1:**  
**Uncertainty Budget for Device Under Test, for 100 MHz to 800 MHz**

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

**FCD-0558 Uncertainty Budget Rev.8**

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob. Dist.	Div.	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	1 g <i>u<sub>i</sub></i> (±%)	10 g <i>u<sub>i</sub></i> (±%)
<b>Measurement System</b>								
Probe Calibration	E.2.1	9.0	N	1.00	1	1	9.0	9.0
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0
<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	R	1.73	0.64	0.43	1.2	0.8
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5
<b>Combined Standard Uncertainty</b>			RSS				11	11
<b>Expanded Uncertainty</b> (95% CONFIDENCE LEVEL)			<i>k</i> =2				22	22

**FCD-0558 Uncertainty Budget Rev.8**

Notes for Tables 1, 2, 3 and 4

- Column headings *a-k* are given for reference.
- Tol. - tolerance in influence quantity.
- Prob. Dist. – Probability distribution
- N, R - normal, rectangular probability distributions
- Div. - divisor used to translate tolerance into normally distributed standard uncertainty
- c<sub>i</sub>* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- u<sub>i</sub>* – SAR uncertainty
- ν<sub>i</sub>* - 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  
**S** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3291\_Jul11**

**CALIBRATION CERTIFICATE**

Object **ES3DV3 - SN:3291**

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

Calibration date: **July 22, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by:	Name <b>Katja Pokovic</b>	Function <b>Technical Manager</b>	Signature 
Approved by:	Name <b>Niels Kuster</b>	Function <b>Quality Manager</b>	

Issued: July 25, 2011

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

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



**S** Schweizerischer Kalibrierdienst  
**S** 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
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.

# Probe ES3DV3

## SN:3291

Manufactured: July 6, 2010  
Calibrated: July 22, 2011

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

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3291

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V/m})^2$ ) <sup>A</sup>	0.87	1.39	0.83	± 10.1 %
DCP (mV) <sup>B</sup>	104.0	101.6	101.6	

### Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>E</sup> (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	122.4	±2.5 %
			Y	0.00	0.00	1.00	122.0	
			Z	0.00	0.00	1.00	123.0	

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the  $E^2$ -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.

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3291

### 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	7.48	7.48	7.48	0.24	1.01	± 13.4 %
450	43.5	0.87	6.94	6.94	6.94	0.16	1.79	± 13.4 %
750	41.9	0.89	6.58	6.58	6.58	1.00	1.00	± 12.0 %
900	41.5	0.97	6.24	6.24	6.24	1.00	1.00	± 12.0 %
1810	40.0	1.40	5.23	5.23	5.23	0.95	1.13	± 12.0 %
1950	40.0	1.40	5.08	5.08	5.08	1.00	1.06	± 12.0 %
2300	39.5	1.67	4.88	4.88	4.88	0.87	1.14	± 12.0 %
2450	39.2	1.80	4.56	4.56	4.56	0.94	1.09	± 12.0 %
2600	39.0	1.96	4.47	4.47	4.47	0.84	1.19	± 12.0 %
3500	37.9	2.91	4.35	4.35	4.35	0.99	1.24	± 13.1 %
3700	37.7	3.12	3.91	3.91	3.91	0.99	1.30	± 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.

## DASY/EASY - Parameters of Probe: ES3DV3- SN:3291

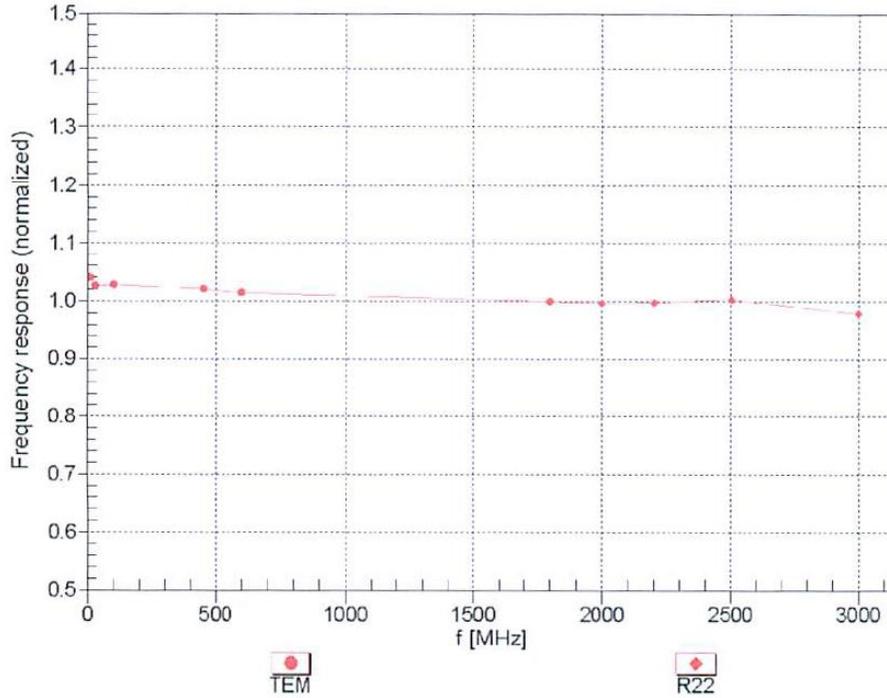
### Calibration Parameter Determined in Body Tissue Simulating Media

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	7.62	7.62	7.62	0.22	1.67	± 13.4 %
450	56.7	0.94	7.46	7.46	7.46	0.08	1.30	± 13.4 %
750	55.5	0.96	6.47	6.47	6.47	1.00	1.14	± 12.0 %
900	55.0	1.05	6.28	6.28	6.28	1.00	1.00	± 12.0 %
1810	53.3	1.52	5.07	5.07	5.07	1.00	1.18	± 12.0 %
1950	53.3	1.52	4.97	4.97	4.97	0.94	1.20	± 12.0 %
2300	52.9	1.81	4.56	4.56	4.56	1.00	1.09	± 12.0 %
2450	52.7	1.95	4.30	4.30	4.30	1.00	1.08	± 12.0 %
2600	52.5	2.16	4.21	4.21	4.21	0.90	1.21	± 12.0 %
3500	51.3	3.31	3.63	3.63	3.63	0.65	1.70	± 13.1 %
3700	51.0	3.55	3.58	3.58	3.58	0.60	1.87	± 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.

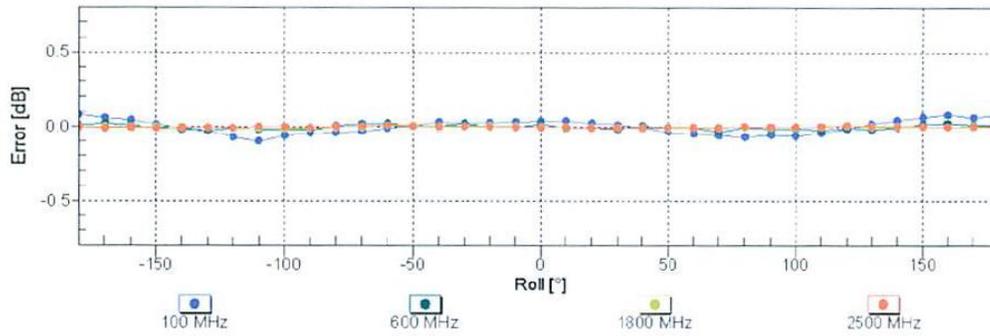
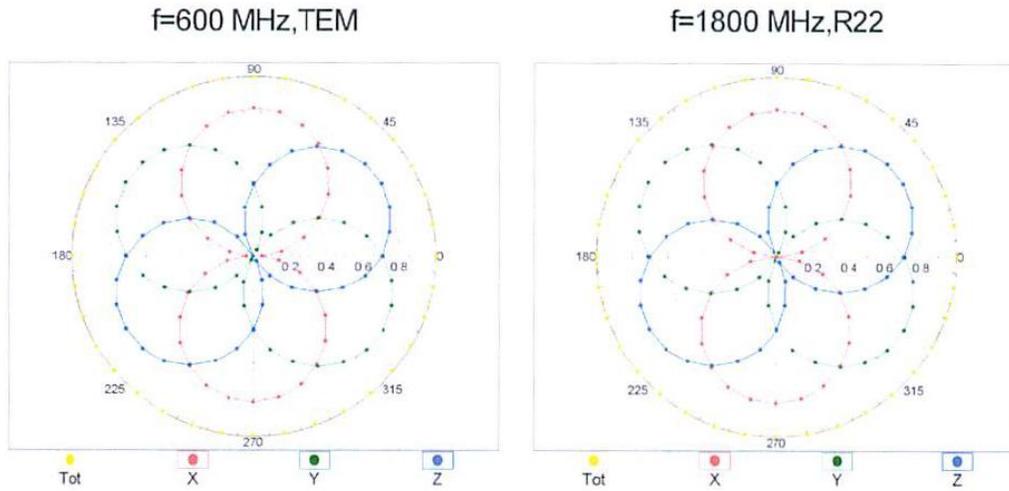
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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



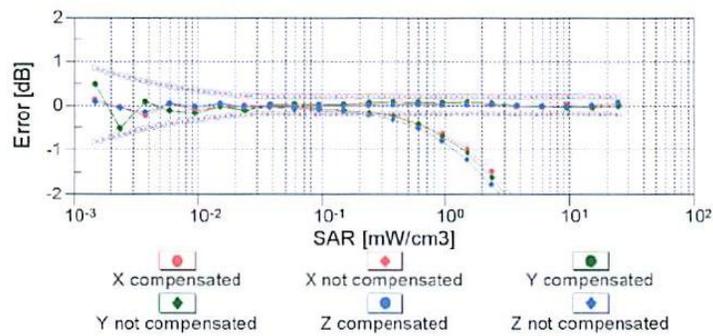
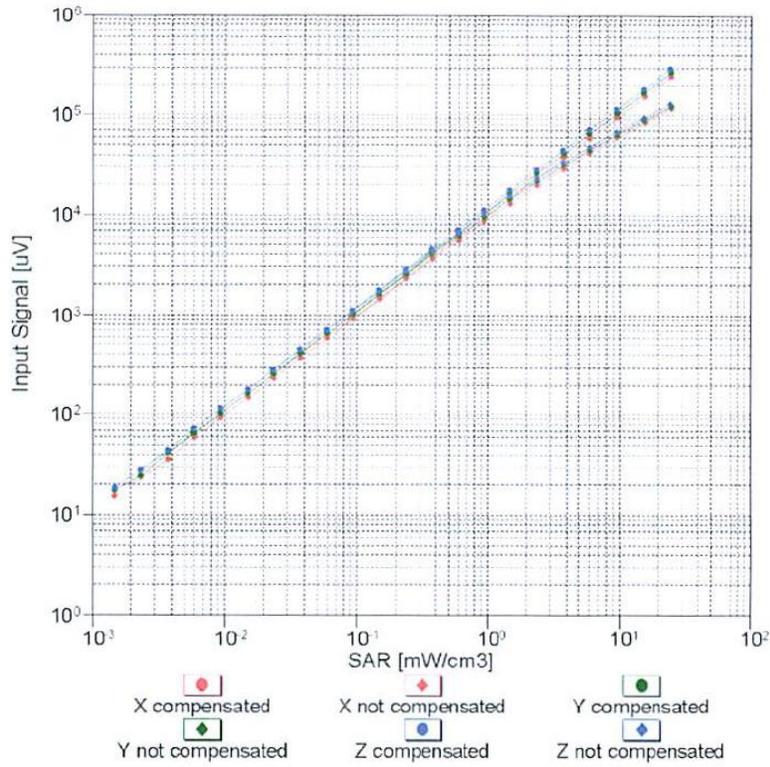
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



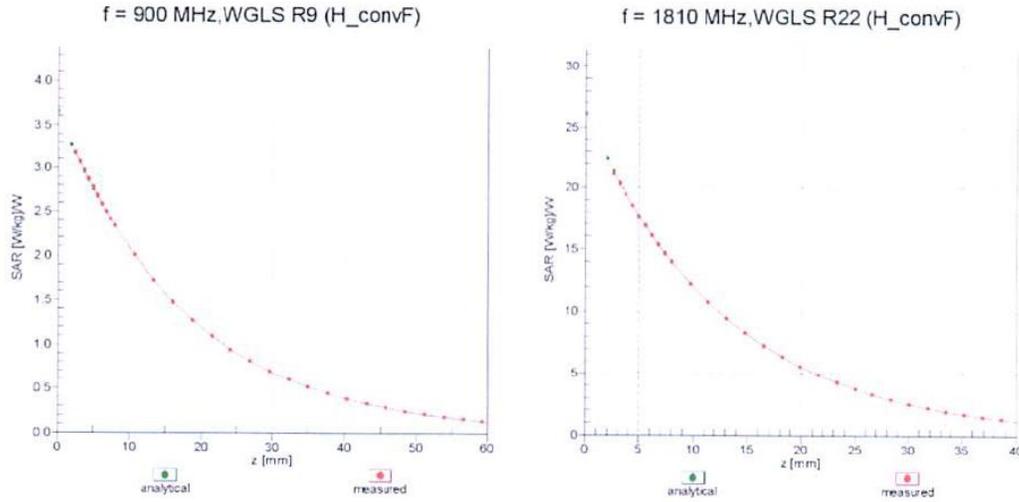
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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

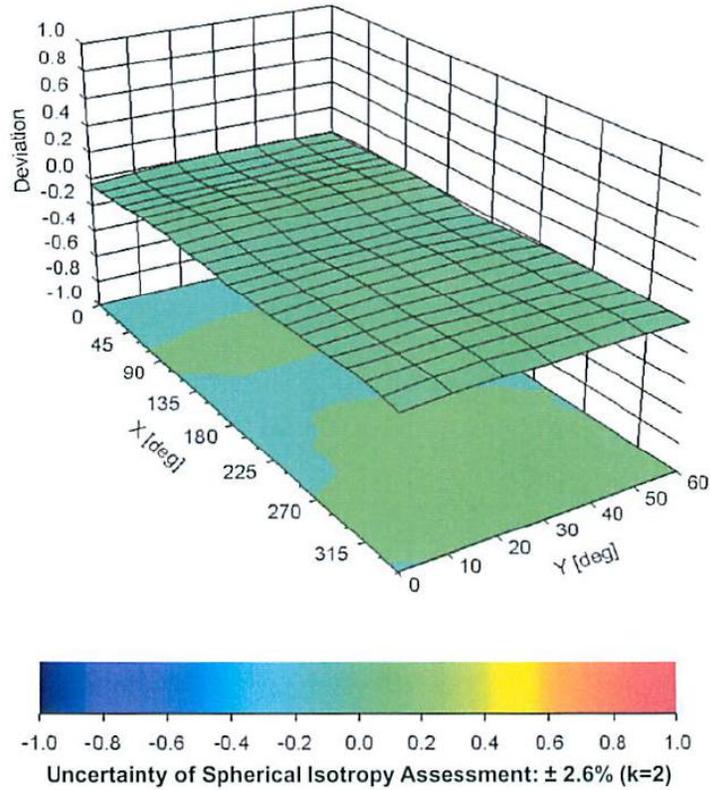


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi, \vartheta$ ), f = 900 MHz



## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3291

### Other Probe Parameters

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

Schmid &amp; Partner Engineering AG

**s p e a g**

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

## Additional Conversion Factors

for Dosimetric E-Field Probe

Type:

**ES3DV3**

Serial Number:

**3291**

Place of Assessment:

**Zurich**

Date of Assessment:

**July 26, 2011**

Probe Calibration Date:

**July 22, 2011**

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

Assessed by:



Schmid &amp; Partner Engineering AG

**s p e a g**

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

**Dosimetric E-Field Probe ES3DV3 SN:3291**Conversion factor ( $\pm$  standard deviation)

150 $\pm$ 50 MHz	<i>ConvF</i>	8.5 $\pm$ 10%	$\epsilon_r = 52.3$ $\sigma = 0.76$ mho/m (head tissue)
250 $\pm$ 50 MHz	<i>ConvF</i>	7.9 $\pm$ 10%	$\epsilon_r = 47.6$ $\sigma = 0.83$ mho/m (head tissue)
150 $\pm$ 50 MHz	<i>ConvF</i>	8.2 $\pm$ 10%	$\epsilon_r = 61.9$ $\sigma = 0.80$ mho/m (body tissue)
250 $\pm$ 50 MHz	<i>ConvF</i>	7.8 $\pm$ 10%	$\epsilon_r = 59.4$ $\sigma = 0.88$ mho/m (body tissue)

**Important Note:**

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

**Please see also DASYS Manual.**

**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

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

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3163\_Apr11**

**CALIBRATION CERTIFICATE**

Object: **ES3DV3 - SN:3163**

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

Calibration date: **April 13, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: April 13, 2011

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

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**S** Servizio svizzero di taratura  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

#### Glossary:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
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>** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<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.

# Probe ES3DV3

## SN:3163

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

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

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

### Basic Calibration Parameters

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

### Modulation Calibration Parameters

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

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the  $E^2$ -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.

## 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	6.88	6.88	6.88	0.25	1.08	± 13.4 %
450	43.5	0.87	6.53	6.53	6.53	0.17	1.84	± 13.4 %
750	41.9	0.89	6.39	6.39	6.39	0.99	1.10	± 12.0 %
900	41.5	0.97	6.04	6.04	6.04	0.99	1.08	± 12.0 %
1810	40.0	1.40	5.05	5.05	5.05	0.89	1.16	± 12.0 %
1950	40.0	1.40	4.88	4.88	4.88	0.87	1.17	± 12.0 %
2300	39.5	1.67	4.70	4.70	4.70	0.77	1.25	± 12.0 %
2450	39.2	1.80	4.44	4.44	4.44	0.77	1.25	± 12.0 %
2600	39.0	1.96	4.29	4.29	4.29	0.75	1.29	± 12.0 %
3500	37.9	2.91	4.06	4.06	4.06	0.99	1.26	± 13.1 %
3700	37.7	3.12	3.63	3.63	3.63	0.99	1.29	± 13.1 %

<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.

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

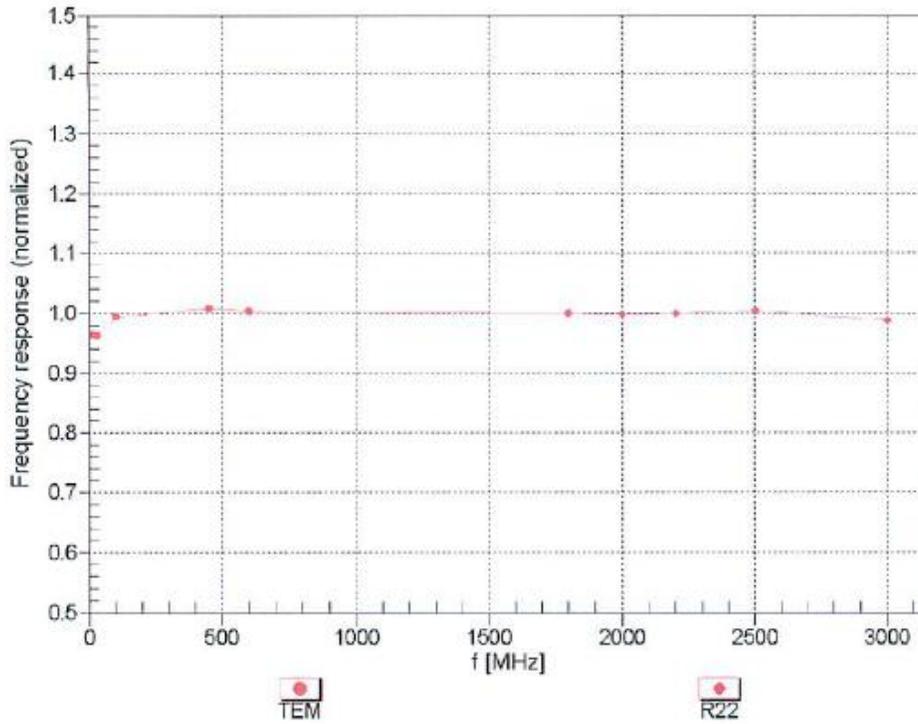
### Calibration Parameter Determined in Body Tissue Simulating Media

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	6.83	6.83	6.83	0.22	1.69	± 13.4 %
450	56.7	0.94	7.01	7.01	7.01	0.09	1.00	± 13.4 %
750	55.5	0.96	6.13	6.13	6.13	0.99	1.14	± 12.0 %
900	55.0	1.05	5.99	5.99	5.99	0.99	1.14	± 12.0 %
1810	53.3	1.52	4.87	4.87	4.87	0.87	1.30	± 12.0 %
1950	53.3	1.52	4.81	4.81	4.81	0.77	1.37	± 12.0 %
2300	52.9	1.81	4.38	4.38	4.38	0.90	1.15	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.99	1.05	± 12.0 %
2600	52.5	2.16	4.07	4.07	4.07	0.99	1.06	± 12.0 %
3500	51.3	3.31	3.47	3.47	3.47	0.99	1.37	± 13.1 %
3700	51.0	3.55	3.42	3.42	3.42	0.99	1.41	± 13.1 %

<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.

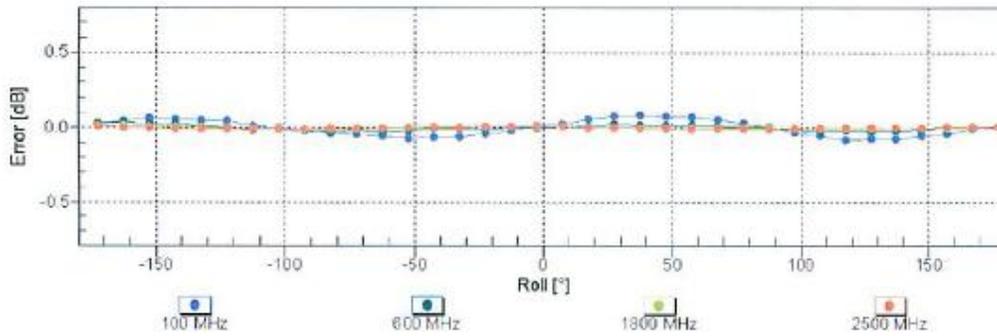
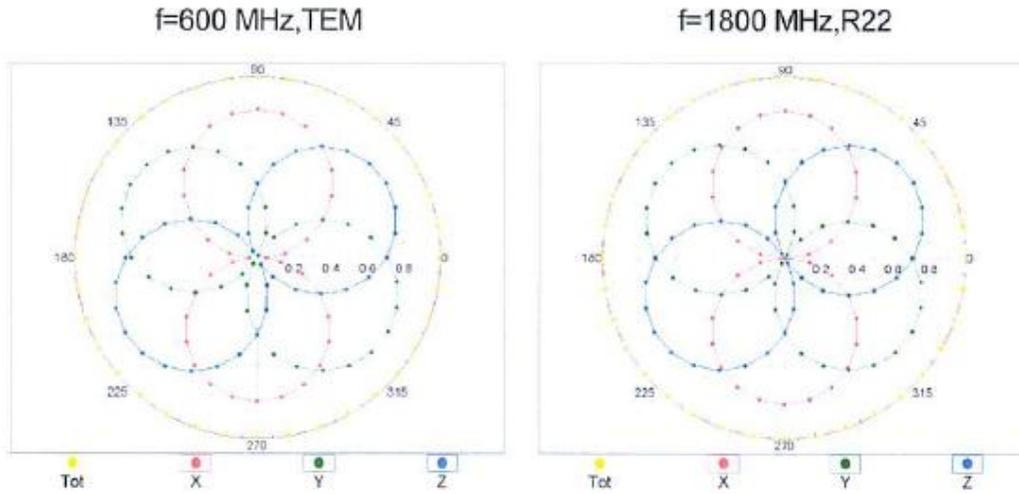
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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



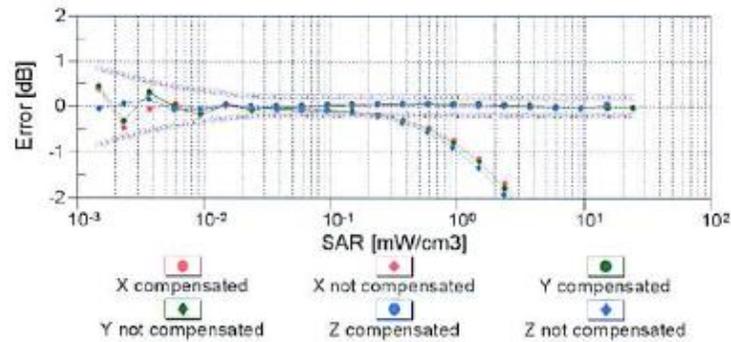
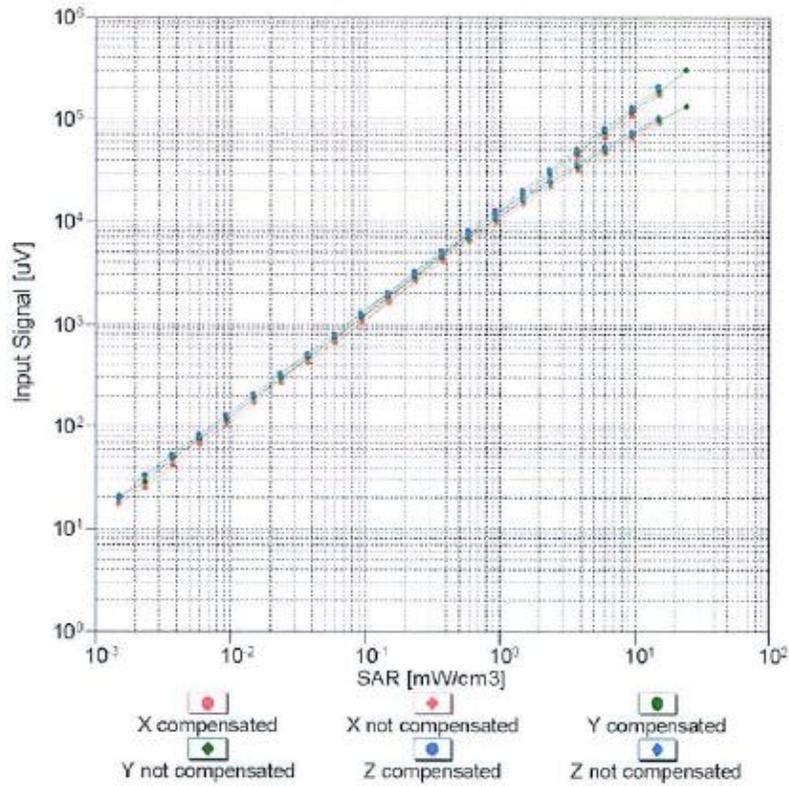
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



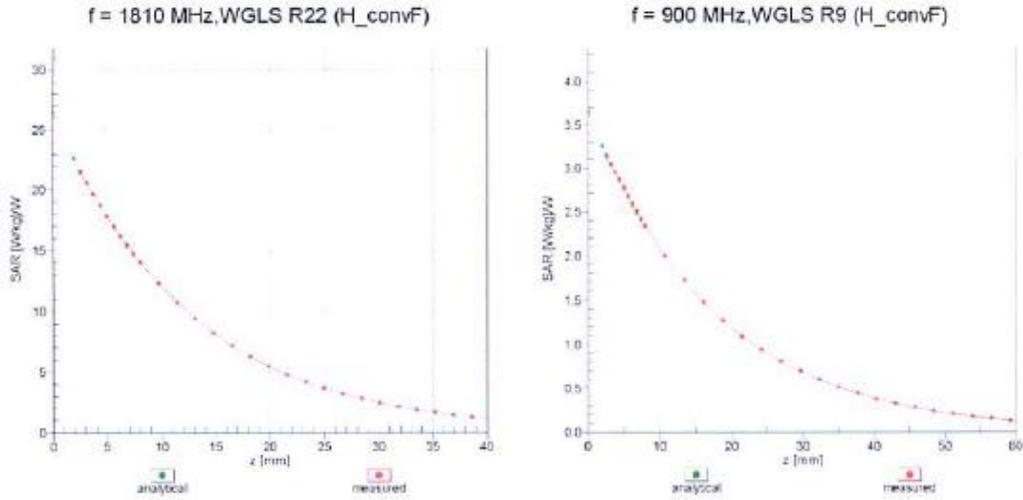
**Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )**

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

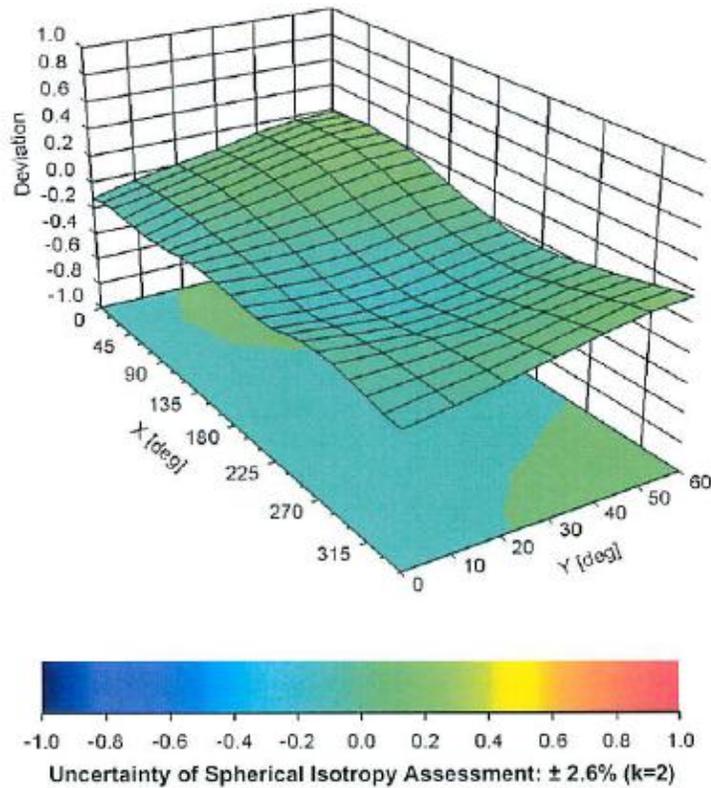


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), f = 900 MHz



ES3DV3- SN:3163

April 13, 2011

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

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

Schmid &amp; 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:

ES3DV3

Serial Number:

3163

Place of Assessment:

Zurich

Date of Assessment:

April 15, 2011

Probe Calibration Date:

April 13, 2011

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

Assessed by:



Schmid &amp; 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 MHz      *ConvF*      **8.2  $\pm$  10%**

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

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

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

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

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

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

$\epsilon_r = 59.4$   
 $\sigma = 0.88$  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



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D450V2-1002\_Sep10**

**CALIBRATION CERTIFICATE**

Object **D450V2 - SN: 1002**

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

Calibration date: **September 15, 2010**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Type-N mismatch combination	SN: 5047.3 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ET3DV6	SN: 1507	30-Apr-10 (No. ET3-1507_Apr10)	Apr-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

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

Issued: September 15, 2010

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Accreditation No.: **SCS 108**

### Glossary:

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

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- DASY4 System Handbook

### Methods Applied and Interpretation of Parameters:

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

**Measurement Conditions**

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

<b>DASY Version</b>	DASY5	V52.2
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Flat Phantom V4.4	Shell thickness: $6 \pm 0.2$ mm
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Area Scan Resolution</b>	dx, dy = 15 mm	
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	450 MHz $\pm$ 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	<b>Temperature</b>	<b>Permittivity</b>	<b>Conductivity</b>
<b>Nominal Head TSL parameters</b>	22.0 °C	43.5	0.87 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	43.6 $\pm$ 6 %	0.83 mho/m $\pm$ 6 %
<b>Head TSL temperature during test</b>	(22.0 $\pm$ 0.2) °C	----	----

**SAR result with Head TSL**

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	condition	
SAR measured	398 mW input power	1.92 mW / g
SAR normalized	normalized to 1W	4.82 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>5.01 mW / g <math>\pm</math> 18.1 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	398 mW input power	1.27 mW / g
SAR normalized	normalized to 1W	3.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>3.29 mW / g <math>\pm</math> 17.6 % (k=2)</b>

**Appendix****Antenna Parameters with Head TSL**

Impedance, transformed to feed point	50.0 $\Omega$ - 9.3 $j\Omega$
Return Loss	- 20.7 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.353 ns
----------------------------------	----------

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

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

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

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	March 22, 2002

**DASY5 Validation Report for Head TSL**

Date/Time: 15.09.2010 10:25:03

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1002**Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1  
Medium: HSL450Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.83$  mho/m;  $\epsilon_r = 43.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

**DASY5 Configuration:**

- Probe: ET3DV6 - SN1507; ConvF(6.62, 6.62, 6.62); Calibrated: 30.04.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 23.04.2010
- Phantom: Flat Phantom 4.4 ; Type: Flat Phantom 4.4; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

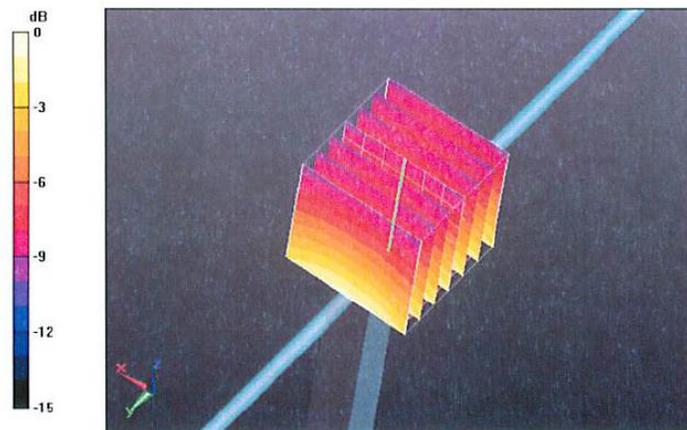
**Pin=398mW/d=15mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.2 V/m; Power Drift = 0.00717 dB

Peak SAR (extrapolated) = 2.97 W/kg

**SAR(1 g) = 1.92 mW/g; SAR(10 g) = 1.27 mW/g**

Maximum value of SAR (measured) = 2.06 mW/g



0 dB = 2.06mW/g

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D450V3-1075\_Aug11**

**CALIBRATION CERTIFICATE**

Object	D450V3 - SN: 1075		
Calibration procedure(s)	QA CAL-15.v6 Calibration procedure for dipole validation kits below 700 MHz		
Calibration date:	August 22, 2011		
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p>			
<b>Primary Standards</b>	<b>ID #</b>	<b>Cal Date (Certificate No.)</b>	<b>Scheduled Calibration</b>
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.3 / 06327	29-Mar-11 (No. 217-01168)	Apr-12
Reference Probe ET3DV6	SN: 1507	29-Apr-11 (No. ET3-1507_Apr11)	Apr-12
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
<b>Secondary Standards</b>	<b>ID #</b>	<b>Check Date (in house)</b>	<b>Scheduled Check</b>
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11
Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 
			Issued: August 24, 2011
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Accreditation No.: **SCS 108**

**Glossary:**

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

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

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

### Measurement Conditions

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

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

### Head TSL parameters

The following parameters and calculations were applied.

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

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	398 mW input power	1.84 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	4.69 mW / g $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.23 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	3.12 mW / g $\pm$ 17.6 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

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

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	398 mW input power	1.80 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	4.50 mW / g $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.20 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	3.01 mW / g $\pm$ 17.6 % (k=2)

**Appendix****Antenna Parameters with Head TSL**

Impedance, transformed to feed point	59.4 $\Omega$ - 2.2 j $\Omega$
Return Loss	- 21.1 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	56.6 $\Omega$ - 5.8 j $\Omega$
Return Loss	- 21.7 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.355 ns
----------------------------------	----------

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

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

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

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	June 24, 2010

**DASY5 Validation Report for Head TSL**

Date: 22.08.2011

Test Laboratory: SPEAG

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

Communication System: CW; Frequency: 450 MHz

Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.86$  mho/m;  $\epsilon_r = 44.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

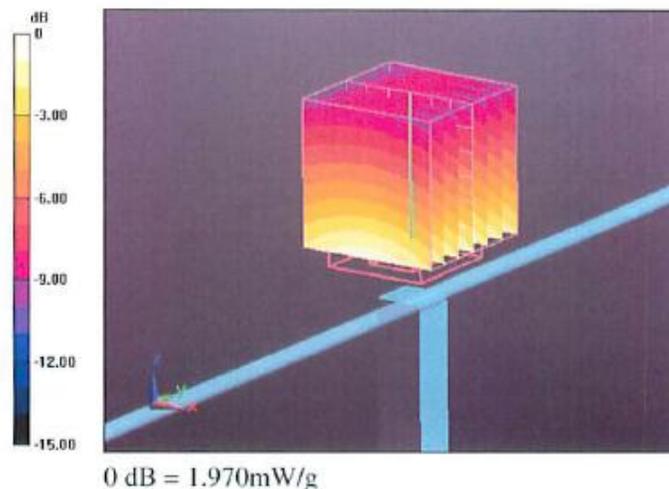
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

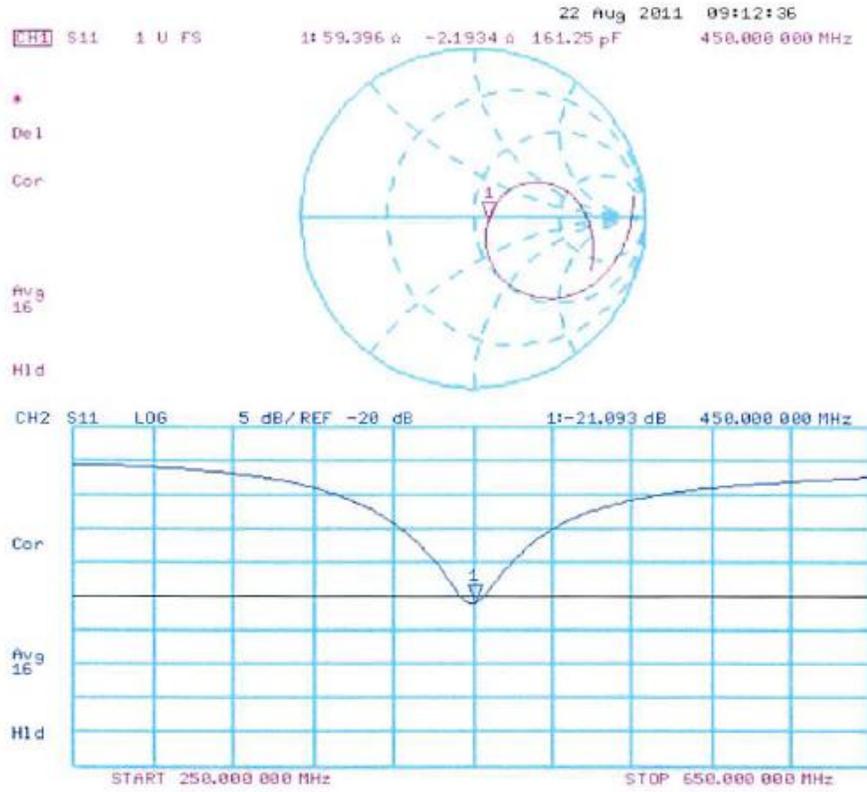
Peak SAR (extrapolated) = 2.798 W/kg

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

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



### Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 22.08.2011

Test Laboratory: SPEAG

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

Communication System: CW; Frequency: 450 MHz

Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.94$  mho/m;  $\epsilon_r = 55.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

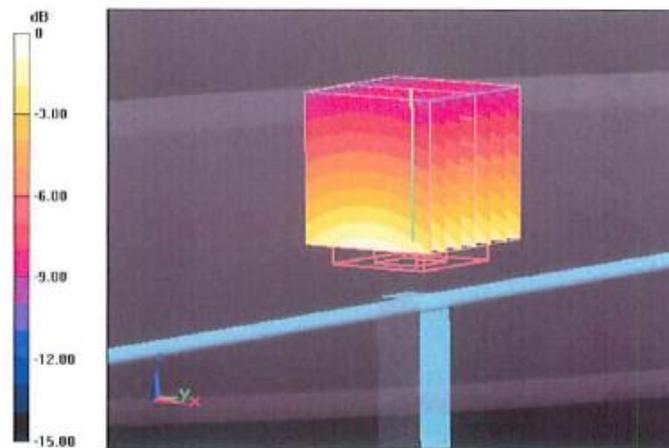
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 2.825 W/kg

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

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



0 dB = 1.920mW/g

Impedance Measurement Plot for Body TSL

