



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

**Motorola Solutions Inc.**  
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**Report Revision:** O  
**Report ID:** SR9748 APX4000 7/800 BT 1 of 2 Rev O 111006

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**Date/s Tested:** 8/24/11-9/20/11  
**Manufacturer/Location:** Penang  
**Sector/Group/Div.:** G&PS  
**Date submitted for test:** 7/26/11  
**DUT Description:** 764-775 MHz and 794-805 MHz at 2.5 W, 806-824 MHz and 851-870 MHz at 3 W, 6.25kHz/12.5kHz/25kHz, Single Display full keypad Model. Capable of digital and analog FM as well as TDMA transmissions. This radio is Bluetooth equipped.  
**Test TX mode(s):** CW (PTT); BT (CW)  
**Max. Power output:** 2.99 W (764-805 MHz), 3.6 W (806-870 MHz); 0.010 W (Bluetooth)  
**Nominal Power:** 2.50 W (764-805MHz), 3.0 W (806-870 MHz) CW; 0.010 W (Bluetooth)  
**Tx Frequency Bands:** 764-775 MHz, 794-805 MHz, 806-824 MHz, 851-870 MHz; 2.402-2.480 GHz (Bluetooth)  
**Signaling type:** FM; TDMA; FHSS(BT)  
**Model(s) Tested:** H51UCH9PW7AN (MUF1554), H51UCH9PW7AN (MUF1555)  
**Model(s) Certified:** H51UCH9PW7AN (MUF1554)  
**Serial Number(s):** 426TMM0204, 426TMM0206, 426TMM0091, 426TMM0092  
**Classification:** Occupational/Controlled  
**FCC ID:** AZ489FT7049; Rule part 90 (764-869 MHz); Rule part 15 (2402-2480 MHz)  
**IC:** 109U-89FT7049

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

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams result is not applicable to FCC filing. The test results clearly demonstrate compliance with ICNIRP (1998) Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz), Health Physics 74, 494-522 RF Exposure limits of 10 W/kg averaged over 10grams of contiguous tissue.

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

**Deanna Zakharia**  
**EMS EME Lab Senior Resource Manager,**  
**Laboratory Director**

**Approval Date:** 10/6/2011

**Certification Date:** 10/6/2011

**Certification No.:** L1110909P & L1110910P

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**Report Revision History**

Date	Revision	Comments
10/6/11	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 model number H51UCH9PW7AN (MUF1554)

## 2.0 Abbreviations / Definitions

CNR: Calibration Not Required  
 EME: Electromagnetic Energy  
 CQPSK: Compatible Quadrature Phase-Shift Keying  
 FHSS: Frequency Hopping Spread Spectrum  
 BT: Bluetooth  
 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  
 TDMA: Time Division Multiple Access

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

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

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

## 3.0 Referenced Standards and Guidelines

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

- IEC62209-1\*(2005) Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)
- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 2.1093 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) signaling incorporating traditional simplex two-way radio transmission protocol.

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

The model represented under this filing utilizes removable antennas (7/800 MHz bands) and an internal fixed antenna (BT) capable of transmitting in the 764-870 MHz and 2.402-2.480 GHz bands respectively. The nominal output powers are 2.5 W (764-805 MHz), 3.0 W (806-870 MHz) with maximum output powers of 2.99 W and 3.6 W respectively. The nominal BT output power is 0.010 W and the maximum output power is 0.010 W as defined by upper limit of the production line final test station. The intended operating positions are “at the face” with the DUT at least 1 inch from the mouth, and “at the body” by means of the offered body worn accessories. Body worn audio and PTT operation is accomplished by means of optional remote accessories that are connected to the radio. Operation at the body without an audio accessory attached is possible by means of wireless BT accessories.

## 7.0 Optional Accessories and Test Criteria:

This device is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required per the guidelines outlined in “SAR Test Reduction Considerations for Occupational PTT Radios” FCC KDB 643646 D01 dated 4/4/11 to assess compliance of this device. The following sections identify the test criteria and details for each accessory category.

### 7.1 Antennas:

There are two 7/800 MHz antennas and one BT internal antenna offered for this product. The table below lists their descriptions.

**TABLE 2**

Antenna Models	Description	*Tested
NAF5085A	7/800 MHz, GPS (764-870 MHz; 1575 MHz) ¼ wave, 0.0dBd	Yes
NAR6595A	7/800 MHz, GPS stubby (764-870MHz; 1575 MHz) ¼ wave, -10dBd	Yes
84009370001	Internal BT (2402-2481 MHz) ¼ wave, 0dBd	No

\*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	2.0” 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	
RMN5116A	Core L/W Headset	Yes	Tested with HMN4104B
RLN5882A	Plus 2-wire with translucent tube – Black - One programmable button	Yes	
PMLN5275C	Core H/D headset	Yes	
PMLN5111A	Plus 3-wire – Black - One programmable button	Yes	
PMMN4062A	Large Plus Noise cancelling RSM IP55 3.5MM jack	Yes	
PMMN4065A	Standard Large IP57 RSM	Yes	
PMMN4024A	Core RSM	Yes	
PMLN5101A	IMPRES Temple Transducer	Yes	
RMN5058A	Core L/W Headset	Yes	
HMN4101B	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	Yes	Tested with HMN4104B. similar to HMN4104B/ RMN5116A
RLN5879A	Core 1 wire – Beige	No	Receive only
RLN5878A	Core 1 wire – Black	No	Receive only
RLN5881A	Plus 2-wire Beige – one programmable button	No	Similar to RLN5882A
RLN5880A	Plus 2-wire Black – one programmable button	No	Similar to RLN5882A
RLN5883A	Plus 2-wire with translucent tube – Beige – one programmable button	No	Similar to RLN5882A
PMLN5112A	Plus 3 wire - Beige-one programmable button	No	Similar to PMLN5111A
PMMN4025A	Smart RSM	No	Similar to PMMN4062A
PMMN4069A	APX Basic Smart RSM, IP55	No	Similar to PMMN4062A

TABLE 5 (Continued)

Audio Acc. Models	Description	*Tested	Comments
AARLN4885B	3.5mm RX only earbud for REM spk mic short coiled cable	No	Receive only
RLN4941A	3.5 mm Receive only Earpiece w/translucent tube – short coiled cable	No	Receive only
WADN4190B	3.5mm ear receive w/coil cable - short	No	Similar to AARLN4885B
PMLN4620A	Rx-only earpiece	No	Receive only
RLN5886A	Low Noise Kit - tube	No	Receive only
RLN5887A	High Noise Kit	No	Receive only
PMMN4040A	IMPRES IP57 Submersible Remote Speaker Microphone	Yes	
PMMN4046A	IMPRES SPEAKER MIC W/VOL, IP57	Yes	
PMMN4067A	ATEX CSA REMOTE SPEAKER MICROPHONE	Yes	
PMMN4050A	IMPRES REMOTE SPEAKER MIC, NC	Yes	
PMLN5102A	CORE ULTRA-LITE HEADSET	Yes	
PMLN5096A	CORE EARSET - D-SHELL	Yes	
PMLN5097A	IMPRES 3 WIRE SURVEILLANCE-BLACK	Yes	
PMLN5106A	IMPRES 3 WIRE SURVEILLANCE-BEIGE	No	Similar to PMLN5097A
PMLN5653A	IMPRES Ear Mic System	Yes	

## 8.0 Description of Test System:



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

The laboratory utilizes a Dosimetric Assessment System (DASY5™) SAR measurement system Version 52.6.2.424 manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. The test system consists of a Stäubli RX90L robot, DAE3&4 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)
OVAL1019 OVAL1020 OVAL1011 OVAL1022	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 835 MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at 764MHz, 809MHz, 835MHz, 851MHz, 869MHz 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	835 MHz	
	Head	Body
Sugar	57.00	44.9
Diacetin	NA	NA
De ionized -Water	40.45	53.06
Salt	1.45	0.94
HEC	1.00	1.00
Bact.	0.10	0.10

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	4/6/2011	4/6/2012
Power Meter (Agilent)	E4418B	US39251267	2/24/2011	2/24/2012
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
Power Sensor (Agilent)	8482B	3318A07393	2/4/2011	2/4/2012
Bi-Directional Coupler (NARDA)	3020A	40295	6/3/2010	6/3/2012
Signal Generator (Agilent)	E4428C	MY47381119	6/24/2011	6/24/2013
AMP (Amplifier Research)	10WD1000	28782	CNR	CNR
Power Meter (Agilent)	E4419B	MY50000505	9/6/2011	9/6/2012
Power Meter (Agilent)	E4418B	GB40206553	4/6/2011	4/6/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495730	4/22/2011	4/22/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495733	4/28/2011	4/28/2012
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50280001	8/8/2011	8/8/2012
Bi-Directional Coupler (NARDA)	3020A	40296	2/5/2010	2/5/2012
Bi-Directional Coupler (NARDA)	3022	70181	11/13/2009	11/13/2011
Signal Generator (Agilent)	E4438C	MY42082269	2/18/2010	2/18/2012
AMP (Amplifier Research)	1W1000	16625	CNR	CNR

**TABLE 8 (Continued)**

Dickson Temperature Recorder	TM125	1195889	3/9/2011	3/9/2012
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	5/18/2011	5/18/2012
Omega Digital Thermometer with J Type TC Probe	HH202A	18812	5/3/2011	5/3/2012
Agilent PNA-L Network Analyzer	N5230A	MY45001092	6/9/2011	6/9/2012
Dielectric Probe Kit (HP)	85070C	US99360076	CNR	CNR
Speag Dipole	D835V2	427	1/27/2011	1/27/2013

## 10.0 SAR Measurement System Verification:

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

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

## 10.1 Equivalent Tissue Test Results:

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

TABLE 9

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
764	FCC Body	0.96 (0.91-1.01)	55.5 (52.7-58.3)	0.92	55.0	8/26/11
				0.92	55.0	8/29/11
				0.92	56.4	9/15/11
764	IEEE/ IEC Head	0.89 (0.85-0.93)	41.9 (39.8-44.0)	0.93	41.6	8/25/11
809	FCC Body	0.97 (0.92-1.02)	55.3 (52.5-58.1)	0.96	54.6	8/26/11
				0.96	55.6	9/19/11
				0.96	55.6	9/20/11
809	IEEE/ IEC Head	0.90 (0.86-0.95)	41.6 (39.5-43.7)	0.89	42.0	8/25/11
835	FCC Body	0.97 (0.92-1.02)	55.2 (52.4-58.0)	0.98	54.3	8/24/11
				0.98	54.3	8/25/11
				0.98	54.3	8/29/11
				0.99	54.5	9/15/11
				0.99	55.3	9/19/11
				0.99	55.3	9/20/11
835	IEEE/ IEC Head	0.90 (0.88-0.98)	41.5 (39.4-43.6)	0.91	41.6	8/26/11
851	FCC Body	0.99 (0.89-0.99)	55.2 (52.4-57.9)	1.00	54.2	8/24/11
				1.00	54.2	8/25/11
851	IEEE/ IEC Head	0.92 (0.87-0.97)	41.5 (39.4-43.6)	0.93	41.6	8/25/11
				0.93	41.4	9/20/11
869	FCC Body	1.01 (0.96-1.06)	55.1 (52.3-57.9)	1.03	55.2	9/19/11

## 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 D835V2 /427	9.29 +/- 10%	9.20	8/24/11
				9.20	8/25/11
				9.20	8/29/11
3291	IEEE/ IEC Head	SPEAG D835V2 /427	8.60 +/- 10%	9.12	8/26/11
3163	FCC Body	SPEAG D835V2 /427	9.29 +/- 10%	9.28	9/15/11
				9.32	9/19/11
				9.32	9/20/11

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

## 11.0 Environmental Test Conditions:

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

**TABLE 11**

	Target	Measured
Ambient Temperature	18 - 25 °C	Range: 21.4-22.6°C Avg. 22.0°C
Relative Humidity	30 - 70 %	Range: 49.5-62.8% Avg. 55.6%
Tissue Temperature	NA	Range: 20.6-22.3°C Avg. 21.4C

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 and without the offered audio accessories as applicable.

**12.3.2 Head:**

Not applicable.

**12.3.3 Face:**

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

**12.4 DUT Test Channels:**

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

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

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. Tests at the body without the offered audio accessory are to satisfy intended use operation with offered wireless BT accessories. In some cases the initial power listed herein may exceed the reported maximum power due to software step size tuning limitations. However, the initial powers measured are not greater than the allowed 5% of the reported maximum power.

### 13.0 DUT Test Data

#### 13.1 Assessment at the Body (764-775MHz band):

The battery NNTN8128A was selected as default battery for assessments at the Body since it is the thinnest battery (refers to Exhibit 7B for the dimension of the battery). The conducted power measurement for all test channels within part 90 frequency range using the default battery NNTN8128A is indicated in 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)
764.0125	3.00
770.0000	2.98
775.0000	2.97

#### 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#
NAR6595A	NNTN8128A	PMLN4651A	HMN4104B	764.0125	3.13	-0.24	4.56	3.38	<b>2.41</b>	1.79	CM-Ab-110826-16
				770.000							
				775.000							
NAF5085A	NNTN8128A	PMLN4651A	HMN4104B	764.0125	3.12	-0.79	2.88	2.12	1.73	1.27	CM-Ab-110826-17
				770.000							
				775.000							

Assessment of the worst case antenna from above with body worn accessory PMLN4651A and 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#
NAR6595A	NNTN8129A	PMLN4651A	HMN4104B	764.0125	3.12	-0.13	3.87	2.83	<b>1.99</b>	1.46	CM-Ab-110826-18
				770.000							
				775.000							

**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#
NAR6595A	NNTN8128A	PMLN7008A	HMN4104B	764.0125	2.99	-0.20	4.89	3.58	<b>2.69</b>	1.97	HvH-Ab-110915-05
				770.000							
				775.000							
NAF5085A	NNTN8128A	PMLN7008A	HMN4104B	764.0125	3.11	-0.32	2.70	2.01	1.45	1.08	CM-Ab-110826-20
				770.000							
				775.000							

Assessment of the worst case antenna from above with body worn accessory PMLN7008A and 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#
NAR6595A	NNTN8129A	PMLN7008A	HMN4104B	764.0125	3.12	-0.063	3.67	2.68	<b>1.86</b>	1.36	CM-Ab-110826-21
				770.000							
				775.000							

#### 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#
NAR6595A	NNTN8128A	PMLN5950A	HMN4104B	764.0125	3.04	-0.170	1.22	0.921	<b>0.63</b>	0.48	JsT-Ab-110829-02
				770.000							
				775.000							
NAF5085A	NNTN8128A	PMLN5950A	HMN4104B	764.0125	3.02	-0.610	0.689	0.520	0.40	0.30	JsT-Ab-110829-03
				770.000							
				775.000							

Assessment of the worst case antenna from above with body worn accessory PMLN5950A and 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#
NAR6595A	NNTN8129A	PMLN5950A	HMN4104B	764.0125	3.01	0.021	1.09	0.821	<b>0.55</b>	0.41	JsT-Ab-110829-04
				770.000							
				775.000							

### 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#
NAR6595A	NNTN8128A	PMLN5950A without belt loop /NTN5243A	HMN4104B	764.0125	3.02	-0.250	3.35	2.47	<b>1.77</b>	1.31	JsT-Ab-110829-05
				770.000							
				775.000							
NAF5085A	NNTN8128A	PMLN5950A without belt loop /NTN5243A	HMN4104B	764.0125	3.01	-0.700	1.51	1.12	0.89	0.66	JsT-Ab-110829-06
				770.000							
				775.000							

Assessment of the worst case antenna from above with body worn accessory PMLN5950A/NTN5243A and 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#
NAR6595A	NNTN8129A	PMLN5950A without belt loop /NTN5243A	HMN4104B	764.0125	3.01	-0.130	2.68	2.00	<b>1.38</b>	1.03	JsT-Ab-110829-07
				770.000							
				775.000							

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

### 13.6 Assessments at the Body (794-824MHz band):

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 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 21**

Test Freq (MHz)	Power (W)
794.0125	2.97
809.0000	3.58
823.9875	3.57

**13.7 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 21 for highest output power channel.

**TABLE 22**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8128A	PMLN4651A	HMN4104B	794.0125							
				809.0000	3.70	-0.43	5.30	3.91	<b>2.93</b>	2.16	ErC-Ab-110826-02
				823.9875							
NAF5085A	NNTN8128A	PMLN4651A	HMN4104B	794.0125							
				809.0000	3.70	-0.50	2.59	1.91	1.45	1.07	ErC-Ab-110826-04
				823.9875							

Assessment of the worst case antenna from above with body worn accessory PMLN4651A and additional offered battery 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#
NAR6595A	NNTN8129A	PMLN4651A	HMN4104B	794.0125							
				809.0000	3.69	-0.78	5.05	3.68	<b>3.02</b>	2.20	ErC-Ab-110826-05
				823.9875							

**13.8 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 21 for highest output power channel.

**TABLE 24**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8128A	PMLN7008A	HMN4104B	794.0125							
				809.0000	3.59	-0.450	6.70	4.92	3.73	2.74	CM-Ab-110915-08
				823.9875							
NAF5085A	NNTN8128A	PMLN7008A	HMN4104B	794.0125							
				809.0000	3.70	-1.07	2.06	1.52	1.32	0.972	ErC-Ab-110826-07
				823.9875							

Assessment of the worst case antenna from above with body worn accessory PMLN7008A and additional offered battery 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#
NAR6595A	NNTN8129A	PMLN7008A	HMN4104B	794.0125							
				809.0000	3.70	-0.32	5.24	3.78	2.82	2.03	ErC-Ab-110826-08
				823.9875							

### 13.9 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 21 for highest output power channel.

**TABLE 26**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8128A	PMLN5950A	HMN4104B	794.0125							
				809.0000	3.70	-0.25	2.22	1.66	<b>1.18</b>	0.879	ErC-Ab-110826-09
				823.9875							
NAF5085A	NNTN8128A	PMLN5950A	HMN4104B	794.0125							
				809.0000	3.70	-0.82	1.06	0.794	0.64	0.48	ErC-Ab-110826-10
				823.9875							

Assessment of the worst case antenna from above with body worn accessory PMLN5950A and additional offered battery 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#
NAR6595A	NNTN8129A	PMLN5950A	HMN4104B	794.0125							
				809.0000	3.70	-0.21	1.93	1.43	<b>1.01</b>	0.75	ErC-Ab-110826-11
				823.9875							

### 13.10 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 21 for highest output power channel.

**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#
NAR6595A	NNTN8128A	PMLN5950A without belt loop /NTN5243A	HMN4104B	794.0125							
				809.0000	3.71	-0.25	5.76	4.22	<b>3.05</b>	2.24	CM-Ab-110826-12
				823.9875							
NAF5085A	NNTN8128A	PMLN5950A without belt loop /NTN5243A	HMN4104B	794.0125							
				809.0000	3.70	-0.440	2.70	1.99	1.49	1.10	CM-Ab-110826-13
				823.9875							

Assessment of the worst case antenna from above with body worn accessory PMLN5950A/NTN5243A and additional offered battery 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#
NAR6595A	NNTN8129A	PMLN5950A without belt loop /NTN5243A	HMN4104B	794.0125							
				809.0000	3.68	-0.17	3.86	2.84	<b>2.01</b>	1.48	CM-Ab-110826-14
				823.9875							

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

**13.11 Assessments at the Body (851-869MHz band):**

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 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 30**

Test Freq (MHz)	Power (W)
851.0125	3.54
860.5000	3.54
869.0000	3.53

**13.12 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 30 for highest output power channel.

**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#
NAR6595A	NNTN8128A	PMLN4651A	HMN4104B	851.0125	3.58	-0.420	5.20	3.85	<b>2.88</b>	2.13	CM-Ab-110824-09
				860.5000							
				869.0000							
NAF5085A	NNTN8128A	PMLN4651A	HMN4104B	851.0125	3.59	-0.580	3.95	2.93	2.26	1.68	CM-Ab-110824-10
				860.5000							
				869.0000							

Assessment of the worst case antenna from above with body worn accessory PMLN4651A and additional offered battery 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#
NAR6595A	NNTN8129A	PMLN4651A	HMN4104B	851.0125	3.58	-0.420	5.02	3.64	<b>2.78</b>	2.02	CM-Ab-110824-11
				860.5000							
				869.0000							

**13.13 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 30 for highest output power channel.

**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#
NAR6595A	NNTN8128A	PMLN7008A	HMN4104B	851.0125	3.60	-0.170	4.47	3.33	<b>2.32</b>	1.73	CM-Ab-110824-12
				860.5000							
				869.0000							
NAF5085A	NNTN8128A	PMLN7008A	HMN4104B	851.0125	3.59	-0.670	1.35	1.03	0.79	0.60	CM-Ab-110824-13
				860.5000							
				869.0000							

Assessment of the worst case antenna from above with body worn accessory PMLN7008A and additional offered battery 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#
NAR6595A	NNTN8129A	PMLN7008A	HMN4104B	851.0125	3.60	-0.410	5.23	3.80	<b>2.87</b>	2.09	CM-Ab-110824-14
				860.5000							
				869.0000							

### 13.14 Assessment 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 30 for highest output power channel.

**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#
NAR6595A	NNTN8128A	PMLN5950A	HMN4104B	851.0125	3.59	-0.320	2.04	1.52	<b>1.10</b>	0.82	ErC-Ab-110825-02
				860.5000							
				869.0000							
NAF5085A	NNTN8128A	PMLN5950A	HMN4104B	851.0125	3.67	-0.430	0.942	0.700	0.52	0.39	ErC-Ab-110825-03
				860.5000							
				869.0000							

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

**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#
NAR6595A	NNTN8129A	PMLN5950A	HMN4104B	851.0125	3.60	-0.340	1.86	1.39	<b>1.01</b>	0.75	ErC-Ab-110825-04
				860.5000							
				869.0000							

### 13.15 Assessment 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 30 for highest output power channel.

**TABLE 37**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8128A	PMLN5950A without belt loop /NTN5243A	HMN4104B	851.0125	3.68	-0.520	4.33	3.18	<b>2.44</b>	1.79	ErC-Ab-110825-05
				860.5000							
				869.0000							
NAF5085A	NNTN8128A	PMLN5950A without belt loop /NTN5243A	HMN4104B	851.0125	3.67	-0.610	2.68	1.96	1.54	1.13	ErC-Ab-110825-06
				860.5000							
				869.0000							

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

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#
NAR6595A	NNTN8129A	PMLN5950A without belt loop /NTN5243A	HMN4104B	851.0125	3.68	-0.540	3.44	2.53	<b>1.95</b>	1.43	ErC-Ab-110825-07
				860.5000							
				869.0000							

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

### 13.16 Assessment of wireless BT configurations:

Assessment without audio cable attached to address wireless BT communications using the highest SAR configuration from body assessments above for each band.

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#
NAR6595A	NNTN8128A	PMLN7008A	None	764.0125	2.99	-0.300	6.38	4.71	3.42	2.52	CM-Ab-110915-06
NAR6595A	NNTN8128A	PMLN7008A	None	809.0000	3.55	-0.790	7.94	5.89	<b>4.83</b>	3.58	CM-Ab-110919-15
NAR6595A	NNTN8128A	PMLN4651A	None	869.0000	3.60	-0.830	3.13	2.31	1.93	1.43	CM-Ab-110919-18

**13.17 Assessments at the Face (764-775MHz band):**

The highest capacity battery NNTN8129A was selected as the default battery. The conducted power measurement for all test channels within Part 90 frequency range using battery NNTN8129A is listed in the Table 41. 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 40**

Test Freq (MHz)	Power (W)
764.0125	2.98
770.0000	2.96
775.0000	2.95

**13.18 Assessment at the Face of 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 40 for highest output power channel.

**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#
NAR6595A	NNTN8129A	None	None	764.0125	3.12	-0.460	1.95	1.45	<b>1.08</b>	0.81	CM-Face-110825-14
				770.000							
				775.000							
NAF5085A	NNTN8129A	None	None	764.0125	3.10	-0.410	1.06	0.789	0.58	0.43	CM-Face-110825-15
				770.000							
				775.000							

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

**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#
NAR6595A	NNTN8128A	None	None	764.0125	3.10	-0.290	1.96	1.46	<b>1.05</b>	0.78	CM-Face-110825-16
				770.000							
				775.000							

**13.19 Assessment at the Face (794-824MHz band):**

The highest capacity battery NNTN8129A was selected as the default battery. The conducted power measurement for all test channels within Part 90 frequency range using battery NNTN8129A is listed in the Table 41. 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 43**

Test Freq (MHz)	Power (W)
794.0125	2.97
809.0000	3.58
823.9875	3.57

**13.20 Assessment at the Face of 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 43 for highest output power channel.

**TABLE 44**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8129A	None	None	794.0125							
				809.0000	3.70	-0.039	2.52	1.86	<b>1.27</b>	0.94	CM-Face-110825-17
				823.9875							
NAF5085A	NNTN8129A	None	None	794.0125							
				809.0000	3.68	-0.044	0.948	0.702	0.48	0.35	CM-Face-110825-19
				823.9875							

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

**TABLE 45**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8128A	None	None	794.0125							
				809.0000	3.71	-0.089	2.57	1.89	<b>1.31</b>	0.96	CM-Face-110825-20
				823.9875							

**13.21 Assessment at the Face (851-869MHz band):**

The highest capacity battery NNTN8129A was selected as the default battery. The conducted power measurement for all test channels within Part 90 frequency range using battery NNTN8129A is listed in the Table 41. 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 46**

Test Freq (MHz)	Power (W)
851.0125	3.54
860.5000	3.54
869.0000	3.53

**13.22 Assessment at the Face of 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 46 for highest output power channel.

**TABLE 47**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8129A	None	None	851.0125	3.67	-0.160	3.73	2.72	<b>1.93</b>	1.41	ErC-Face-110825-09
				860.5000							
				869.0000							
NAF5085A	NNTN8129A	None	None	851.0125	3.66	-0.260	2.17	1.58	1.15	0.84	ErC-Face-110825-10
				860.5000							
				869.0000							

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

**TABLE 48**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8128A	None	None	851.0125	3.59	-0.017	5.59	4.07	<b>2.91</b>	2.12	CM-Face-110829-14
				860.5000							
				869.0000							

### 13.23 Assessment of the BT band:

N/A

### 13.24 Shorten Scan Assessment:

**Short scan assessment:** A “shortened” scan was performed to validate the SAR drift of the full DASY5™ coarse and 5x5x7 zoom scans. Note that the shortened scan represents the zoom scan performance result; this is obtained by first running a coarse scan to find the peak area and then, using a newly charged battery, a 5x5x7 zoom scan only was performed. The results of the shortened cube scan presented in APPENDIX E demonstrate that the scaling methodology used to determine the calculated SAR results presented herein are valid. The SAR result from the table below is provided in APPENDIX E.

**TABLE 50**

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
NAR6595A	NNTN8128A	PMLN7008A	None	809.0000	3.61	-0.190	8.09	6.00	4.23	3.13	JsT-Ab-110920-02

### 14.0 Simultaneous Transmission Exclusion:

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

## 15.0 Conclusion:

The highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing: Model H51UCH9PW7AN (MUF1554).

### Results for FCC Part 90

**TABLE 51**

Frequency Range (MHz)	Max Calc at Body (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
764-869	4.83	3.58	NA	NA

**Table 52**

Frequency Range (MHz)	Max Calc at Face (W/kg)		Simultaneous Tx	
	1g-SAR	10g-SAR	1g-SAR	10g-SAR
764-869	2.91	2.12	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 the standards listed in section 3.0 for occupational/controlled RF Exposure limits of 10 W/kg averaged over 10 grams of contiguous tissue.

## **APPENDIX A**

### **Measurement Uncertainty**

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

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$
Uncertainty Component	IEEE 1528 section	Tol. ( $\pm$ %)	Prob Dist	Div.	$c_i$ (1 g)	$c_i$ (10 g)	1 g $u_i$ ( $\pm$ %)	10 g $u_i$ ( $\pm$ %)
<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

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

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

### FCD-0558 Uncertainty Budget Rev.8

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

<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>	<i>k</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> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
<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				9	9	99999
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<i>k</i> =2				18	17	

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

Notes for Tables 1, 2, 3 and 4

a) Column headings *a-k* are given for reference.

b) Tol. - tolerance in influence quantity.

c) Prob. Dist. – Probability distribution

d) N, R - normal, rectangular probability distributions

e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty

f) *c<sub>i</sub>* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.

g) *u<sub>i</sub>* – SAR uncertainty

h) *v<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.

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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 108**

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### 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<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

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

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

## 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

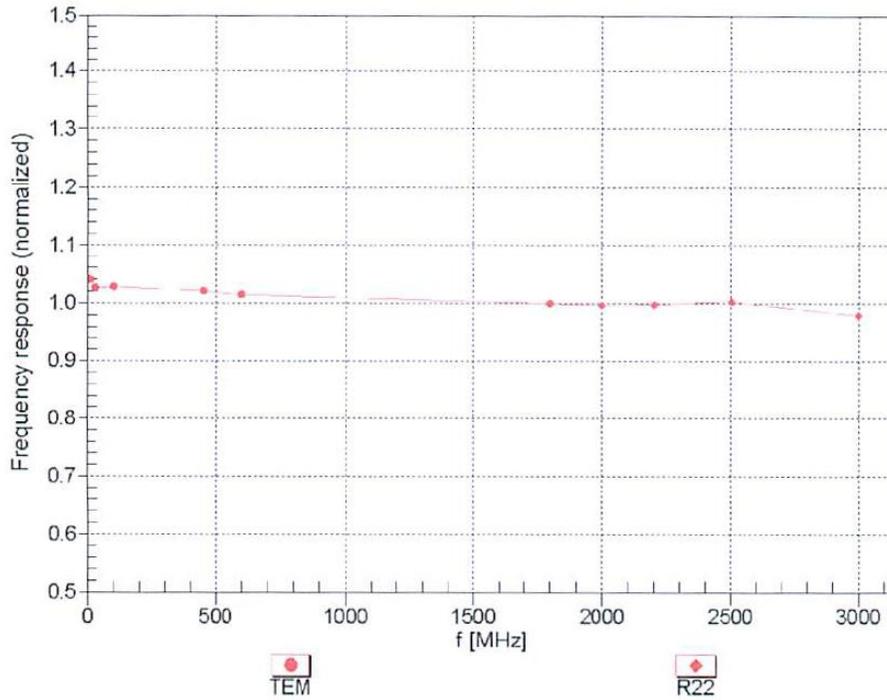
### Calibration Parameter Determined in Body Tissue Simulating Media

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.

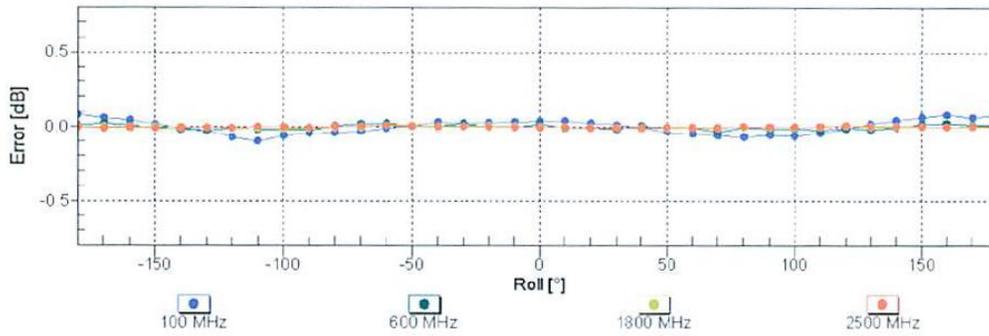
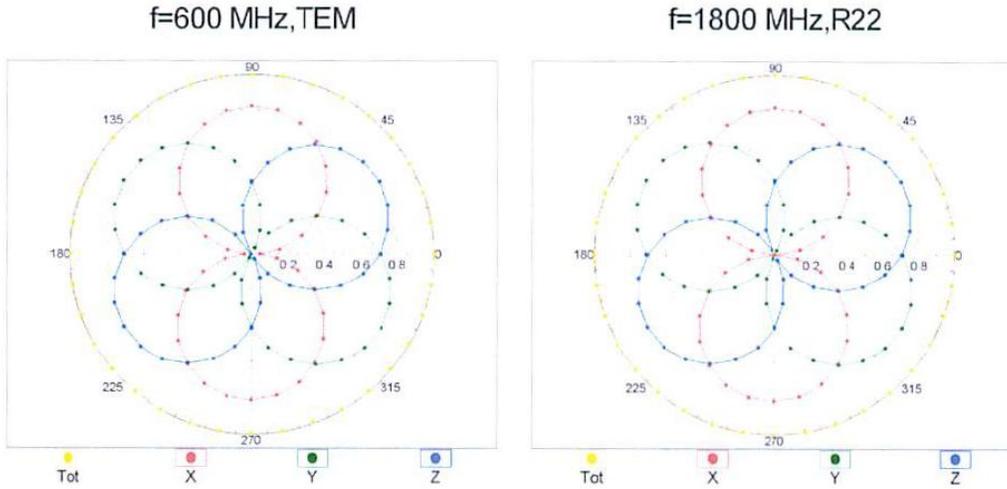
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted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



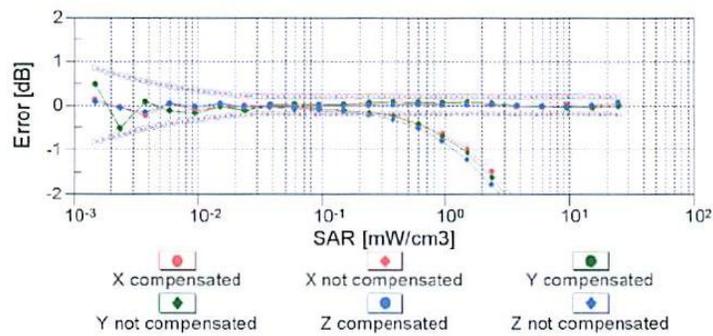
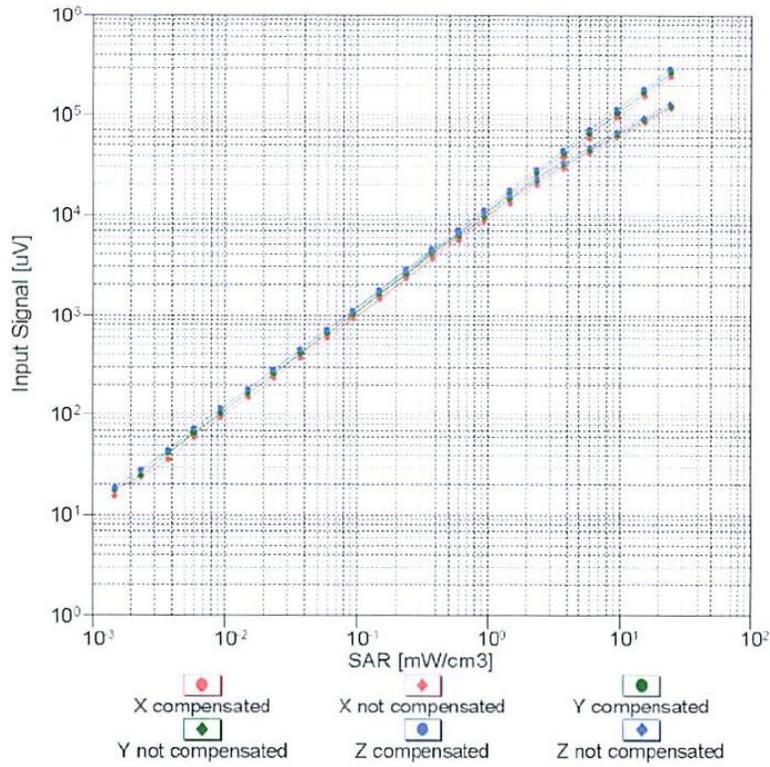
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



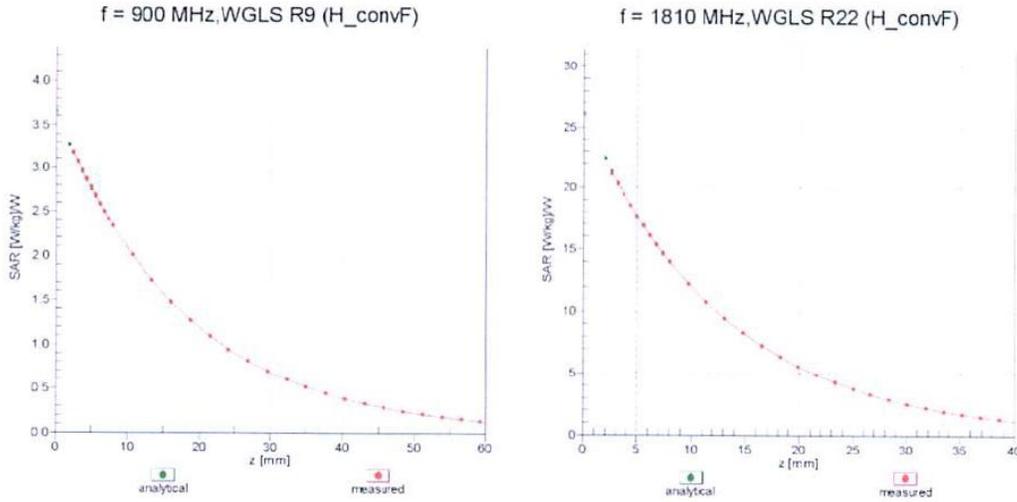
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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

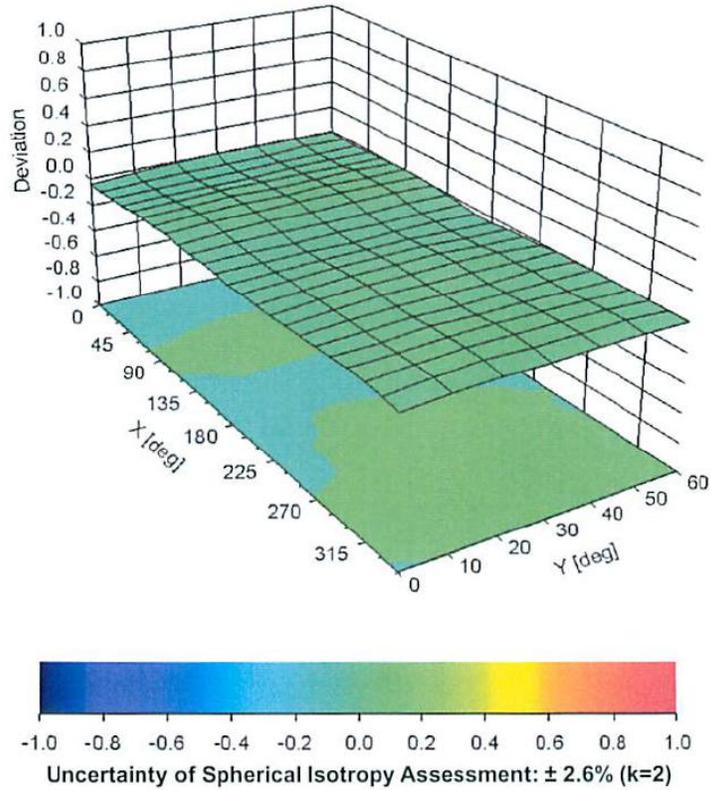


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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

Issued: April 13, 2011

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Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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#### 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 $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis

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

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

#### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>: Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  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>: 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

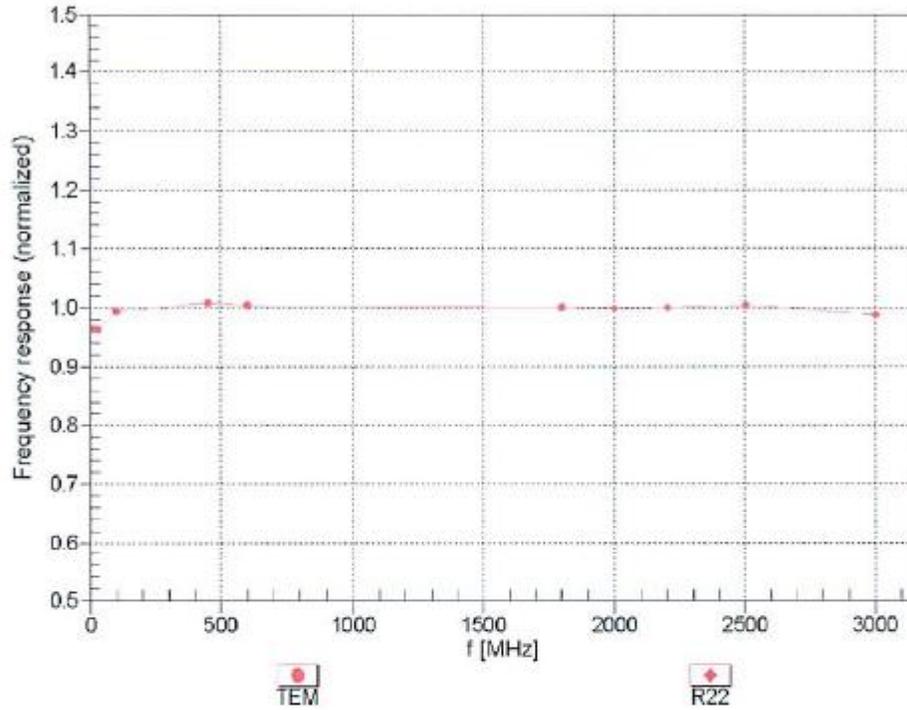
### Calibration Parameter Determined in Body Tissue Simulating Media

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.

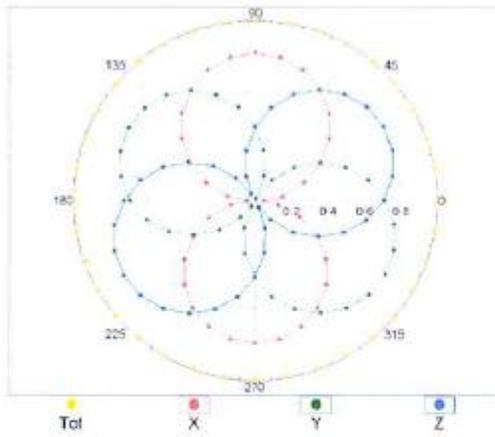
### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



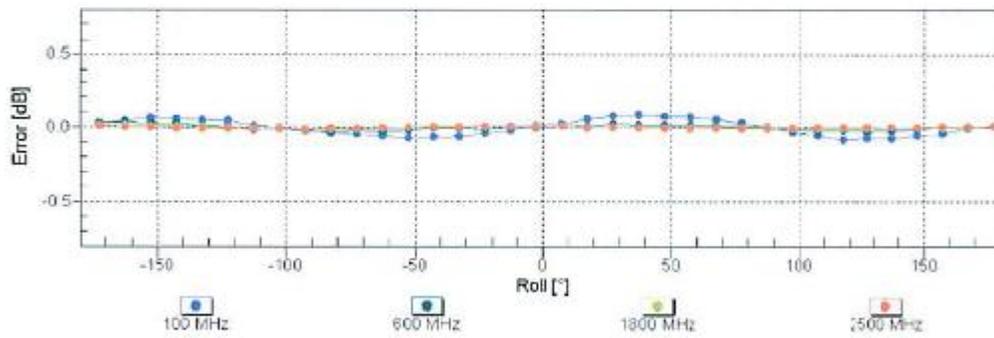
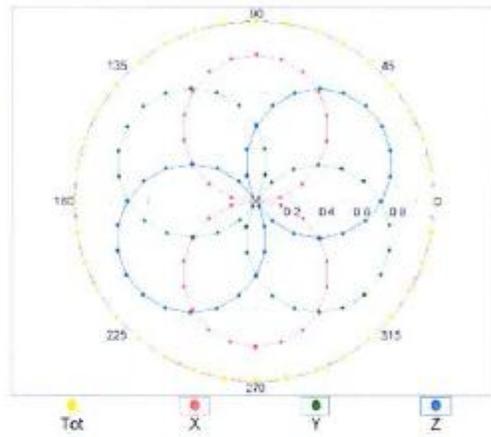
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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

f=600 MHz,TEM

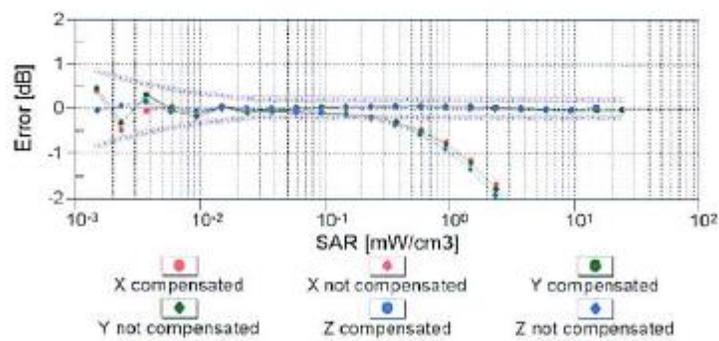
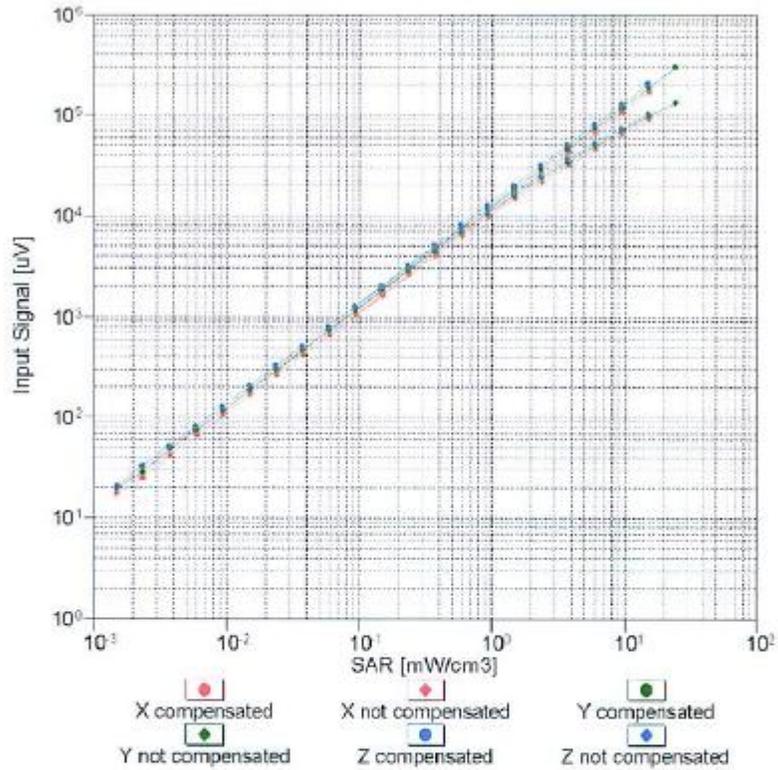


f=1800 MHz,R22



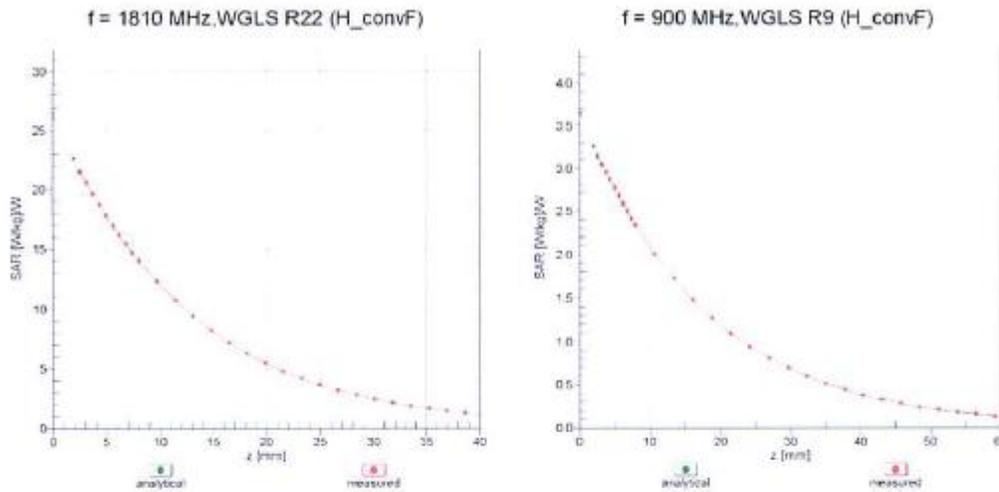
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

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

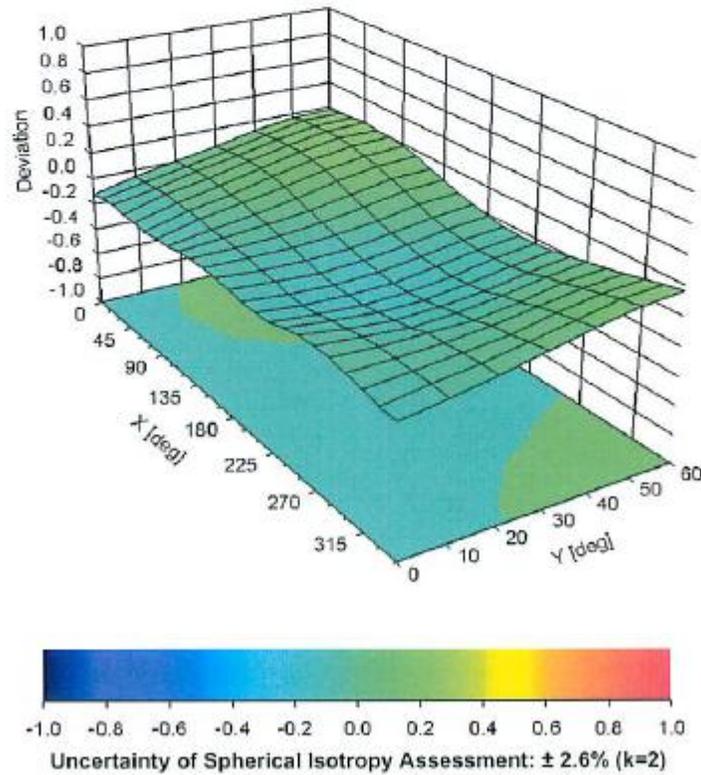


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

### Conversion Factor Assessment



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



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

Sensor Arrangement	Triangular
Connector Angle (°)	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:

**3163**

Place of Assessment:

**Zurich**

Date of Assessment:

**April 15, 2011**

Probe Calibration Date:

**April 13, 2011**

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

Assessed by:



## Dosimetric E-Field Probe ES3DV3 SN:3163

Conversion factor ( $\pm$  standard deviation)

150 MHz	<i>ConvF</i>	<b>8.2 <math>\pm</math> 10%</b>	$\epsilon_r = 52.3$ $\sigma = 0.76 \text{ mho/m}$ (head tissue)
250 MHz	<i>ConvF</i>	<b>7.7 <math>\pm</math> 10%</b>	$\epsilon_r = 47.6$ $\sigma = 0.83 \text{ mho/m}$ (head tissue)
150 MHz	<i>ConvF</i>	<b>7.9 <math>\pm</math> 10%</b>	$\epsilon_r = 61.9$ $\sigma = 0.80 \text{ mho/m}$ (body tissue)
250 MHz	<i>ConvF</i>	<b>7.5 <math>\pm</math> 10%</b>	$\epsilon_r = 59.4$ $\sigma = 0.88 \text{ mho/m}$ (body tissue)

### Important Note:

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

**Please see also DASYS Manual.**

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

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



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

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

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D835V2-427\_Jan11**

**CALIBRATION CERTIFICATE**

Object: **D835V2 - SN: 427**

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

Calibration date: **January 27, 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 (MSTE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37482704	06-Oct-10 (No. 217-01206)	Oct-11
Power sensor HP 8481A	US37292793	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06927	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
UR24	SN: 801	10-Jun-10 (No. UAb-4-801_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41022317	18-Oct-09 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-05	100005	4-Aug-99 (in house check Oct-08)	In house check: Oct-11
Network Analyzer HP 8733E	US37390585 S4205	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Jaron Kastrel** (Name) / **Laboratory Technician** (Function) / *[Signature]* (Signature)

Approved by: **Katja Pokovic** (Name) / **Technical Manager** (Function) / *[Signature]* (Signature)

Issued: January 27, 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  
C Servizio svizzero di taratura  
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: SCS 108

#### Glossary:

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

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

- 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.

<b>DASY Version</b>	DASY5	V52.6
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V4.9	
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	835 MHz $\pm$ 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	41.5	0.90 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	41.3 $\pm$ 6 %	0.89 mho/m $\pm$ 6 %
<b>Head TSL temperature during test</b>	(21.8 $\pm$ 0.2) °C	----	----

**SAR result with Head TSL**

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	<b>Condition</b>	
SAR measured	250 mW input power	2.36 mW / g
SAR normalized	normalized to 1W	9.44 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.50 mW /g <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	<b>condition</b>	
SAR measured	250 mW input power	1.54 mW / g
SAR normalized	normalized to 1W	6.16 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>6.19 mW /g <math>\pm</math> 16.5 % (k=2)</b>

**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

**SAR result with Body TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.50 mW / g
SAR normalized	normalized to 1W	10.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.80 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.64 mW / g
SAR normalized	normalized to 1W	6.56 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.47 mW / g ± 16.5 % (k=2)</b>

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

Impedance, transformed to feed point	51.2 $\Omega$ - 4.4 j $\Omega$
Return Loss	- 26.9 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	46.8 $\Omega$ - 5.9 j $\Omega$
Return Loss	- 23.2 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.423 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	September 20, 2000

**DASY5 Validation Report for Head TSL**

Date/Time: 21.01.2011 09:54:57

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:427**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.89$  mho/m;  $\epsilon_r = 41.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

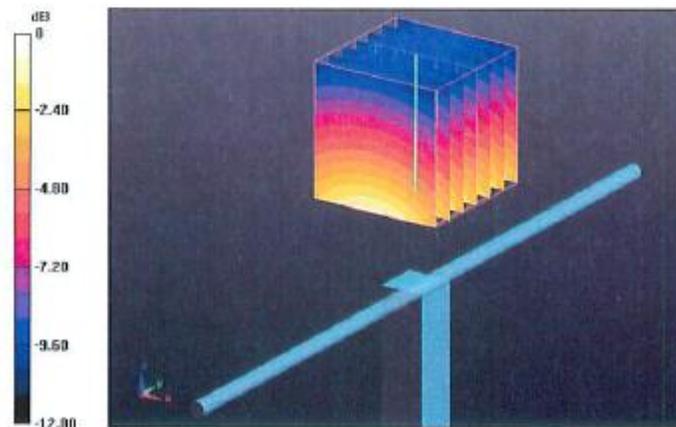
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.222 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.558 W/kg

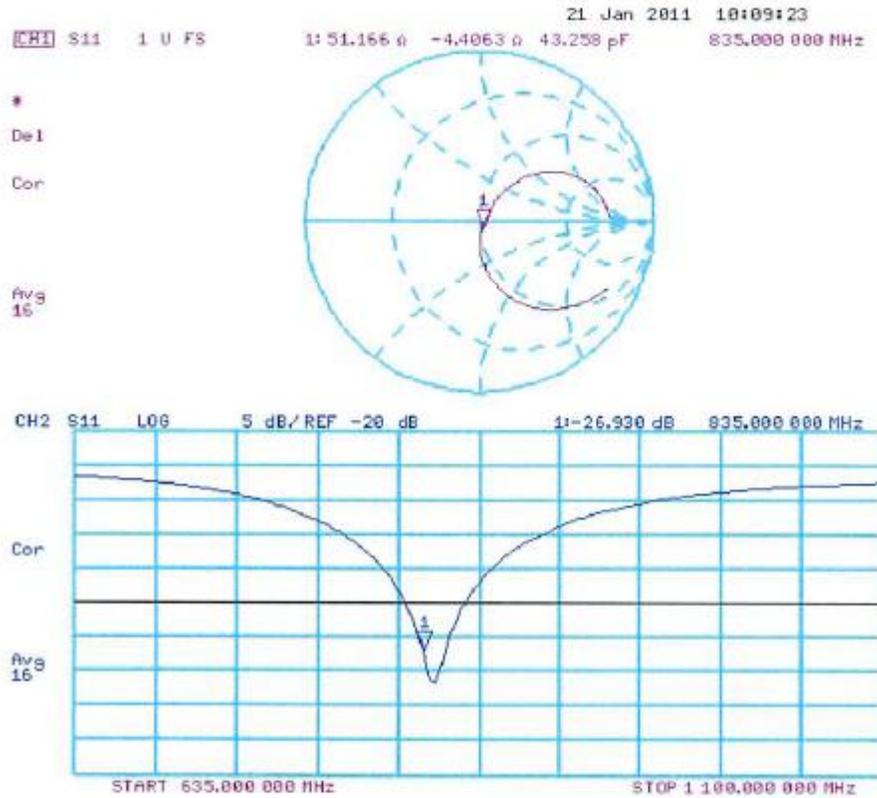
**SAR(1 g) = 2.36 mW/g; SAR(10 g) = 1.54 mW/g**

Maximum value of SAR (measured) = 2.756 mW/g



0 dB = 2.760mW/g

### Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date/Time: 27.01.2011 11:41:22

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:427**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.99$  mho/m;  $\epsilon_r = 54.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

### DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

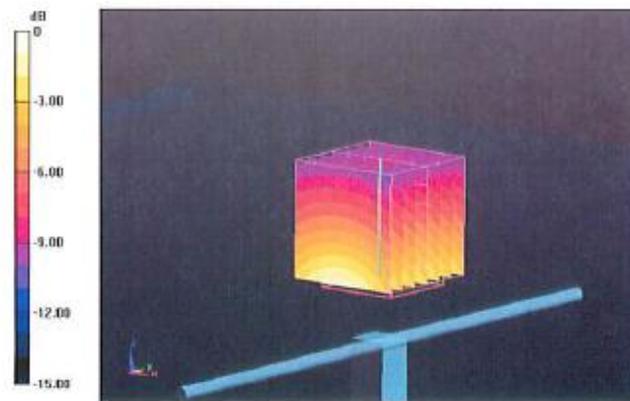
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.027 V/m; Power Drift = -0.0036 dB

Peak SAR (extrapolated) = 3.698 W/kg

**SAR(1 g) = 2.5 mW/g; SAR(10 g) = 1.64 mW/g**

Maximum value of SAR (measured) = 2.914 mW/g



0 dB = 2.910mW/g

### Impedance Measurement Plot for Body TSL

