MOTOROLA SOLUTIONS

ACCREDITED
TESTING CERT # 2518.01

# DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

**Motorola Solutions Inc.**
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**Date of Report:** 2/6/12
**Report Revision:** O
**Report ID:** SR10103 APX4000 VHF BT 1 of 2 Rev O 120206

| | |
|---|---|
| **Responsible Engineer:** | Michael Sailsman (Senior Staff Eng.) |
| **Report Author:** | Michael Sailsman (Senior Staff Eng.) |
| **Date/s Tested:** | 12/21/11-12/27/11; 1/31/12 |
| **Manufacturer/Location:** | Penang |
| **Sector/Group/Div.:** | AESS Astro Engineering Subscriber Solutions |
| **Date submitted for test:** | 12/15/11 |
| **DUT Description:** | 136 - 174MHz 3-5.9W 6.25kHz/12.5kHz/25kHz, Single Display Model full keypad. Capable of digital and analog FM transmission. Also capable of TDMA transmission and BT |
| **Test TX mode(s):** | CW (PTT); BT (CW) |
| **Max. Power output:** | 5.9W; 0.010 W (Bluetooth) |
| **Nominal Power:** | 5.5W, 0.010 W (Bluetooth) |
| **Tx Frequency Bands:** | 136 - 174 MHz; 2.402-2.480 GHz (Bluetooth) |
| **Signaling type:** | FM; TDMA; FHSS(BT) |
| **Model(s) Tested:** | H51KDH9PW7AN (MUD2601) |
| **Model(s) Certified:** | H51KDH9PW7AN (MUD2601) |
| **Serial Number(s):** | 426TMZ0214, 426TMZ0211 |
| **Classification:** | Occupational/Controlled |
| **FCC ID:** | AZ489FT3828; Rule Part 90 150.8 - 174MHz. Results outside this band are not applicable to demonstrate FCC compliance. |
| **IC:** | 109U-89FT3828; 138-144MHz; 148-149.9MHz and 150.05-174MHz. Results outside this band are not applicable to demonstrate IC compliance. |

* 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 M Zakharia

**Deanna Zakharia**
**EMS EME Lab Senior Resource Manager,**
**Laboratory Director**
**Approval Date:** 2/6/2012

**Certification Date**: 2/6/12

**Certification No.:** L1120208P

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## Report Revision History

| Date | Revision | Comments |
|---|---|---|
| 2/6/12 | 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 H51KDH9PW7AN (MUD2601)

## 2.0 Abbreviations / Definitions

CNR: Calibration Not Required
EME: Electromagnetic Energy
C4FM CQPSK**:** Continuous 4 level Frequency modulation Compatible Quadrature Phase-Shift Keying
CW: Continuous Wave
F2: 2 slot TDMA
DSP: Digital signal processing
FHSS: Frequency Hopping Spread Spectrum
BT: Bluetooth
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(d) sub-part J:2011
- 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, (VHF band) and an internal fixed antenna (BT), capable of transmitting in the 136-174 MHz and 2.402-2.480 GHz bands respectively. The VHF band nominal output power is 5.5W with maximum output power of 5.9 W and the nominal BT output power is 0.010 W and the maximum output power is 0.010 W as defined by the 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 is one VHF band antenna and one BT internal antenna offered for this product. The table below lists their descriptions.

**TABLE 2**

| Antenna Models | Description | Selected for test | *Tested |
|---|---|---|---|
| NAR6593A | VHF/GPS (136-174MHz; 1575MHz) ¼ wave, -7dBi | Yes | Yes |
| 84009370001 | Internal speaker/mic/flex Bluetooth (2402-2481 MHz) ¼ wave 0dBd | Yes | Yes |

*Refer to Exhibit 7B for antenna separation distances**.** Device only operates in the VHF band

### 7.2 Batteries:

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

**TABLE 3**

| Battery Models | Description | Selected for test | *Tested | Comments |
|---|---|---|---|---|
| NNTN8128A | IMPRES Li Ion slim battery (Non FM 1900 mAh) | Yes | Yes | |
| NNTN8129A | IMPRES Hi-Cap Li-Ion FM 2300mAh | Yes | Yes | |
| PMNN4424A | APX4000 IMPRES Li Ion High capacity Non FM 2300mAh | Yes | 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 | Selected for test | *Tested | Comments |
|---|---|---|---|---|
| PMLN6085A | Leather carry case w/ 2.5" swivel belt loop | Yes | Yes | |
| PMLN7008A | 2.5" Belt clip | Yes | Yes | |
| PMLN4651A | 2.0" Belt clip | Yes | Yes | |
| NTN5243A | Carry strap | Yes | 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 | Selected for test | *Tested | Comments |
|---|---|---|---|---|
| HMN4104B | IMPRES Display Submersible RSM w/jack & Ch. Selector | Yes | Yes | |
| RMN5116A | Temple Transducer Headset | Yes | Yes | Tested with HMN4104B |
| HMN4101B | RSM w/o Display and w/o Channel Knob | No | No | Similar to HMN4104B – same cable length and connector pins |
| HMN4103B | Display RSM w/o Channel Knob | No | No | Similar to HMN4104B – same cable length and connector pins |
| RLN6424A | Rx-Only Secondary Audio Accessory for DRSM | No | No | Similar to RMN5116A – connects to RSM |
| PMLN5275C | Core H/D headset | Yes | No | Per KDB provisions test not required. |
| PMLN5111A | Plus 3-wire – Black - One programmable button | Yes | No | Per KDB provisions test not required. |
| PMLN5112A | Plus 3 wire - Beige-one programmable button | No | No | Similar to PMLN5111A |
| PMMN4062A | Large Plus Noise cancelling RSM IP55 3.5MM jack | Yes | No | Per KDB provisions test not required. |
| PMMN4069A | APX Basic Smart RSM, IP55 | No | No | Similar to PMMN4062A |
| PMMN4025A | Smart RSM | No | No | Similar to PMMN4062A - same cable length and connector pins |
| PMMN4065A | Standard Large IP57 RSM | Yes | No | Per KDB provisions test not required. |
| PMMN4024A | Core RSM | Yes | No | Per KDB provisions test not required. |
| PMLN5101A | IMPRES Temple Transducer | Yes | No | Per KDB provisions test not required. |
| RMN5058A | Core L/W Headset | Yes | No | Per KDB provisions test not required. |
| RLN5879A | Core 1 wire – Beige | No | No | Receive only |
| RLN5878A | Core 1 wire – Black | No | No | Receive only |
| RLN5882A | Plus 2-wire with translucent tube – Black - One programmable button | Yes | No | Per KDB provisions test not required. |
| RLN5881A | Plus 2-wire Beige – one programmable button | No | No | Similar to RLN5882A |
| RLN5880A | Plus 2-wire Black – one programmable button | No | No | Similar to RLN5882A |
| RLN5883A | Plus 2-wire with translucent tube – Beige – one programmable button | No | No | Similar to RLN5882A |

**TABLE 5 (Continued)**

| Audio Acc. Models | Description | Selected for test | *Tested | Comments |
|---|---|---|---|---|
| AARLN4885B | 3.5mm RX only earbud for REM spk mic short coiled cable | No | No | Receive only |
| WADN4190B | 3.5mm ear receive w/coil cable - short | No | No | Similar to AARLN4885B - same cable length and connector pins |
| RLN4941A | 3.5 mm Receive only Earpiece w/translucent tube – short coiled cable | No | No | Receive only |
| PMLN4620A | Rx-only earpiece | No | No | Receive only |
| RLN5886A | Low Noise Kit - tube | No | No | Receive only |
| RLN5887A | High Noise Kit | No | No | Receive only |
| PMMN4040A | IMPRES IP57 Submersible Remote Speaker Microphone | Yes | No | Per KDB provisions test not required. |
| PMMN4046A | IMPRES SPEAKER MIC W/VOL, IP57 | Yes | No | Per KDB provisions test not required. |
| PMMN4050A | IMPRES REMOTE SPEAKER MIC, NC | Yes | No | Per KDB provisions test not required. |
| PMLN5102A | CORE ULTRA-LITE HEADSET | Yes | No | Per KDB provisions test not required. |
| PMLN5096A | CORE EARSET - D-SHELL | Yes | No | Per KDB provisions test not required. |
| PMLN5097A | IMPRES 3 WIRE SURVEILLANCE-BLACK | Yes | No | Per KDB provisions test not required. |
| PMLN5106A | IMPRES 3 WIRE SURVEILLANCE-BEIGE | No | No | Similar to PMLN5097A – different color |
| PMLN5653A | IMPRES Ear Mic System | Yes | No | Per KDB provisions test not required. |

## 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, DAE4 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) |
|---|---|---|---|---|---|
| OVAL1018<br>OVAL1109 | 300MHz -6GHz;<br>Er = 4+/- 1,<br>Loss Tangent = ≤0.05 | 600x400x190 | 2mm<br>+/- 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 300MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters for each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

## Simulated Tissue Composition (by mass)

**TABLE 7**

| % of listed ingredients | 300 MHz | |
|---|---|---|
| | Head | Body |
| Sugar | 56.0 | 47.1 |
| Diacetin | NA | NA |
| De ionized -Water | 37.5 | 49.48 |
| Salt | 5.4 | 2.32 |
| 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 | MY50000505 | 9/6/2011 | 9/6/2012 |
| Power Meter (Agilent) | E4418B | GB40206553 | 4/6/2011 | 4/6/2012 |
| Power Meter (Agilent) | E4418B | US39251267 | 2/24/2011 | 2/24/2012 |
| Power Sensor (Agilent) | 8482B | 3318A07393 | 2/4/2011 | 2/4/2012 |
| 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 |
| Signal Generator (HP) | E4421B | US40051446 | 8/12/2010 | 8/12/2012 |
| AMP (Amplifier Research) | 1W1000 | 16625 | CNR | CNR |
| | | | | |
| Dickson Temperature Recorder | TM125 | 1195889 | 3/9/2011 | 3/9/2012 |
| Omega Digital Thermometer with J Type TC Probe | HH200A | 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 | D300V3 | 1015 | 7/7/2011 | 7/7/2013 |

## 10.0 SAR Measurement System Verification:

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

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

### 10.1 Equivalent Tissue Test Results:

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

## TABLE 9

| Frequency (MHz) | Tissue Type | Conductivity Target (S/m) | Dielectric Constant Target | Conductivity Meas. (S/m) | Dielectric Constant Meas. | Tested Date |
|---|---|---|---|---|---|---|
| 136 | IEEE/ IEC Head | 0.75 (0.71-0.79) | 53.0 (50.4-55.7) | 0.72 | 53.3 | 12/27/11 |
| 136 | FCC Body | 0.79 (0.75-0.83) | 62.3 (59.2-65.4) | 0.78 | 62.3 | 1/31/12 |
| | | | | | | |
| 140 | IEEE/ IEC Head | 0.75 (0.71-0.79) | 52.8 (50.2-55.4) | 0.73 | 53.0 | 12/27/11 |
| 140 | FCC Body | 0.79 (0.75-0.83) | 62.2 (59.1-65.3) | 0.78 | 62.1 | 1/31/12 |
| | | | | | | |
| 143 | IEEE/ IEC Head | 0.76 (0.72-0.80) | 52.6 (50.0-55.2) | 0.73 | 52.8 | 12/27/11 |
| 143 | FCC Body | 0.80 (0.76-0.84) | 62.1 (59.0-65.2) | 0.78 | 62.0 | 1/31/12 |
| | | | | | | |
| 147 | IEEE/ IEC Head | 0.76 (0.72-0.80) | 52.4 (49.8-55.0) | 0.73 | 52.5 | 12/27/11 |
| 147 | FCC Body | 0.80 (0.76-0.84) | 62.0 (58.9-65.1) | 0.78 | 61.8 | 1/31/12 |
| | | | | | | |
| 151 | IEEE/ IEC Head | 0.76 (0.72-0.80) | 52.3 (49.7-54.9) | 0.74 | 52.2 | 12/27/11 |
| 151 | FCC Body | 0.80 (0.76-0.84) | 61.9 (58.8-65.0) | 0.79 | 61.6 | 1/31/12 |
| | | | | | | |
| 168 | FCC Body | 0.81 (0.77-0.85) | 61.5 (58.4-64.6) | 0.80 | 61.6 | 12/21/11 |
| | | | | 0.80 | 61.0 | 1/31/12 |
| | | | | | | |
| 162 | IEEE/ IEC Head | 0.77 (0.73-0.81) | 51.4 (48.8-54.0) | 0.78 | 53.3 | 12/22/11 |
| | | | | | | |
| 300 | IEEE/ IEC Head | 0.87 (0.83-0.91) | 45.3 (43.0-47.6) | 0.87 | 45.1 | 12/27/11 |
| 300 | FCC Body | 0.92 (0.87-0.97) | 58.2 (55.3-61.1) | 0.88 | 57.7 | 12/21/11 |
| | | | | 0.89 | 57.8 | 12/22/11 |
| | | | | 0.89 | 57.2 | 1/31/12 |

## 10.2 System Check Test Results:

System performance checks were conducted each day during the SAR assessment. The results are normalized to 1W. APPENDIX D 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 |
|---|---|---|---|---|---|
| 3163 | FCC Body | SPEAG D300V3 /1015 | 2.80 (+- 10%) | 2.76 | 12/21/11 |
| | | | | 2.78 | 12/22/11 |
| | | | | 2.81 | 1/31/12 |
| 3163 | IEEE/ IEC Head | SPEAG D300V3 /1015 | 2.81 (+- 10%) | 2.92 | 12/27/11 |

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

**TABLE 11**

| | Target | Measured |
|---|---|---|
| **Ambient Temperature** | 18 - 25 ˚C | Range: 21.6-24.2˚C<br>Avg. 22.4˚C |
| **Relative Humidity** | 30 - 70 % | Range: 19.4-56.0%<br>Avg. 47.9% |
| **Tissue Temperature** | NA | Range: 21.0-22.3˚C<br>Avg. 21.8C |

Relative humidity target range is a recommended target

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

## 12.0 DUT Test Methodology

### 12.1 Measurements

SAR measurements were performed using the DASY system described in section 8.0 using 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.

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

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

## 12.5 DUT Test Plan:

The guidelines and requirements outlined in "SAR Test Reduction Considerations for Occupational PTT Radios" FCC KDB 643646 D01 dated 4/4/11 for head (face) and body were used to assess compliance of this device. All modes of operation identified in section 6.0 were considered during the development of the test plan. In some cases the initial power listed herein may exceed the reported maximum power due to software step size tuning limitations. However, the initial powers measured are not greater than the allowed 5% of the reported maximum power.

# 13.0 DUT Test Data

## 13.1 Assessment at the Body (150.8-173.4 MHz 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) |
|---|---|
| 150.8 | 5.69 |
| 156.0125 | 5.70 |
| 162.0125 | 5.71 |
| 167.7 | 5.72 |
| 173.4 | 5.69 |

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

Assessment of offered antenna 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8128A | PMLN4651A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.80 | -0.34 | 0.860 | 0.557 | **0.47** | 0.31 | HvH-Ab-111221-02 |
| | | | | 173.4 | | | | | | | |

Assessment of the worst case configuration from above with body worn accessory PMLN4651A and additional offered batteries 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | PMLN4651A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.80 | -0.31 | 0.870 | 0.552 | **0.48** | 0.30 | HvH-Ab-111221-03 |
| | | | | 173.4 | | | | | | | |
| | | | | | | | | | | | |
| NAR6593A | PMNN4424A | PMLN4651A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.80 | -0.29 | 0.846 | 0.546 | 0.46 | 0.30 | HvH-Ab-111221-04 |
| | | | | 173.4 | | | | | | | |

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

Assessment of offered antenna 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8128A | PMLN7008A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.85 | -0.36 | 0.917 | 0.593 | **0.50** | 0.32 | HvH-Ab-111221-05 |
| | | | | 173.4 | | | | | | | |

Assessment of the worst case configuration from above with body worn accessory PMLN7008A and additional offered batteries 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | PMLN7008A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.82 | -0.32 | 0.888 | 0.565 | **0.48** | 0.31 | HvH-Ab-111221-06 |
| | | | | 173.4 | | | | | | | |
| | | | | | | | | | | | |
| NAR6593A | PMNN4424A | PMLN7008A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.80 | -0.27 | 0.758 | 0.490 | 0.41 | 0.27 | HvH-Ab-111221-07 |
| | | | | 173.4 | | | | | | | |

## 13.4 Assessments at the Body with Body worn PMLN6085A:

Assessment of offered antenna with the default battery and body worn accessory PMLN6085A 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8128A | PMLN6085A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.62 | -0.37 | 0.208 | 0.165 | **0.12** | 0.09 | ErC-Ab-120131-02 |
| | | | | 173.4 | | | | | | | |

Assessment of the worst case configuration from above with body worn accessory PMLN6085A and additional offered batteries 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | PMLN6085A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.67 | -0.33 | 0.207 | 0.164 | **0.12** | 0.09 | ErC-Ab-120131-03 |
| | | | | 173.4 | | | | | | | |
| | | | | | | | | | | | |
| NAR6593A | PMNN4424A | PMLN6085A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.74 | -0.45 | 0.205 | 0.163 | 0.12 | 0.09 | ErC-Ab-120131-04 |
| | | | | 173.4 | | | | | | | |

## 13.5 Assessments at the Body with Body worn PMLN6085A/NTN5243A:

Assessment of offered antenna with the default battery and body worn accessory PMLN6085A/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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8128A | PMLN6085A without belt loop /NTN5243A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.77 | -0.47 | 1.13 | 0.468 | **0.64** | 0.27 | ErC-Ab-120131-05 |
| | | | | 173.4 | | | | | | | |

Assessment of the worst case configuration from above with body worn accessory PMLN6085A/NTN5243A and additional offered batteries 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | PMLN6085A without belt loop /NTN5243A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.75 | -0.30 | 1.23 | 0.499 | **0.68** | 0.27 | ErC-Ab-120131-06 |
| | | | | 173.4 | | | | | | | |
| | | | | | | | | | | | |
| NAR6593A | PMNN4424A | PMLN6085A without belt loop /NTN5243A | HMN4104B | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | | | | | | | |
| | | | | 167.7 | 5.80 | -0.45 | 1.10 | 0.455 | 0.62 | 0.26 | ErC-Ab-120131-07 |
| | | | | 173.4 | | | | | | | |

**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 of wireless BT configurations:

Assessment of offered antenna with the default battery and body worn accessory PMLN6085A/NTN5243A without audio accessory attached. Refer to table 12 for highest output power channel.

**TABLE 21**

| Antenna | Battery | Carry Accessory | Cable Accessory | Test Freq (MHz) | Init Pwr (W) | SAR Drift (dB) | Meas. 1g-SAR (mW/g) | Meas. 10g-SAR (mW/g) | Max Calc. 1g-SAR (mW/g) | Max Calc. 10g-SAR (mW/g) | Run# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | PMLN6085A without belt loop /NTN5243A | None | 167.7 | 5.70 | -0.35 | 1.91 | 0.732 | **1.07** | 0.41 | ErC-Ab-120131-08 |

## 13.7 Assessment outside FCC Part 90 at the body (136-150.8 MHz):

Assessment at the Body for frequencies outside FCC part 90, using highest SAR test configuration from Part 90 assessments above. SAR plots of the highest results per table (bolded) are presented in appendices E-G.

**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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | PMLN6085A without belt loop /NTN5243A | None | 136.00 | 5.73 | -1.15 | 3.40 | 1.23 | 2.28 | 0.83 | ErC-Ab-120131-11 |
| | | | | 139.7 | 5.68 | -0.64 | 3.97 | 1.49 | **2.39** | 0.90 | CM-Ab-120131-12 |
| | | | | 143.4 | 5.68 | -0.25 | 3.62 | 1.39 | 1.99 | 0.76 | CM-Ab-120131-13 |
| | | | | 147.1 | 5.69 | -0.11 | 2.37 | 1.11 | 1.26 | 0.59 | CM-Ab-120131-14 |
| | | | | *150.8 | 5.69 | -0.088 | 2.62 | 1.05 | **1.39** | 0.56 | CM-Ab-120131-15 |

* Testing outside FCC part 90 included the high band edge frequency of 150.8MHz. Since this frequency is also part of the FCC allocated band this result will be reported as the highest SAR for FCC Part 90 in the conclusion section 15.

## 13.8 Assessments at the Face (150.8-173.4 MHz 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 23. 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 23**

| Test Freq (MHz) | Power (W) |
|---|---|
| 150.8 | 5.71 |
| 156.0125 | 5.70 |
| 162.0125 | 5.72 |
| 167.7 | 5.71 |
| 173.4 | 5.70 |

## 13.9 Assessment at the Face with default battery:

Assessment of the offered antenna with the default batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Head SAR Test Considerations. Refer to table 23 for highest output power channel.

**TABLE 24**

| Antenna | Battery | Carry Accessory | Cable Accessory | Test Freq (MHz) | Init Pwr (W) | SAR Drift (dB) | Meas. 1g-SAR (mW/g) | Meas. 10g-SAR (mW/g) | Max Calc. 1g-SAR (mW/g) | Max Calc. 10g-SAR (mW/g) | Run# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | None | None | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | 5.76 | -0.520 | 0.861 | 0.669 | **0.50** | 0.39 | CM-Face-111222-09 |
| | | | | 167.7 | | | | | | | |
| | | | | 173.4 | | | | | | | |

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 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8128A | None | None | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | 5.68 | -0.820 | 0.919 | 0.709 | **0.58** | 0.44 | CM-Face-111222-12 |
| | | | | 167.7 | | | | | | | |
| | | | | 173.4 | | | | | | | |
| | | | | | | | | | | | |
| NAR6593A | PMNN4424A | None | None | 150.8 | | | | | | | |
| | | | | 156.0125 | | | | | | | |
| | | | | 162.0125 | 5.78 | -0.520 | 0.869 | 0.676 | 0.50 | 0.39 | CM-Face-111222-11 |
| | | | | 167.7 | | | | | | | |
| | | | | 173.4 | | | | | | | |

## 13.10 Assessment outside FCC Part 90 at the face (136-150.8 MHz):

Assessment at the Body for frequencies outside FCC part 90, using highest SAR test configuration from Part 90 assessments above. SAR plots of the highest results per table (bolded) are presented in appendices E-G.

**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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8128A | None | None | 136.00 | 5.69 | -0.98 | 1.22 | 0.94 | 0.79 | 0.61 | ErC-Face-111227-02 |
| | | | | 139.7 | 5.82 | -1.29 | 1.32 | 1.02 | **0.90** | 0.70 | ErC-Face-111227-03 |
| | | | | 143.4 | 5.89 | -0.47 | 1.29 | 1.00 | 0.72 | 0.56 | ErC-Face-111227-04 |
| | | | | 147.1 | 5.83 | -0.11 | 1.28 | 0.998 | 0.66 | 0.52 | ErC-Face-111227-05 |
| | | | | 150.8 | 5.75 | -0.09 | 1.19 | 0.932 | **0.62** | 0.49 | ErC-Face-111227-06 |

* Testing outside FCC part 90 included the high band edge frequency of 150.8MHz. Since this frequency is also part of the FCC allocated band this result will be reported as the highest SAR for FCC Part 90 in the conclusion section 15.

## 13.11 Assessment of BT band:

See section 14.0 for test exclusion explanation.

## 13.12 Shortened 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 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# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAR6593A | NNTN8129A | PMLN6085A without belt loop /NTN5243A | None | 167.7 | 5.63 | -0.12 | 1.22 | 0.599 | **0.66** | 0.32 | ErC-Ab-120131-10 |

## 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 H51KDH9PW7AN (MUD2601).

**TABLE 28**

| Designator | Frequency (MHz) | Max Calc at Body (mW/g) | | Max Calc at Face (mW/g) | |
|---|---|---|---|---|---|
| | | 1g-SAR | 10g-SAR | 1g-SAR | 10g-SAR |
| Overall | 136.0-174 | 2.39 | 0.90 | 0.90 | 0.70 |
| | | | | | |
| FCC | 150.8-173.4 | 1.39 | 0.56 | 0.62 | 0.49 |
| | | | | | |
| IC | 138-144<br>148-149.9<br>150.05-174 | 2.39 | 0.90 | 0.90 | 0.70 |

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 and for Dipole test frequencies ranging from 300MHz to 800MHz. Therefore, the highest tolerance for the probe calibration uncertainty is indicated.

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

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

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

## Uncertainty Budget for System Validation (dipole & flat phantom) for 300 MHz to 800 MI

| *a* | *b* | *c* | *d* | *e = f(d,k)* | *f* | *g* | *h = c x f / e* | *i = c x g / e* | *k* |
|---|---|---|---|---|---|---|---|---|---|
| Uncertainty Component | IEEE 1528 section | Tol. (± %) | Prob. Dist. | Div. | $c_i$ (1 g) | $c_i$ (10 g) | 1 g $u_i$ (±%) | 10 g $u_i$ (±%) | $v_i$ |
| **Measurement System** | | | | | | | | | |
| Probe Calibration | E.2.1 | 9.0 | N | 1.00 | 1 | 1 | 9.0 | 9.0 | ∞ |
| Axial Isotropy | E.2.2 | 4.7 | R | 1.73 | 1 | 1 | 2.7 | 2.7 | ∞ |
| Spherical Isotropy | E.2.2 | 9.6 | R | 1.73 | 0 | 0 | 0.0 | 0.0 | ∞ |
| Boundary Effect | E.2.3 | 1.0 | R | 1.73 | 1 | 1 | 0.6 | 0.6 | ∞ |
| Linearity | E.2.4 | 4.7 | R | 1.73 | 1 | 1 | 2.7 | 2.7 | ∞ |
| System Detection Limits | E.2.5 | 1.0 | R | 1.73 | 1 | 1 | 0.6 | 0.6 | ∞ |
| Readout Electronics | E.2.6 | 0.3 | N | 1.00 | 1 | 1 | 0.3 | 0.3 | ∞ |
| Response Time | E.2.7 | 1.1 | R | 1.73 | 1 | 1 | 0.6 | 0.6 | ∞ |
| Integration Time | E.2.8 | 0.0 | R | 1.73 | 1 | 1 | 0.0 | 0.0 | ∞ |
| RF Ambient Conditions - Noise | E.6.1 | 3.0 | R | 1.73 | 1 | 1 | 1.7 | 1.7 | ∞ |
| RF Ambient Conditions - Reflections | E.6.1 | 0.0 | R | 1.73 | 1 | 1 | 0.0 | 0.0 | ∞ |
| Probe Positioner Mechanical Tolerance | E.6.2 | 0.4 | R | 1.73 | 1 | 1 | 0.2 | 0.2 | ∞ |
| Probe Positioning w.r.t. Phantom | E.6.3 | 1.4 | R | 1.73 | 1 | 1 | 0.8 | 0.8 | ∞ |
| Max. SAR Evaluation (ext., int., avg.) | E.5 | 3.4 | R | 1.73 | 1 | 1 | 2.0 | 2.0 | ∞ |
| **Dipole** | | | | | | | | | |
| Dipole Axis to Liquid Distance | 8, E.4.2 | 2.0 | R | 1.73 | 1 | 1 | 1.2 | 1.2 | ∞ |
| Input Power and SAR Drift Measurement | 8, 6.6.2 | 5.0 | R | 1.73 | 1 | 1 | 2.9 | 2.9 | ∞ |
| **Phantom and Tissue Parameters** | | | | | | | | | |
| Phantom Uncertainty | E.3.1 | 4.0 | R | 1.73 | 1 | 1 | 2.3 | 2.3 | ∞ |
| Liquid Conductivity (target) | E.3.2 | 5.0 | R | 1.73 | 0.64 | 0.43 | 1.8 | 1.2 | ∞ |
| Liquid Conductivity (measurement) | E.3.3 | 3.3 | R | 1.73 | 0.64 | 0.43 | 1.2 | 0.8 | ∞ |
| Liquid Permittivity (target) | E.3.2 | 5.0 | R | 1.73 | 0.6 | 0.49 | 1.7 | 1.4 | ∞ |
| Liquid Permittivity (measurement) | E.3.3 | 1.9 | R | 1.73 | 0.6 | 0.49 | 0.6 | 0.5 | ∞ |
| **Combined Standard Uncertainty** | | | RSS | | | | 11 | 11 | 99999 |
| **Expanded Uncertainty** (95% CONFIDENCE LEVEL) | | | *k*=2 | | | | 22 | 22 | |

**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) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

# APPENDIX B
# Probe Calibration Certificates

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

**S** Schweizerischer Kalibrierdienst
**C** Service suisse d'étalonnage
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: ES3-3163_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<br>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 |

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

Issued: April 13, 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
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

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

Accreditation No.: SCS 108

## Glossary:

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

## Calibration is Performed According to the Following Standards:

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

## Methods Applied and Interpretation of Parameters:

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

# Probe ES3DV3

## SN:3163

Manufactured: October 8, 2007
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 ($\mu V/(V/m)^2$)[A] | 1.34 | 1.14 | 1.06 | ± 10.1 % |
| DCP (mV)[B] | 100.6 | 102.9 | 102.3 | |

## Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|
| 10000 | CW | 0.00 | X | 0.00 | 0.00 | 1.00 | 112.6 | ±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%.

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

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

## Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 300 | 45.3 | 0.87 | 6.88 | 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 % |

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

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

## Calibration Parameter Determined in Body Tissue Simulating Media

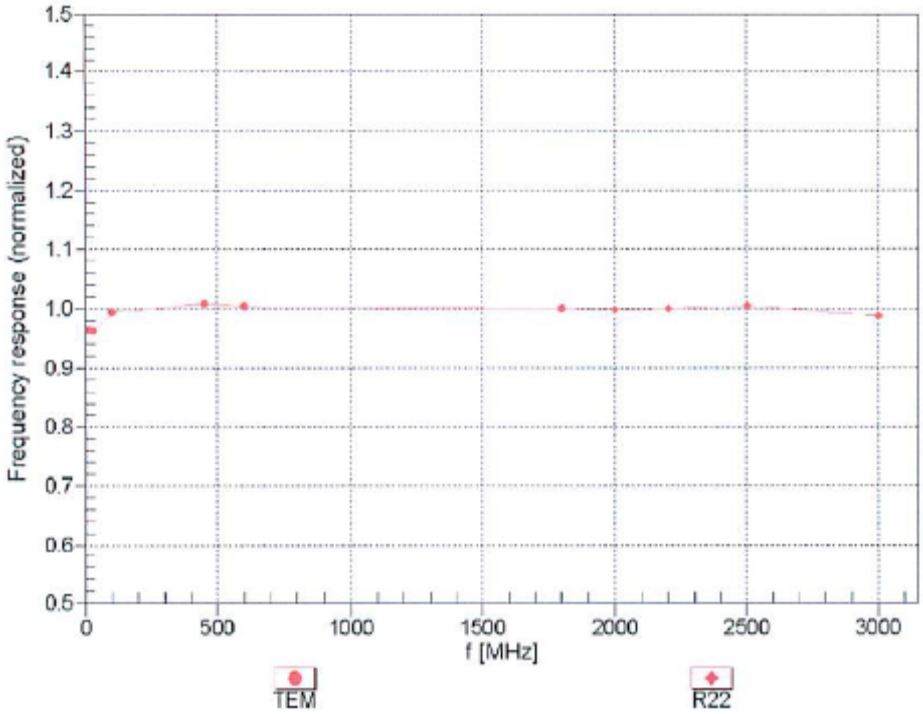
| f (MHz) [C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 300 | 58.2 | 0.92 | 6.83 | 6.83 | 6.83 | 0.22 | 1.69 | ± 13.4 % |
| 450 | 56.7 | 0.94 | 7.01 | 7.01 | 7.01 | 0.09 | 1.00 | ± 13.4 % |
| 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 % |

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

ES3DV3– SN:3163 April 13, 2011

# Frequency Response of E-Field

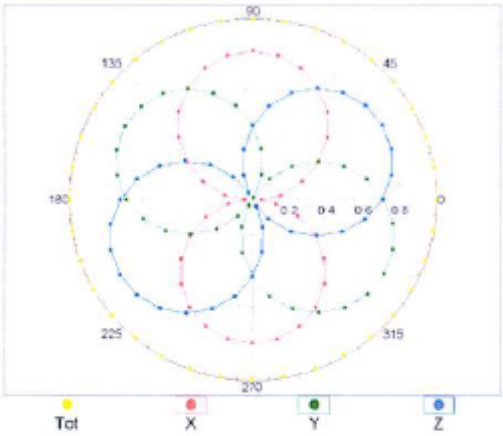
(TEM-Cell:ifi110 EXX, Waveguide: R22)



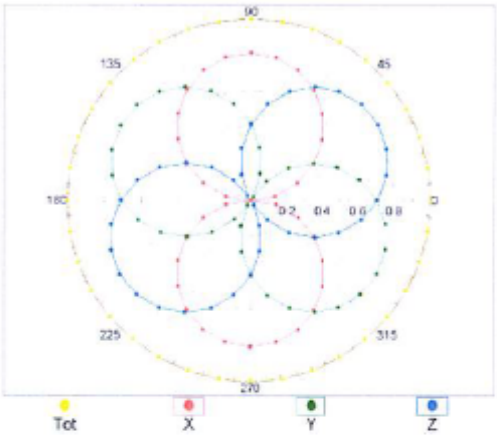

**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

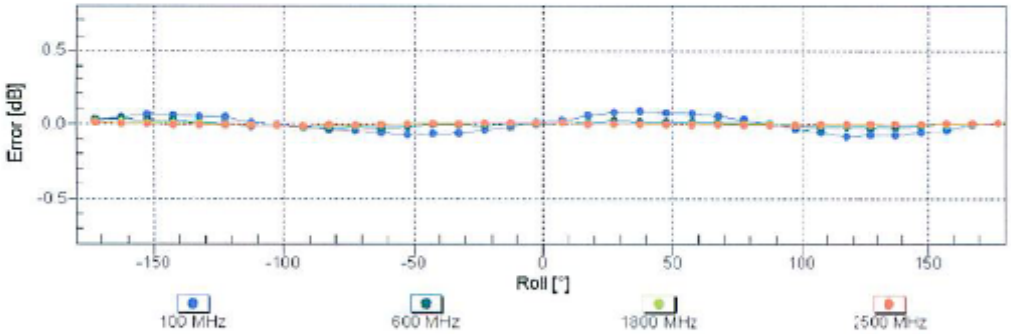
# Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



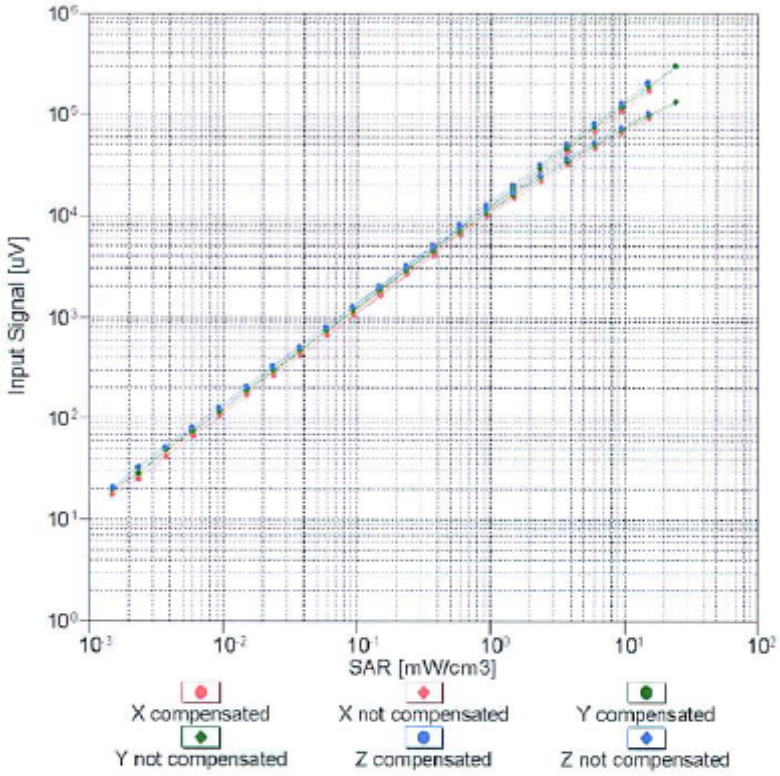

f=1800 MHz,R22

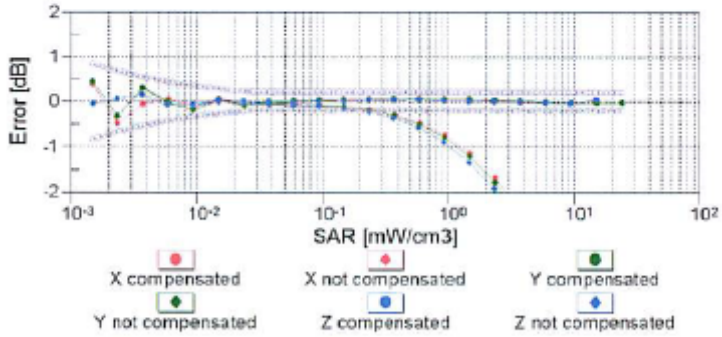



**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

# Dynamic Range f($SAR_{head}$)
(TEM cell , f = 900 MHz)



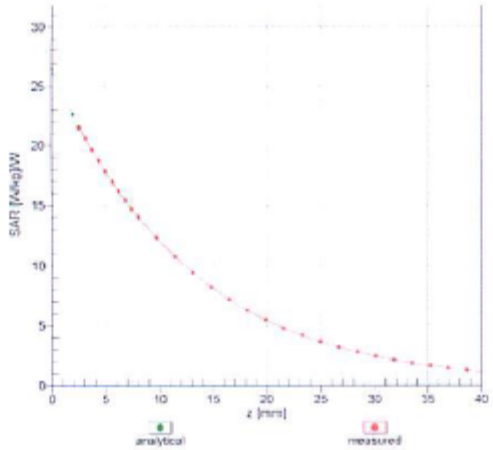




**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

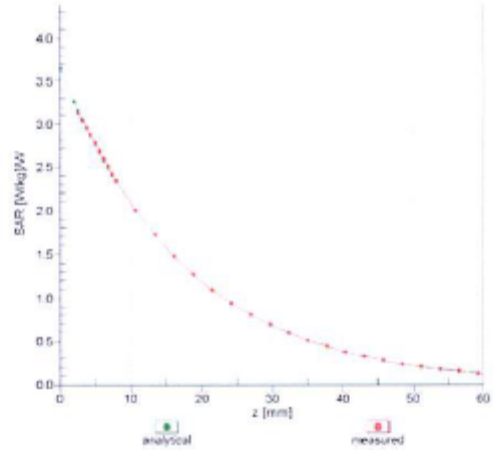
ES3DV3– SN:3163 April 13, 2011

# Conversion Factor Assessment

f = 1810 MHz,WGLS R22 (H_convF)

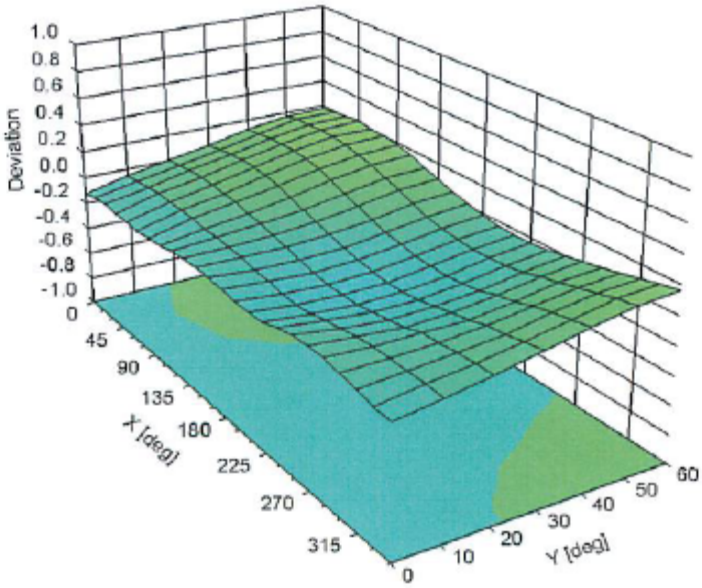


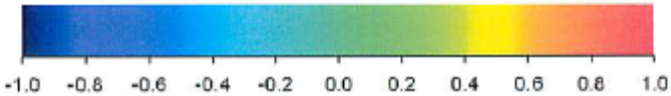

f = 900 MHz,WGLS R9 (H_convF)




# Deviation from Isotropy in Liquid

**Error (ϕ, ϑ), f = 900 MHz**




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

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

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s p e a g

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

# Additional Conversion Factors

**for Dosimetric E-Field Probe**

| | |
|---|---|
| Type: | **ES3DV3** |
| Serial Number: | **3163** |
| Place of Assessment: | **Zurich** |
| Date of Assessment: | **April 15, 2011** |
| Probe Calibration Date: | **April 13, 2011** |

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

Assessed by:

Schmid & Partner Engineering AG

s p e a g

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

## Dosimetric E-Field Probe ES3DV3 SN:3163

Conversion factor (± standard deviation)

| | | | |
|---|---|---|---|
| **150 MHz** | *ConvF* | **8.2 ± 10%** | $\varepsilon_r$ = 52.3<br>$\sigma$ = 0.76 mho/m<br>(head tissue) |
| **250 MHz** | *ConvF* | **7.7 ± 10%** | $\varepsilon_r$ = 47.6<br>$\sigma$ = 0.83 mho/m<br>(head tissue) |
| **150 MHz** | *ConvF* | **7.9 ± 10%** | $\varepsilon_r$ = 61.9<br>$\sigma$ = 0.80 mho/m<br>(body tissue) |
| **250 MHz** | *ConvF* | **7.5 ± 10%** | $\varepsilon_r$ = 59.4<br>$\sigma$ = 0.88 mho/m<br>(body tissue) |

**Important Note:**

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

**Please see also DASY Manual.**

# APPENDIX C
# Dipole Calibration Certificates

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

**S** Schweizerischer Kalibrierdienst
**C** Service suisse d'étalonnage
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: **D300V3-1015_Jul11**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D300V3 - SN: 1015 |
| Calibration procedure(s) | QA CAL-15.v6<br>Calibration procedure for dipole validation kits below 700 MHz |
| Calibration date: | July 07, 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 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 29-Mar-11 (No. 217-01168) | Apr-12 |
| Reference Probe ET3DV6 | SN: 1507 | 30-Apr-10 (No. ET3-1507_Apr10) | Apr-11 |
| DAE4 | SN: 654 | 23-Apr-10 (No. DAE4-654_Apr10) | Apr-11 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06 | 100005 | 4-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

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

Issued: July 13, 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
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Accreditation No.: **SCS 108**

**Glossary:**

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

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

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

**Additional Documentation:**

d) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.6.2 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | ELI4 Flat Phantom | Shell thickness: 2 ± 0.2 mm |
| **Distance Dipole Center - TSL** | 15 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 300 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 45.3 | 0.87 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 44.8 ± 6 % | 0.88 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 398 mW input power | 1.17 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **2.91 mW /g ± 18.1 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 398 mW input power | 0.769 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **1.91 mW /g ± 17.6 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 58.2 | 0.92 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 58.1 ± 6 % | 0.91 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 398 mW input power | 1.16 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **2.94 mW / g ± 18.1 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 398 mW input power | 0.791 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **2.00 mW / g ± 17.6 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 54.6 Ω - 6.8 jΩ |
| Return Loss | - 22.2 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 53.6 Ω - 9.1 jΩ |
| Return Loss | - 20.5 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.746 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 | November 30, 2010 |

## DASY5 Validation Report for Head TSL

Date: 07.07.2011

Test Laboratory: SPEAG

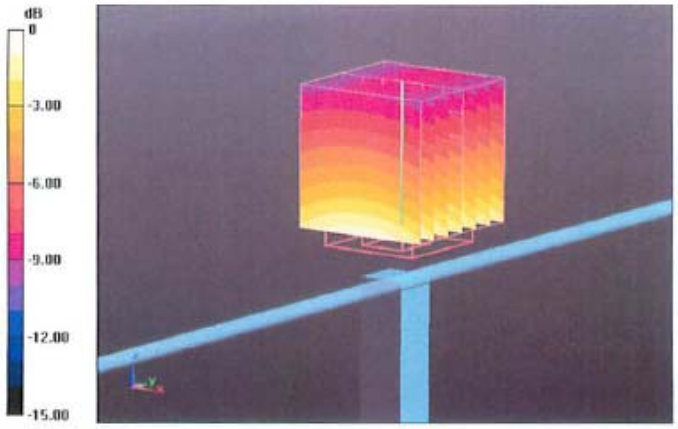
**DUT: Dipole 300 MHz; Type: D300V3; Serial: D300V3 - SN:1015**

Communication System: CW; Frequency: 300 MHz
Medium parameters used: f = 300 MHz; $\sigma$ = 0.88 mho/m; $\varepsilon_r$ = 44.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

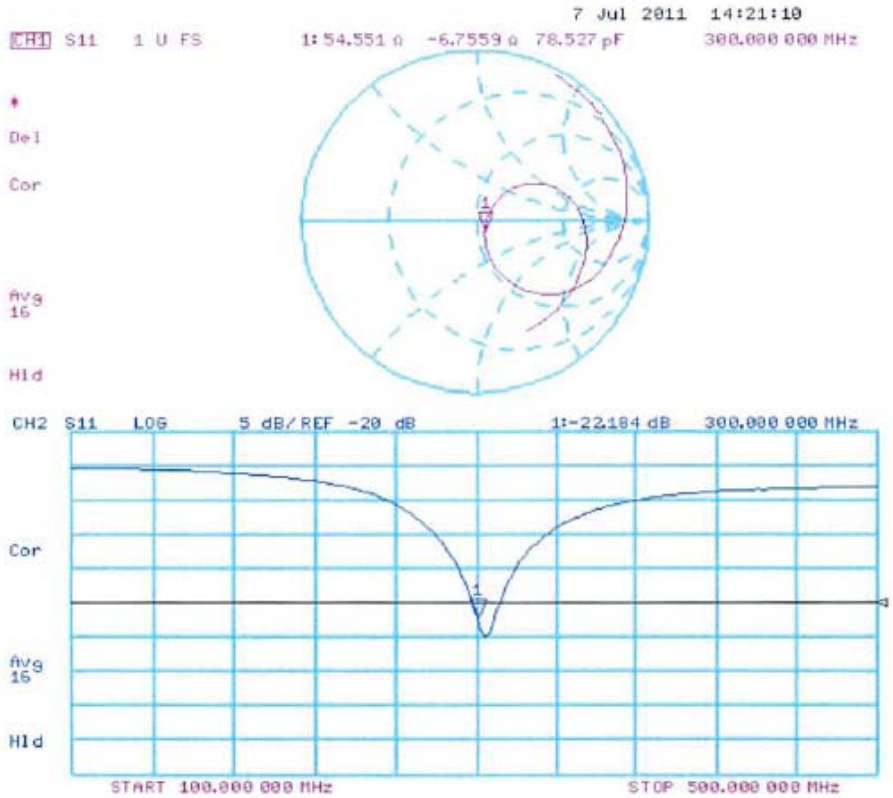
- Probe: ET3DV6 - SN1507; ConvF(7.39, 7.39, 7.39); Calibrated: 30.04.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

**Head/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 38.178 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.954 W/kg
**SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.769 mW/g**
Maximum value of SAR (measured) = 1.239 mW/g




0 dB = 1.240mW/g

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 07.07.2011

Test Laboratory: SPEAG

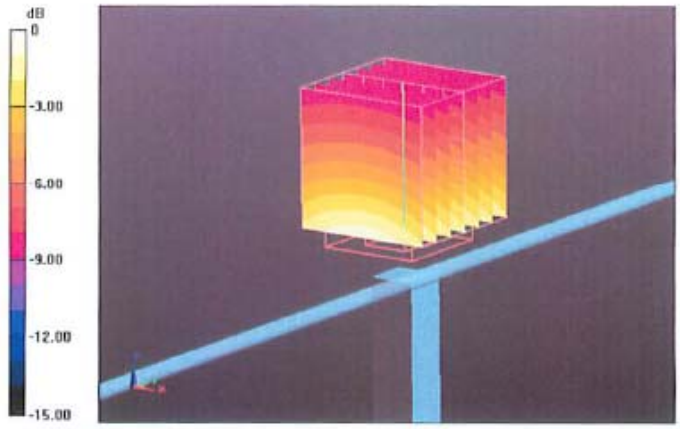
**DUT: Dipole 300 MHz; Type: D300V3; Serial: D300V3 - SN:1015**

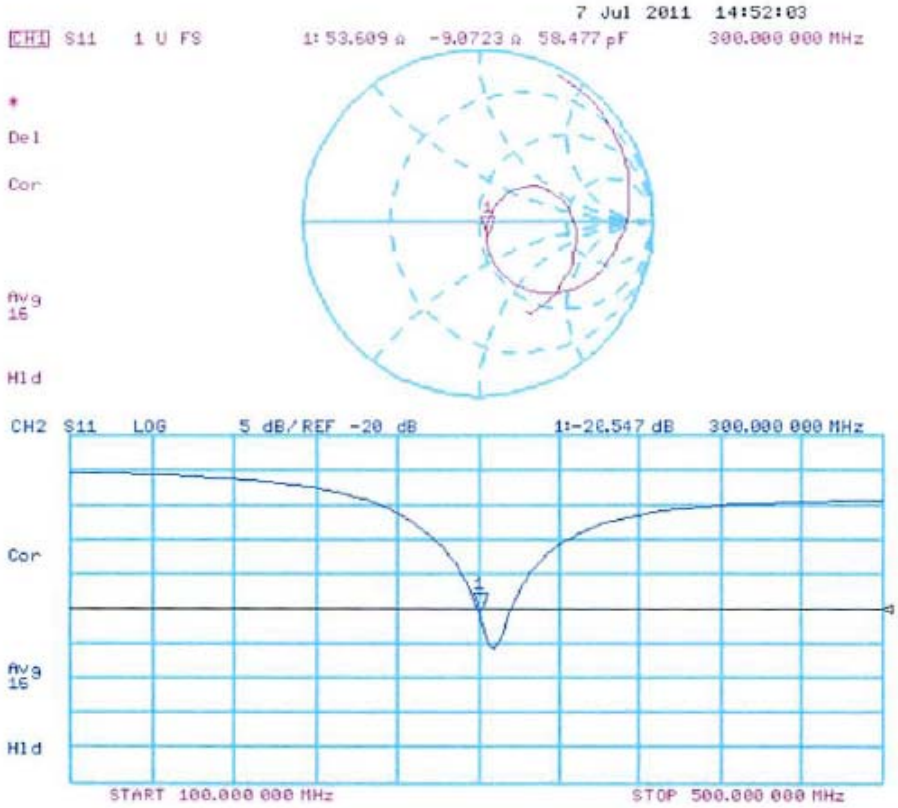
Communication System: CW; Frequency: 300 MHz
Medium parameters used: f = 300 MHz; $\sigma$ = 0.91 mho/m; $\varepsilon_r$ = 58.1; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.88, 6.88, 6.88); Calibrated: 30.04.2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

**Body/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 38.275 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.753 W/kg
**SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.791 mW/g**
Maximum value of SAR (measured) = 1.239 mW/g




0 dB = 1.240mW/g

## Impedance Measurement Plot for Body TSL