

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

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Date/s Tested: 09/05/2012-09/13/2012 & 9/25/2012
Manufacturer/Location: Motorola, Reynosa/Schaumburg
Sector/Group/Div.: AESS – Astro Engineering Subscriber Solutions
Date submitted for test: 7/30/2012
DUT Description: 380 - 470MHz 10-100 mW 6.25kHz/12.5kHz/25kHz, Dual Display full keypad Model. Capable of digital and analog FM transmission. Also capable of TDMA transmission. This radio is Bluetooth equipped.
Test TX mode(s): CW (PTT); CW (BlueTooth)
Max. Power output: 120 mW; 10 mW (Bluetooth)
Nominal Power: 100 mW; 10 mW (Bluetooth)
Tx Frequency Bands: 380 - 470 MHz; 2.402-2.480 GHz (Bluetooth)
Signaling type: FM, TDMA, FHSS (Bluetooth)
Model(s) Tested: H99QAH9PW7AN (NUE1155)
Model(s) Certified: H99QAH9PW7AN (NUE1155)
Serial Number(s): CAI1216CCH
Classification: Occupational/Controlled
FCC ID: AZ489FT4908; Rule Part 90 (406.1-470 MHz); Rule part 15 (2402 – 2480 MHz)
 Results outside FCC bands are not applicable for FCC compliance demonstration.
IC: 109U-89FT4908

* 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.

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Approval Date: 10/11/2012

Certification Date: 10/16/2012

Certification No.: L1121001P

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Report Revision History

Date	Revision	Comments
10/10/2012	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 H99QAH9PW7AN (NUE1155).

2.0 Abbreviations / Definitions

BT: Bluetooth
CNR: Calibration Not Required
CQPSK: Compatible Quadrature Phase-Shift Keying
CW: Continuous Wave
C4FM: Compatible 4-level Frequency Modulation
DC: Duty Cycle
DSP: Digital Signal Processor
DUT: Device Under Test
EME: Electromagnetic Energy
FHSS: Frequency Hopping Spread Spectrum
FM: Frequency Modulation/Factorial Mutual
NA: Not Applicable
PSM: Public safety Microphone
PTT: Push to Talk
RF: Radio Frequency
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. Negative or reduced SAR scaling is not permitted.

6.0 Description of Device Under Test (DUT)

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

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

The model represented under this filing utilizes a removable UHF R1 antennas and an internal fixed antenna (Bluetooth) capable of transmitting in the 380-470 MHz and 2.402-2.480 GHz (Bluetooth) bands respectively. The nominal output powers are 100 mW (UHF R1), with maximum output powers of 120 mW. The nominal BT output power is 10 mW and the maximum output power is 10 mW 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, and “at the shoulder” by means of the offered Public Safety Microphone. 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. Although accessories can be selected for test, not all are tested per the thresholds outlined in the KDB. The following sections identify the test criteria and details for each accessory category. Refer to Exhibit 7B for antenna separation distances.

7.1 Antennas

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

TABLE 2

Antenna Models	Description	Selected for test	Tested
PMAE4065A	¼ wave whip, UHF/GPS/PSM, 380 - 520MHz / 1575MHz	Yes	Yes
FAF5259A	¼ wave, UHF/GPS (radio only), 380 - 470MHz / 1575MHz	Yes	Yes
84009370001	¼ wave internal Bluetooth; 2402-2481 MHz	Yes	NA

7.2 Batteries

There are 10 batteries offered for this product. The table below lists the batteries, and battery description.

TABLE 3

Battery Models	Description	Selected for test	Tested	Comments
NNTN7033A	IMPRES Li Ion Battery FM, 4100 mAh	Yes	Yes	
NNTN7034A	IMPRES Li Ion Battery, 4200 mAh	Yes	Yes	
NNTN7035A	IMPRES NiMH Ruggedized Battery FM, 2000 mAh	No	No	Similar to NNTN7036A except for ruggedize use
NNTN7036A	IMPRES NiMH Battery FM, 2000 mAh	Yes	Yes	
NNTN7037A	IMPRES NiMH Battery, 2100 mAh	Yes	Yes	
NNTN7038A	IMPRES Li Ion Battery, 2900 mAh	Yes	Yes	
NNTN7573A	IMPRES NiMH Ruggedized Battery, 2100 mAh	No	No	Similar to NNTN7037A except for ruggedize use
NNTN8092A	IMPRES Li Ion Ruggedized Battery FM, 2300mAh	Yes	Yes	
NNTN8182A	IMPRES Li Ion Battery, 2900 mAh	Yes	Yes	
PMNN4403A	IMPRES Li Ion Slim Battery, 2150 mAh	Yes	Yes	

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
NNTN8269A	Nylon Interceptor ATV Carry Case	Yes	Yes	Item does not support the following batteries; NNTN7034A, NNTN7033A, NNTN7036A, NNTN7037A, NNTN7573A & NNTN7035A
NTN5243A	Carry Strap	Yes	Yes	Tested with PMLN5658A, PMLN5657A, PMLN5660A & PMLN5659A
NTN9179A	HI ACTI SWIVEL D CLIP & BL (for use with universal carry holder)	Yes	Yes	Tested with PMLN5709A
PMLN5658A	Leather Fixed BL Carry, works with LiIon 2150 & 2900 mAH	Yes	Yes	Item does not support the following batteries; NNTN7034A, NNTN7033A, NNTN7036A, NNTN7037A, NNTN7573A & NNTN7035A
PMLN5657A	Leather D ring Swivel BL Carry, works with LiIon 2150 & 2900 mAH	Yes	Yes	Item does not support the following batteries; NNTN7034A, NNTN7033A, NNTN7036A, NNTN7037A, NNTN7573A & NNTN7035A
PMLN5660A	Leather Fixed BL Carry, works with HI Cap 4200 and 4100 mAH	Yes	Yes	Item does not support the following batteries; PMNN4403A, NNTN7035A, NNTN7036A, NNTN7037A, NNTN7038A, NNTN7573A, NNTN8182A & NNTN8092A
PMLN5659A	Leather D ring Swivel BL Carry, works with HI Cap 4200 and 4100 mAH	Yes	Yes	Item does not support the following batteries; PMNN4403A, NNTN7035A, NNTN7036A, NNTN7037A, NNTN7038A, NNTN7573A, NNTN8182A & NNTN8092A
PMLN5709A	Universal Carry Holder	Yes	Yes	Tested with NTN9179A, HLN6875A & NTN8266B
HLN6875A	3 in. Belt Clip -Plastic (for use with universal carry holder)	Yes	Yes	Tested with PMLN5709A
NTN8266B	2 1/2 in. Belt Clip -Plastic (for use with universal carry holder)	Yes	Yes	Tested with PMLN5709A
4205823V08	PSM Shoulder Clip	Yes	Yes	Tested with PSM PMMN4059B, PMMN4060B & PMMN4061B

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
PMMN4059B	Public Safety Mic 18 inch IP55, 3.5mm jack TX/RX	Yes	Yes	PSM testing only
PMMN4060B	Public Safety Mic 24 inch IP55, 3.5mm jack TX/RX	Yes	Yes	PSM testing only
PMMN4061B	Public Safety Mic 30 inch IP55, 3.5mm jack TX/RX	Yes	Yes	PSM testing only
RMN5058A	Core L/W Headset	Yes	Yes	
HMN4104B	IMPRES Display Submersible RSM w/jack & Ch. Selector	Yes	No	
HMN4101B	Model D-IMPRES no display submersible RSM w/ jack, no chnl	No	No	Similar to HMN4104B – same cable length and connector pins
HMN4103B	Model B-IMPRES no display submersible RSM w/ jack, no chnl	No	No	Similar to HMN4104B – same cable length and connector pins
RMN5116A	Rx/Tx boomless bone conductive temple transducer for DRSM	Yes	No	Intended for test with HMN4104B
PMLN5275C	Core H/D headset	Yes	No	
PMLN5111A	Plus 3-wire – Black – One programmable button	Yes	No	
PMLN5112A	Plus 3-wire – Beige – One programmable button	No	No	Similar to PMLN5111A, differ color
PMLN5101A	IMPRES Temple Transducer	Yes	No	
PMMN4062A	Large Plus Noise cancelling RSM IP55 3.5MM jack	Yes	No	
PMMN4069A	Large RSM with audio jack	No	No	Similar to PMMN4062A
PMMN4025A	Small RSM IP54 with 3.5mm jack Rx only	No	No	Similar to PMMN4062A – same cable length and connector pins
PMMN4065A	Standard Large IP57 RSM	Yes	No	
PMMN4024A	Small Core RSM IP54 with 3.5mm jack Rx only	Yes	No	
RLN5882A	Plus 2-wire with translucent tube – Black – One programmable button	Yes	No	
RLN5881A	Plus 2 wire - Beige-one programable button	No	No	BS to RLN5882A, differ ear piece
RLN5883A	Plus 2 wire /w translucent tube - Beige one programable button	No	No	BS to RLN5882A, differ color
RLN5880A	Plus 2-wire Black – one programmable button	No	No	Similar to RLN5882A
ZMN6031A	SPKR MIC 3 PIECE	Yes	No	Intended for test with NNTN7869A
ZMN6032A	SPKR MIC 2 PIECE	Yes	No	Intended for test with NNTN7869A
ZMN6038A	SPKR MIC 2 PIECE XL	No	No	Similar to ZMN6032A
ZMN6039A	SPKR MIC 3 PIECE XL	No	No	Similar to ZMN6031A
NNTN7869A	Surveillance/Keyloader Accessory Adapter	Yes	No	Intended for test w/ ZMN6031A, ZMN6032A

TABLE 5 Continued

Audio Acc. Models	Description	Selected for test	Tested	Comments
BDN6731A	Earpiece, Mic and PTT combined with extra loud earpiece BLACK	Yes	No	Intended for test w/ BDN6783A
BDN6732A	Earpiece, Mic and PTT separate with extra loud earpiece BLACK	Yes	No	Intended for test w/ BDN6783A
BDN6780A	Earbud Single w/ Mic & PTT	Yes	No	Intended for test w/ BDN6783A
BDN6783A	Headset/Earpiece Audio Accessory Adapter	Yes	No	Intended for test w/ BDN6731A, BDN6732A, BDN6780A
BDN6667A	Earpiece, Mic & PTT Combo	No	No	Similar to BDN6731A
BDN6668A	Earpiece, Mic & PTT Separate	No	No	Similar to BDN6732A
BDN6669A	Earpiece, Mic and PTT combined with extra loud earpiece BEIGE	No	No	Similar to BDN6731A
BDN6670A	Earpiece, Mic and PTT separate with extra loud earpiece BEIGE	No	No	Similar to BDN6732A
BDN6729A	Earpiece, Mic and PTT combined BLACK	No	No	Similar to BDN6731A
BDN6730A	Earpiece, Mic and PTT separate BLACK	No	No	Similar to BDN6732A
RLN6424A	Rx-Only earpiece with translucent tube and rubber eartip	No	No	Receive only, similar to RMN5116A – connects to RSM
BDN6664A	Earpiece with standard earpiece BEIGE Tilt / Man Down Switch	No	No	Receive only
BDN6665A	Earpiece w/ XL Earphone	No	No	Receive only
BDN6666A	Earpiece w/ Volume Control	No	No	Receive only
BDN6719A	Earpad, w/3.5 MM threaded plug	No	No	Receive only
BDN6726A	Earpiece with standard earpiece BLACK	No	No	Receive only
BDN6727A	Earpiece with extra loud earphone BLACK	No	No	Receive only
BDN6728A	Earpiece with volume control BLACK	No	No	Receive only
BDN6781A	Earbud, single, receive only, black	No	No	Receive only
RLN5878A	Core 1 wire – Black	No	No	Receive only
RLN5879A	Core 1 wire - Beige-	No	No	Receive only
RLN5886A	Low Noise Kit Tube	No	No	Receive only
RLN5887A	High Noise Kit	No	No	Receive only
PMLN4620A	D-Shell RX-Only Earpiece (3.5mm)	No	No	Receive only
RLN4941A	3.5mm RX ONLY EARPIECE W/TRANSLUCENT TUBE-Short coiled cbl	No	No	Receive only
AARLN4885B	3.5mm RX ONLY EARBUD FOR REM SPK MIC short coiled cbl	No	No	Receive only
WADN4190B	3.5mm EAR RCVR W/COIL CBL-Short cbl	No	No	Receive only

8.0 Description of Test System



8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 6

Dosimetric System type	System version	DAE type	Probe Type
Schmid & Partner Engineering AG SPEAG DASY 5	52.8.2.961	DAE3	ES3DV3 (E-Field)

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

8.2 Description of Phantom(s)

TABLE 7

Phantom type	Phantom ID (s)	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
Dual Flat	NA	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190	2mm +/- 0.2mm	Wood	< 0.05
SAM	NA					
Elliptical	OVAL1108 OVAL1011					

8.3 Description of Simulated Tissue

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

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in table 8 below for 450 MHz. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Simulated Tissue Composition (by mass)

TABLE 8

Reference Standards	% of listed ingredients	450MHz	
		Head	Body
FCC Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 91-01)	Sugar	56.0	46.5
IEEE 1528-2003	Diacetin	NA	NA
IEC62209-1 (2005)	De ionized – Water	39.10	50.53
CENELEC – EN62209-1 (2006)	Salt	3.80	1.87
	HEC	1	1
	Bact.	0.1	0.1

Reference section 10.1 for target parameters

9.0 Additional Test Equipment

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

TABLE 9

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Probe				
Speag Probe	ES3DV3	3147	1/25/2012	1/25/2013
DAE				
Speag DAE	DAE3	401	3/9/2012	3/9/2013
RF Equipment				
Power Meter (Agilent)	E4419B	MY45103725	3/30/2012	3/30/2013
Power Meter (Agilent)	E4418B	US39251266	2/3/2012	2/3/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50280001	8/3/2012	8/3/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY50290001	8/3/2012	8/3/2013
E-Series Avg. Power Sensor (Agilent)	E9301B	MY41495594	2/6/2012	2/6/2013
Bi-Directional Coupler (NARDA)	3020A	40296	2/9/2012	2/9/2014
Bi-Directional Coupler (NARDA)	3022	77115	3/2/2012	3/2/2014
Signal Generator (Agilent)	E4428C	MY47381119	6/24/2011	6/24/2013
AMP (Amplifier Research)	10WD1000	28782	CNR	CNR
Temperature Recording Equipment				
Dickson Temperature Recorder	TM325	12121144	5/18/2012	5/18/2013
Omega Digital Thermometer with J Type TC Probe	HH200A	20857	10/28/2011	10/28/2012
Omega Digital Thermometer with J Type TC Probe	HH202A	18800	2/22/2012	2/22/2013
Omega Digital Thermometer with J Type TC Probe	HH202A	18801	5/23/2012	5/23/2013
Omega Digital Thermometer with J Type TC Probe	HH202A	18812	6/25/2012	6/25/2013
Tissue Station				
Agilent PNA-L Network Analyzer	N5230A	MY45001092	6/4/2012	6/4/2013
*Dielectric Probe Kit (HP)	85070C	US99360076	CNR	CNR
Dipole				
Speag Dipole	D450V3	1077	11/15/2011	11/15/2013

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

10.0 SAR Measurement System Verification

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

10.1 Equivalent Tissue Test Results

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

TABLE 10

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
380	FCC Body	0.93 (0.88-0.98)	57.4 (54.5-60.3)	0.89	58.8	9/13/12
				0.91	57.6	9/25/12
380	IEEE / IEC Head	0.87 (0.83-0.91)	44.3 (42.1-46.6)	0.86	46.2	9/6/12
393	FCC Body	0.93 (0.89-0.98)	57.3 (54.4-60.1)	0.89	58.6	9/13/12
				0.90	56.5	9/25/12
393	IEEE / IEC Head	0.87 (0.83-0.91)	44.2 (42.0-46.4)	0.83	45.9	9/6/12
406	FCC Body	0.93 (0.89-0.98)	57.1 (54.3-60.0)	0.91	57.9	9/5/12
				0.91	58.0	9/6/12
				0.90	57.6	9/7/12
				0.93	57.6	9/10/12
				0.92	58.1	9/11/12
				0.91	57.5	9/12/12
				0.90	58.3	9/13/12
406	IEEE / IEC Head	0.87 (0.83-0.91)	44.0 (41.8-46.2)	0.86	44.7	9/5/12
				0.85	45.7	9/6/12
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.9-59.5)	0.95	57.3	9/5/12
				0.94	57.4	9/6/12
				0.91	56.4	9/7/12
				0.94	56.9	9/10/12
				0.95	57.4	9/11/12
				0.94	56.9	9/12/12
				0.91	57.6	9/13/12
0.98	57.0	9/25/12				
450	IEEE / IEC Head	0.87 (0.83-0.91)	43.5 (41.3-45.7)	0.89	43.8	9/5/12
				0.90	44.9	9/6/12

10.2 System Check Test Results

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

TABLE 11

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Reference SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3147	450 MHz FCC Body	D450V3 / 1077	4.49 +/- 10%	1.14	4.56	9/5/12
				1.15	4.60	9/6/12
				1.13	4.52	9/7/12
				1.14	4.56	9/10/12
				1.14	4.56	9/11/12
				1.13	4.52	9/12/12
				1.13	4.52	9/13/12
				1.15	4.60	9/25/12
3147	450 MHz IEEE / IEC Head	D450V3 / 1077	4.67 +/- 10%	1.21	4.84	9/5/12
				1.21	4.84	9/6/12

11.0 Environmental Test Conditions

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

TABLE 12

	Target	Measured
Ambient Temperature	18 – 25 °C	Range: 21.1 – 21.8°C Avg. 21.6 °C
Relative Humidity	30 – 70 %	Range: 53.2 – 61.2 % Avg. 55.7%
Tissue Temperature	NA	Range: 20.7-21.7°C Avg. 21.2°C

Relative humidity target range is a recommended target

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

12.0 DUT Test Methodology

12.1 Measurements

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

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.

Shoulder: the PSM was positioned in the intended use configuration against the phantom with the offered shoulder clip.

12.3.2 Head

Not applicable.

12.3.3 Face

The DUT was positioned with its' front and back 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/shoulder were used to assess compliance of this device. All modes of operation identified in section 6.0 were considered during the development of the test plan. All tests were performed in 100% CW mode and then 50% duty cycle was applied to the final results. In some cases the initial power listed herein may exceed the reported maximum power due to software step size tuning limitations. However, the initial powers measured are not greater than the allowed 5% of the reported maximum power.

13.0 DUT Test Data

13.1 Assessments at the Body for 406.1 –470.0 MHz band

The battery PMNN4403A was selected as the default battery for assessments at the Body since it is the thinnest battery (refers to Exhibit 7B for the dimension of the battery). The conducted power measurements for all test channels within FCC Part 90 frequency range using the default battery PMNN4403A are indicated in Table 13. The channel with the highest conducted power will be identified as the default channel per KDB 643646 D01 SAR Test for PTT Radios v01r01. SAR plots of the highest results per table (bolded) are presented in APPENDICES E-G.

TABLE 13

Test Freq (MHz)	Power (mW)
406.125	119
422.000	119
438.000	119
454.000	119
470.000	119

Assessments at the Body with Body worn NNTN8269A

Assessment of the offered antennas with default battery, body worn NNTN8269A, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 14

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-520 MHz)	PMNN4403 A	NNTN8269A	RMN5058A	406.125	114	-0.05	0.25	0.18	0.13	0.10	CM-Ab-120906-22
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	PMNN4403 A	NNTN8269A	RMN5058A	406.125	114	-0.10	0.31	0.23	0.17	0.12	CM-Ab-120906-23
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7038A	NNTN8269A	RMN5058A	406.125	117	-0.12	0.30	0.13	0.16	0.07	ErC-Ab-120907-02
	NNTN8182A			406.125	116	-0.11	0.31	0.23	0.17	0.12	ErC-Ab-120907-03
	NNTN8092A			406.125	116	-0.11	0.28	0.20	0.15	0.11	ErC-Ab-120907-04

Assessments at the Body with Body worn NTN9179A with PMLN5709A holster

Assessment of the offered antennas with the default battery, body worn NTN9179A with PMLN5709A holster, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 15

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	PMNN4403 A	NTN9179A w/PMLN5709 A	RMN5058A	406.125	115	-0.03	0.10	0.07	0.05	0.04	ErC-Ab-120907-05
				422.000							
				438.000							
				454.000							
FAF5259A (380-470 MHz)	PMNN4403 A	NTN9179A w/PMLN5709 A	RMN5058A	406.125	116	-0.40	0.09	0.07	0.05	0.04	ErC-Ab-120907-06
				422.000							
				438.000							
				454.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7034A	NTN9179A w/PMLN5709 A	RMN5058A	406.125	116	-0.37	0.05	0.04	0.03	0.02	ErC-Ab-120907-07
	NNTN7033A			406.125	116	-0.30	0.05	0.04	0.03	0.02	ErC-Ab-120907-08
	NNTN7036A			406.125	116	-0.07	0.10	0.08	0.05	0.04	ErC-Ab-120907-09
	NNTN7037A			406.125	117	-0.06	0.11	0.08	0.06	0.04	ErC-Ab-120907-10
	NNTN7038A			406.125	116	-0.45	0.09	0.07	0.05	0.04	ErC-Ab-120907-11
	NNTN8182A			406.125	116	-0.48	0.09	0.07	0.05	0.04	ErC-Ab-120907-12
	NNTN8092A			406.125	116	-0.41	0.09	0.07	0.05	0.04	ErC-Ab-120907-13

Assessments at the Body with Body worn PMLN5658A

Assessment of the offered antennas with the default battery, body worn PMLN5658A, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 16

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	PMNN4403 A	PMLN5658A	RMN5058A	406.125	116	-0.06	0.10	0.07	0.05	0.04	ErC-Ab-120907-14
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	PMNN4403 A	PMLN5658A	RMN5058A	406.125	116	-0.01	0.14	0.11	0.07	0.05	JsT-Ab-120910-02
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7038A	PMLN5658A	RMN5058A	406.125	116	-0.10	0.13	0.10	0.07	0.05	JsT-Ab-120910-03
	NNTN8182A			406.125	116	-0.10	0.16	0.12	0.08	0.06	JsT-Ab-120910-04
	NNTN8092A			406.125	115	-0.06	0.12	0.09	0.06	0.05	JsT-Ab-120910-05

Assessments at the Body with Body worn PMLN5657A

Assessment of the offered antennas with the default battery and body worn PMLN5657A with additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 17

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	PMNN4403 A	PMLN5657A	RMN5058A	406.125	116	0.00	0.07	0.06	0.04	0.03	JsT-Ab-120910-06
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	PMNN4403 A	PMLN5657A	RMN5058A	406.125	117	-0.51	0.08	0.06	0.04	0.03	JsT-Ab-120910-07
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7038A	PMLN5657A	RMN5058A	406.125	116	-0.39	0.08	0.06	0.04	0.03	JsT-Ab-120910-08
	NNTN8182A			406.125	116	-0.45	0.08	0.06	0.05	0.03	JsT-Ab-120910-09
	NNTN8092A			406.125	115	-0.45	0.07	0.05	0.04	0.03	JsT-Ab-120910-10

Assessments at the Body with Body worn PMLN5658A with NTN5243A carry strap

Assessment of the offered antennas with the default battery, body worn PMLN5658A with NTN5243A carry strap, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 18

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	PMNN4403 A	NTN5243A/ PMLN5658A	RMN5058A	406.125	116	-0.01	0.10	0.08	0.05	0.04	JsT-Ab-120910-11
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	PMNN4403 A	NTN5243A/ PMLN5658A	RMN5058A	406.125	115	-0.07	0.13	0.10	0.07	0.05	JsT-Ab-120910-12
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7038A	NTN5243A/ PMLN5658A	RMN5058A	406.125	116	-0.06	0.14	0.10	0.07	0.05	JsT-Ab-120910-13
	NNTN8182A			406.125	117	-0.06	0.16	0.12	0.08	0.06	JsT-Ab-120910-14
	NNTN8092A			406.125	116	-0.06	0.12	0.09	0.06	0.05	JsT-Ab-120910-15

Assessments at the Body with Body worn PMLN5657A (no belt loop) with NTN5243A carry strap

Assessment of the offered antennas with the default battery, body worn PMLN5657A (no belt loop) with NTN5243A carry strap, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 19

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	PMNN4403 A	NTN5243A/ PMLN5657A w/o loop	RMN5058A	406.125	116	0.01	0.16	0.11	0.08	0.06	JsT-Ab-120911-02
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	PMNN4403 A	NTN5243A/ PMLN5657A w/o loop	RMN5058A	406.125	116	-0.30	0.18	0.13	0.10	0.07	JsT-Ab-120911-03
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7038A	NTN5243A/ PMLN5657A w/o loop	RMN5058A	406.125	116	-0.10	0.19	0.13	0.10	0.07	JsT-Ab-120911-04
	NNTN8182A			406.125	115	-0.10	0.18	0.13	0.10	0.07	JsT-Ab-120911-05
	NNTN8092A			406.125	116	-0.27	0.16	0.11	0.09	0.06	JsT-Ab-120911-06

Assessments at the Body with Body worn PMLN5660A

Assessment of the offered antennas with the default battery, body worn PMLN5660A and additional offered battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 20

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	NNTN7034A	PMLN5660A	RMN5058A	406.125	116	-0.08	0.10	0.07	0.05	0.04	JsT-Ab-120911-07
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	NNTN7034A	PMLN5660A	RMN5058A	406.125	117	-0.58	0.09	0.06	0.05	0.04	JsT-Ab-120911-08
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered battery											
PMAE4065A (380-470 MHz)	NNTN7033A	PMLN5660A	RMN5058A	406.125	116	-0.11	0.07	0.06	0.04	0.03	JsT-Ab-120911-09

Assessments at the Body with Body worn PMLN5659A

Assessment of the offered antennas with the default battery, body worn PMLN5659A and additional offered battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 21

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	NNTN7034A	PMLN5659A	RMN5058A	406.125	116	-0.05	0.05	0.04	0.03	0.02	JsT-Ab-120911-10
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	NNTN7034A	PMLN5659A	RMN5058A	406.125	116	-0.42	0.05	0.04	0.03	0.02	JsT-Ab-120911-11
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered battery											
FAF5259A (380-470 MHz)	NNTN7033A	PMLN5659A	RMN5058A	406.125	115	-0.09	0.05	0.04	0.03	0.02	JsT-Ab-120911-12

Assessments at the Body with Body worn PMLN5660A with NTN5243A carry strap

Assessment of the offered antennas with the default battery, body worn PMLN5660A with NTN5243A carry strap and additional offered battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 22

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	NNTN7034A	NTN5243A/ PMLN5660A	RMN5058A	406.125	117	-0.08	0.08	0.06	0.04	0.03	JsT-Ab-120911-13
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	NNTN7034A	NTN5243A/ PMLN5660A	RMN5058A	406.125	116	-0.51	0.06	0.05	0.04	0.03	JsT-Ab-120911-14
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered battery											
PMAE4065A (380-470 MHz)	NNTN7033A	NTN5243A/ PMLN5660A	RMN5058A	406.125	116	-0.13	0.07	0.05	0.04	0.03	JsT-Ab-120912-02

Assessments at the Body with Body worn PMLN5659A (no belt loop) with NTN5243A carry strap

Assessment of the offered antennas with the default battery, body worn PMLN5659A (no belt loop) with NTN5243A carry strap, and additional offered battery per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 23

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	NNTN7034A	NTN5243A/ PMLN5659A w/o loop	RMN5058A	406.125	116	-0.08	0.21	0.11	0.11	0.06	JsT-Ab- 120912-03
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	NNTN7034A	NTN5243A/ PMLN5659A w/o loop	RMN5058A	406.125	116	-0.53	0.16	0.09	0.09	0.05	JsT-Ab- 120912-04
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered battery											
PMAE4065A (380-470 MHz)	NNTN7033A	NTN5243A/ PMLN5659A w/o loop	RMN5058A	406.125	117	-0.15	0.15	0.09	0.08	0.05	JsT-Ab- 120912-05

Assessments at the Body with Body worn HLN6875A with PMLN5709A holster

Assessment of the offered antennas with the default battery, body worn HLN6875A with PMLN5709A holster, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 24

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	PMNN4403 A	HLN6875A w/PMLN5709 A	RMN5058A	406.125	116	-0.05	0.10	0.07	0.05	0.04	JsT-Ab-120912-06
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	PMNN4403 A	HLN6875A w/PMLN5709 A	RMN5058A	406.125	115	-0.09	0.13	0.10	0.07	0.05	JsT-Ab-120912-07
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7034A	HLN6875A w/PMLN5709 A	RMN5058A	406.125	116	-0.55	0.06	0.05	0.04	0.03	JsT-Ab-120912-08
	NNTN7033A			406.125	116	-0.43	0.06	0.04	0.03	0.02	JsT-Ab-120912-09
	NNTN7036A			406.125	116	-0.08	0.12	0.09	0.06	0.05	JsT-Ab-120912-10
	NNTN7037A			406.125	116	-0.06	0.12	0.09	0.07	0.05	JsT-Ab-120912-11
	NNTN7038A			406.125	116	-0.08	0.13	0.10	0.07	0.05	JsT-Ab-120912-12
	NNTN8182A			406.125	115	-0.09	0.14	0.11	0.08	0.06	JsT-Ab-120912-13
	NNTN8092A			406.125	116	-0.15	0.12	0.09	0.06	0.05	JsT-Ab-120912-14

Assessments at the Body with Body worn NTN8266B with PMLN5709A holster

Assessment of the offered antennas with the default battery, body worn NTN8266B with PMLN5709A holster, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 13 for highest output power channel.

TABLE 25

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-470 MHz)	PMNN4403 A	NTN8266B w/PMLN5709 A	RMN5058A	406.125	116	-0.06	0.18	0.13	0.09	0.07	JsT-Ab-120912-15
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	PMNN4403 A	NTN8266B w/PMLN5709 A	RMN5058A	406.125	116	-0.46	0.18	0.13	0.10	0.08	JsT-Ab-120912-16
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
FAF5259A (380-470 MHz)	NNTN7034A	NTN8266B w/PMLN5709 A	RMN5058A	406.125	116	-0.52	0.13	0.10	0.08	0.06	JsT-Ab-120912-17
	NNTN7033A			406.125	116	-0.30	0.13	0.09	0.07	0.05	JsT-Ab-120913-02
	NNTN7036A			406.125	116	-0.05	0.20	0.15	0.10	0.08	JsT-Ab-120913-03
	NNTN7037A			406.125	115	-0.06	0.18	0.13	0.09	0.07	JsT-Ab-120913-04
	NNTN7038A			406.125	116	-0.51	0.20	0.14	0.11	0.08	JsT-Ab-120913-05
	NNTN8182A			406.125	116	-0.44	0.20	0.14	0.11	0.08	JsT-Ab-120913-06
	NNTN8092A			406.125	115	-0.52	0.17	0.13	0.10	0.07	JsT-Ab-120913-07

Assessment of other audio accessories at the body

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

13.2 Assessments of wireless BT configuration

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

TABLE 26

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
FAF5259A (380-470 MHz)	PMNN4403 A	NNTN8269A	None	406.125	116	-0.08	0.27	0.20	0.14	0.11	JsT-Ab-120913-08
				422.000							
				438.000							
				454.000							
				470.000							

13.3 Assessments outside FCC Part 90 at the body

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

TABLE 27

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
FAF5259A (380-470 MHz)	PMNN4403 A	NNTN8269A	RMN5058A	380.000	117	-0.31	0.13	0.10	0.07	0.05	JsT-Ab-120913-09
				393.000	116	-0.49	0.16	0.12	0.09	0.07	JsT-Ab-120913-10
PMAE4065A (380-520 MHz)	PMNN4403 A	NNTN8269A	RMN5058A	380.000	116	-0.49	0.19	0.14	0.11	0.08	JsT-Ab-120913-11
				393.000	116	-0.02	0.23	0.17	0.12	0.09	JsT-Ab-120913-12

13.4 Assessment at the Shoulder with Public Safety Microphone (PSM)

The highest capacity battery NNTN7034A was selected as the default battery. The conducted power measurement for all test channels within FCC Part 90 frequency range using the default battery NNTN7034A is indicated in the Table 28. The channel with the 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 F-G.

TABLE 28

Test Freq (MHz)	Power (mW)
406.125	119
422.000	119
438.000	119
454.000	119
470.000	118

Assessments at the Shoulder with PSM’s PMMN4059B, PMMN4060B & PMMN4061B

Assessment of the offered antenna with the default battery, body worn 4205823V08 with PSMs PMMN4059B, PMMN4060B & PMMN4061B per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Body SAR Test Considerations for Body worn Accessories. Refer to Table 28 for highest output power channel.

TABLE 29

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-520 MHz)	NNTN7034A	4205823V08 Rev. L	PMMN4059B	406.125	115	0.01	0.15	0.11	0.08	0.06	CM-Ab-120905-05
				422.000							
				438.000							
				454.000							
				470.000							
PMAE4065A (380-520 MHz)	NNTN7034A	4205823V08 Rev. L	PMMN4060B	406.125	116	0.00	0.13	0.09	0.07	0.05	CM-Ab-120905-06
				422.000							
				438.000							
				454.000							
				470.000							
PMAE4065A (380-520 MHz)	NNTN7034A	4205823V08 Rev. L	PMMN4061B	406.125	117	0.01	0.10	0.06	0.05	0.03	CM-Ab-120905-07
				422.000							
				438.000							
				454.000							
				470.000							

13.5 Assessments outside FCC Part 90 at the Shoulder

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

TABLE 30

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-520 MHz)	NNTN7034A	4205823V08 Rev. L	PMMN4059B	380.000	116	-0.98	0.13	0.07	0.08	0.05	CM-Ab-120925-13
				393.000	114	-0.06	0.19	0.11	0.10	0.06	CM-Ab-120925-14

13.6 Assessments at the Face 406.1-470.0 MHz band

The highest capacity battery NNTN7034A was selected as the default battery. The conducted power measurement for all test channels within FCC Part 90 frequency range using the default battery NNTN7034A is indicated in the Table 31. The channel with the 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 31

Test Freq (MHz)	Power (mW)
406.125	119
422.000	119
438.000	119
454.000	119
470.000	118

Assessments at the Face with Front Side of DUT

Assessment of the offered antennas with the default battery NNTN7034A, front of DUT facing phantom, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Head SAR Test Considerations. Refer to Table 31 for highest output power channel.

TABLE 32

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-520 MHz)	NNTN7034A	None (@ Front)	None	406.125	117	-0.08	0.11	0.08	0.06	0.04	CM-Face-120905-09
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	NNTN7034A	None (@ Front)	None	406.125	116	-0.40	0.08	0.06	0.04	0.03	CM-Face-120905-10
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
PMAE4065A (380-520 MHz)	NNTN7033A	None (@ Front)	None	406.125	116	-0.02	0.07	0.06	0.04	0.03	CM-Face-120905-11
	NNTN7036A			406.125	116	0.00	0.12	0.09	0.06	0.05	CM-Face-120905-12
	NNTN7037A			406.125	116	0.02	0.12	0.09	0.06	0.05	JsT-Face-120906-02
	NNTN7038A			406.125	116	-0.01	0.17	0.13	0.09	0.07	JsT-Face-120906-03
	NNTN8182A			406.125	116	-0.02	0.18	0.14	0.09	0.07	JsT-Face-120906-04
	NNTN8092A			406.125	116	0.01	0.14	0.10	0.07	0.05	JsT-Face-120906-05
	PMNN4403 A			406.125	116	-0.02	0.21	0.16	0.11	0.08	JsT-Face-120906-06

Assessments at the Face with Back Side of DUT

Assessment of the offered antennas with the default battery NNTN7034A, back of DUT facing phantom, and additional offered batteries per KDB 643646 D01 SAR Test for PTT Radios v01r01 – Head SAR Test Considerations. Refer to Table 31 for highest output power channel.

TABLE 33

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
PMAE4065A (380-520 MHz)	NNTN7034A	None (@ Back)	None	406.125	116	-0.05	0.12	0.09	0.06	0.05	JsT-Face-120906-07
				422.000							
				438.000							
				454.000							
				470.000							
FAF5259A (380-470 MHz)	NNTN7034A	None (@ Back)	None	406.125	116	-0.49	0.09	0.06	0.05	0.04	JsT-Face-120906-08
				422.000							
				438.000							
				454.000							
				470.000							
Assessment of the additional offered batteries											
PMAE4065A (380-520 MHz)	NNTN7033A	None (@ Back)	None	406.125	115	-0.06	0.10	0.07	0.05	0.04	JsT-Face-120906-09
	NNTN7036A			406.125	116	-0.01	0.12	0.09	0.06	0.05	JsT-Face-120906-10
	NNTN7037A			406.125	116	-0.03	0.12	0.09	0.06	0.05	JsT-Face-120906-11
	NNTN7038A			406.125	116	-0.07	0.18	0.14	0.09	0.07	JsT-Face-120906-12
	NNTN8182A			406.125	115	-0.02	0.19	0.14	0.10	0.07	JsT-Face-120906-13
	NNTN8092A			406.125	116	-0.02	0.16	0.12	0.08	0.06	JsT-Face-120906-14
	PMNN4403A			406.125	116	-0.02	0.18	0.13	0.09	0.07	JsT-Face-120906-15

13.7 Assessments outside FCC Part 90 at the Face

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

TABLE 34

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
FAF5259A (380-470 MHz)	PMNN4403 A	None (@ Front)	None	380.000	115	-0.01	0.08	0.06	0.04	0.03	CM-Face-120906-19
				393.000	115	-0.42	0.10	0.08	0.06	0.04	CM-Face-120906-17
PMAE4065A (380-520 MHz)	PMNN4403 A	None (@ Front)	None	380.000	115	-0.56	0.13	0.10	0.08	0.06	CM-Face-120906-20
				393.000	115	-0.37	0.17	0.12	0.09	0.07	CM-Face-120906-18

13.8 Shortened Scan Assessment

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

TABLE 35

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (mW)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
FAF5259A (380-470 MHz)	PMNN4403A	NNTN8269A	RMN5058A	406.125	117	-0.01	0.30	0.22	0.15	0.11	JsT-Ab-120913-15

14.0 Simultaneous Transmission Exclusion

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

15.0 Conclusion

Based on the test guidelines from KDB643646, the highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing:

TABLE 30

Designator	Frequency band (MHz)	Max Calc at Body (mW/g)		Max Calc at Face (mW/g)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
Overall	380-470	0.17	0.12	0.11	0.08
FCC	406.1-470.0	0.17	0.12	0.11	0.08

All results are scaled to the maximum output power

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams result is not applicable to FCC filing.

APPENDIX A

Measurement Uncertainty

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

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. ($\pm \%$)	Prob Dist	Div.	c_i (1 g)	c_i (10 g)	1 g u_i ($\pm\%$)	10 g u_i ($\pm\%$)	v_i
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	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				14	13	965
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				27	27	

FCD-0558 Uncertainty Budget Rev.8

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

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$	<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
Measurement System									
Probe Calibration	E.2.1	6.7	N	1.00	1	1	6.7	6.7	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				10	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			$k=2$				19	19	

FCD-0558 Uncertainty Budget Rev.8.1

Notes for Tables 1, 2, 3 and 4

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

APPENDIX B
Probe Calibration Certificates

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3147_Jan12**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3147**

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: **January 25, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	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-11 (No. ES3-3013_Dec11)	Dec-12
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 Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: January 27, 2012

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

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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., $\vartheta = 0$ 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_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ 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_{x,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.

ES3DV3 – SN:3147

January 25, 2012

Probe ES3DV3

SN:3147

Manufactured: July 12, 2007
Calibrated: January 25, 2012

Calibrated for DASYS/EASY Systems
(Note: non-compatible with DASYS2 system!)

ES3DV3- SN:3147

January 25, 2012

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3147

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	1.26	1.20	1.18	± 10.1 %
DCP (mV) ^B	100.8	104.2	104.7	

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	107.9	±2.7 %
			Y	0.00	0.00	1.00	113.9	
			Z	0.00	0.00	1.00	106.4	

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 E²-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.

ES3DV3- SN:3147

January 25, 2012

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3147

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	45.3	0.87	7.00	7.00	7.00	0.24	1.05	± 13.4 %
450	43.5	0.87	6.50	6.50	6.50	0.14	1.70	± 13.4 %
750	41.9	0.89	6.29	6.29	6.29	0.20	2.38	± 12.0 %
900	41.5	0.97	5.97	5.97	5.97	0.24	2.24	± 12.0 %
1810	40.0	1.40	5.18	5.18	5.18	0.80	1.17	± 12.0 %
1950	40.0	1.40	4.97	4.97	4.97	0.62	1.28	± 12.0 %
2300	39.5	1.67	4.78	4.78	4.78	0.80	1.23	± 12.0 %
2450	39.2	1.80	4.49	4.49	4.49	0.74	1.32	± 12.0 %
2600	39.0	1.96	4.30	4.30	4.30	0.75	1.34	± 12.0 %
3500	37.9	2.91	4.25	4.25	4.25	1.00	0.94	± 13.1 %
3700	37.7	3.12	3.78	3.78	3.78	1.00	1.18	± 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:3147

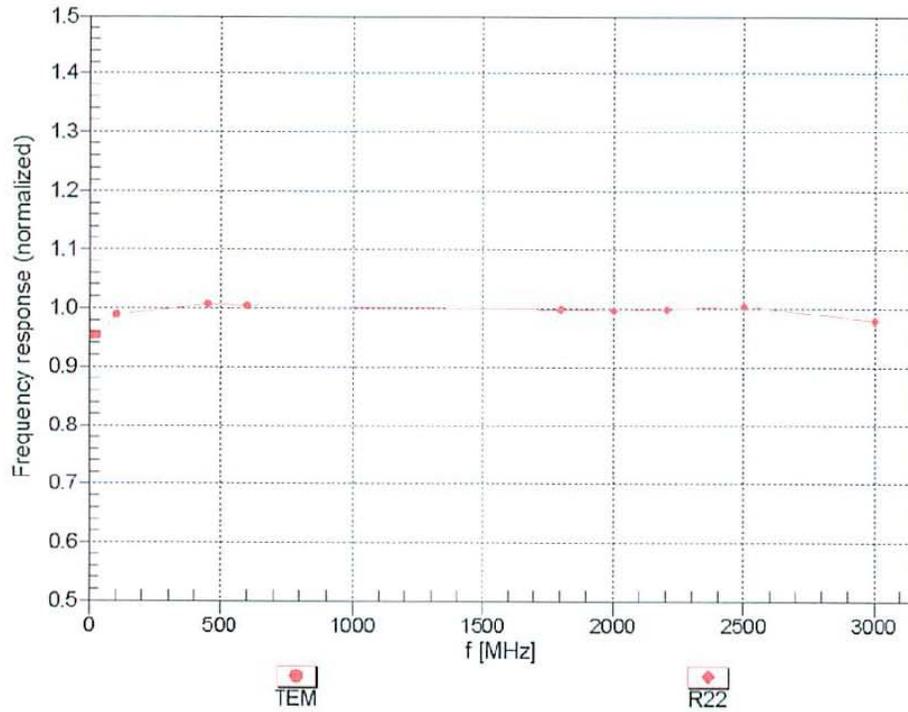
Calibration Parameter Determined in Body Tissue Simulating Media

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	6.81	6.81	6.81	0.20	1.31	± 13.4 %
450	56.4	0.94	6.92	6.92	6.92	0.09	1.00	± 13.4 %
750	55.5	0.96	6.15	6.15	6.15	0.80	1.14	± 12.0 %
900	55.0	1.05	6.03	6.03	6.03	0.80	1.12	± 12.0 %
1810	53.3	1.52	4.82	4.82	4.82	0.45	1.80	± 12.0 %
1950	53.3	1.52	4.74	4.74	4.74	0.62	1.46	± 12.0 %
2300	52.9	1.81	4.33	4.33	4.33	0.80	1.15	± 12.0 %
2450	52.7	1.95	4.23	4.23	4.23	0.80	0.99	± 12.0 %
2600	52.5	2.16	4.08	4.08	4.08	0.67	1.01	± 12.0 %
3500	51.3	3.31	3.45	3.45	3.45	1.00	1.34	± 13.1 %
3700	51.0	3.55	3.40	3.40	3.40	0.76	1.62	± 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.

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

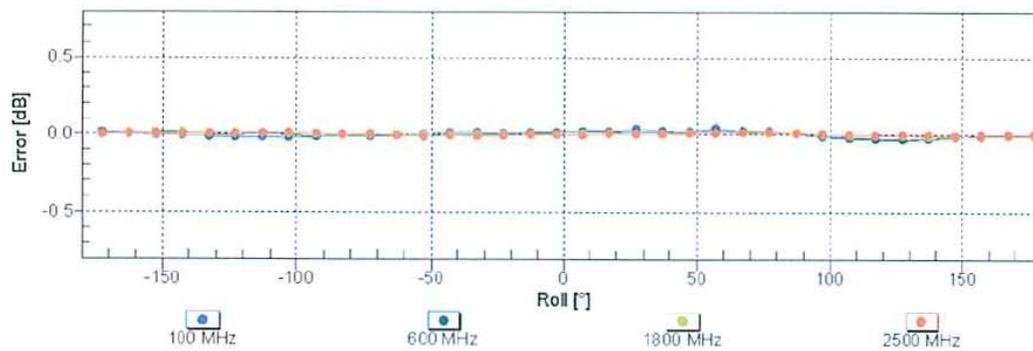
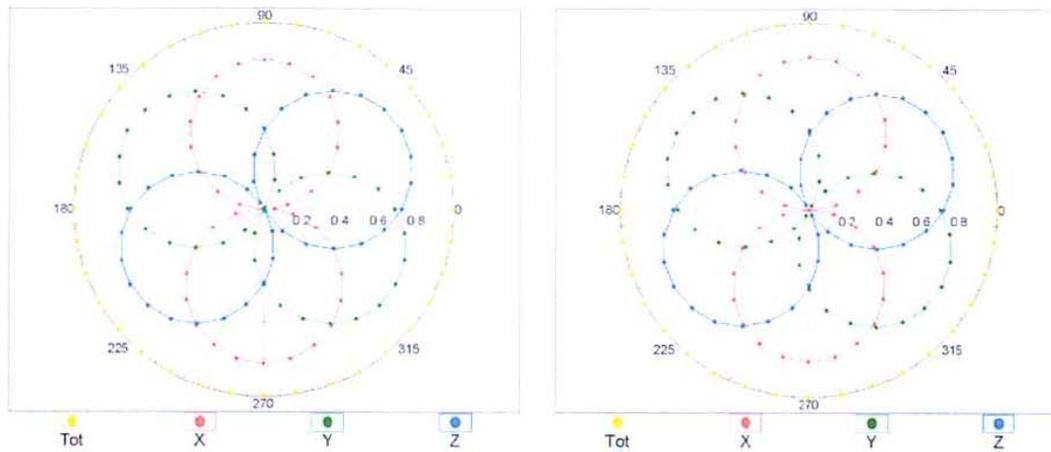


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

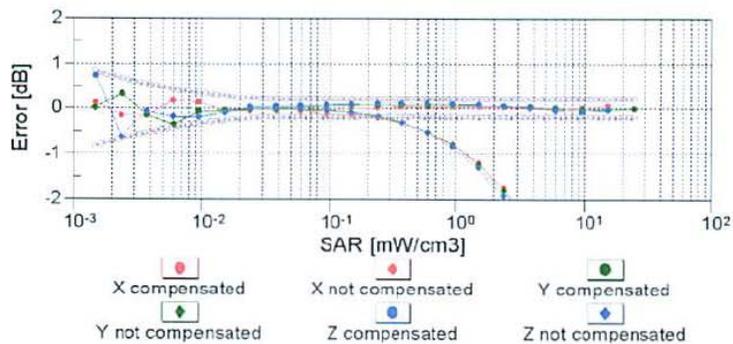
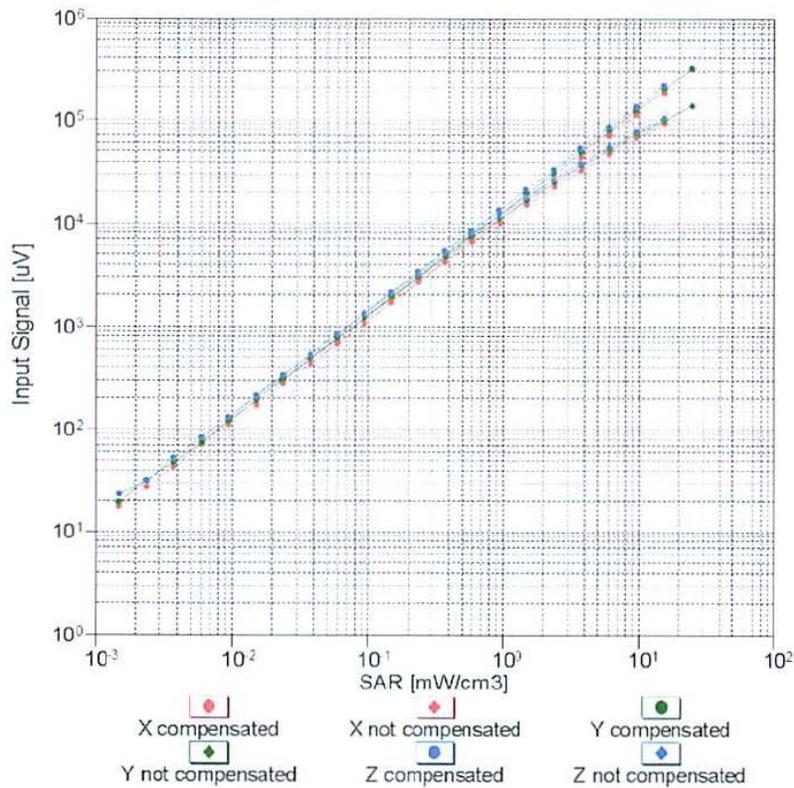
f=600 MHz,TEM

f=1800 MHz,R22



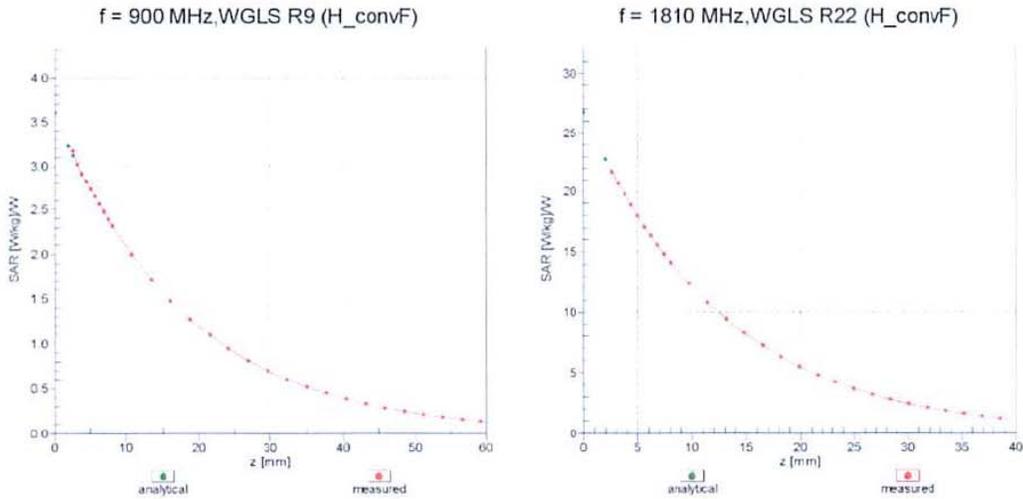
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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

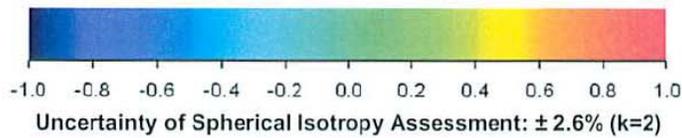
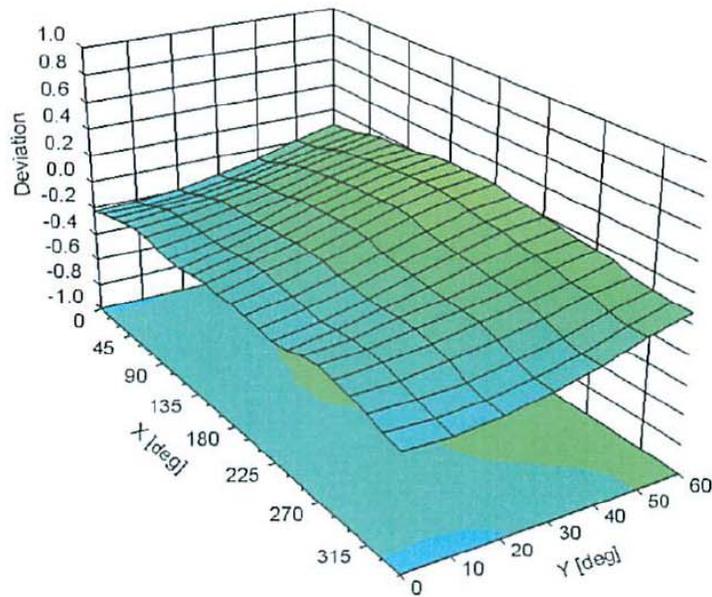


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, ϑ), f = 900 MHz



ES3DV3- SN:3147

January 25, 2012

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3147

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 & Partner Engineering AG

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:	3147
Place of Assessment:	Zurich
Date of Assessment:	January 27, 2012
Probe Calibration Date:	January 25, 2012

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

Assessed by: 

Schmid & Partner Engineering AG

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Dosimetric E-Field Probe ES3DV3 SN:3147

Conversion factor (\pm standard deviation)

150 \pm 50 MHz *ConvF* 8.1 \pm 10%

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

150 \pm 50 MHz *ConvF* 7.8 \pm 10%

$\epsilon_r = 61.9 \pm 5\%$
 $\sigma = 0.80 \pm 5\%$ mho/m
(body tissue)

Important Note:
For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASYS software must have the following entries: Alpha = 0 and Delta = 1.
Please see also DASYS Manual.

APPENDIX C
Dipole Calibration Certificates

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Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D450V3-1077_Nov11/2**

CALIBRATION CERTIFICATE (Replacement of No:D450V3-1077_Nov11)

Object: **D450V3 - SN: 1077**

Calibration procedure(s): **QA CAL-15.v6
Calibration procedure for dipole validation kits below 700 MHz**

Calibration date: **November 15, 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	29-Apr-11 (No. ET3-1507_Apr11)	May-12
DAE4	SN: 654	03-May-11 (No. DAE4-654_May11)	May-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: March 5, 2012

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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.

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

Measurement Conditions

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

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	450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	44.1 \pm 6 %	0.85 mho/m \pm 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	1.82 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	4.67 mW / g \pm 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.21 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	3.10 mW / g \pm 17.6 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	55.0 \pm 6 %	0.92 mho/m \pm 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	1.77 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	4.49 mW / g \pm 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.18 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	2.99 mW / g \pm 17.6 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	58.2 Ω - 5.0 jΩ
Return Loss	- 21.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	55.2 Ω - 7.3 jΩ
Return Loss	- 21.4 dB

General Antenna Parameters and Design

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

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 24, 2010

DASY5 Validation Report for Head TSL

Date: 15.11.2011

Test Laboratory: SPEAG

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1077

Communication System: CW; Frequency: 450 MHz

Medium parameters used: $f = 450$ MHz; $\sigma = 0.85$ mho/m; $\epsilon_r = 44.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

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

Reference Value = 49.455 V/m; Power Drift = -0.02 dB

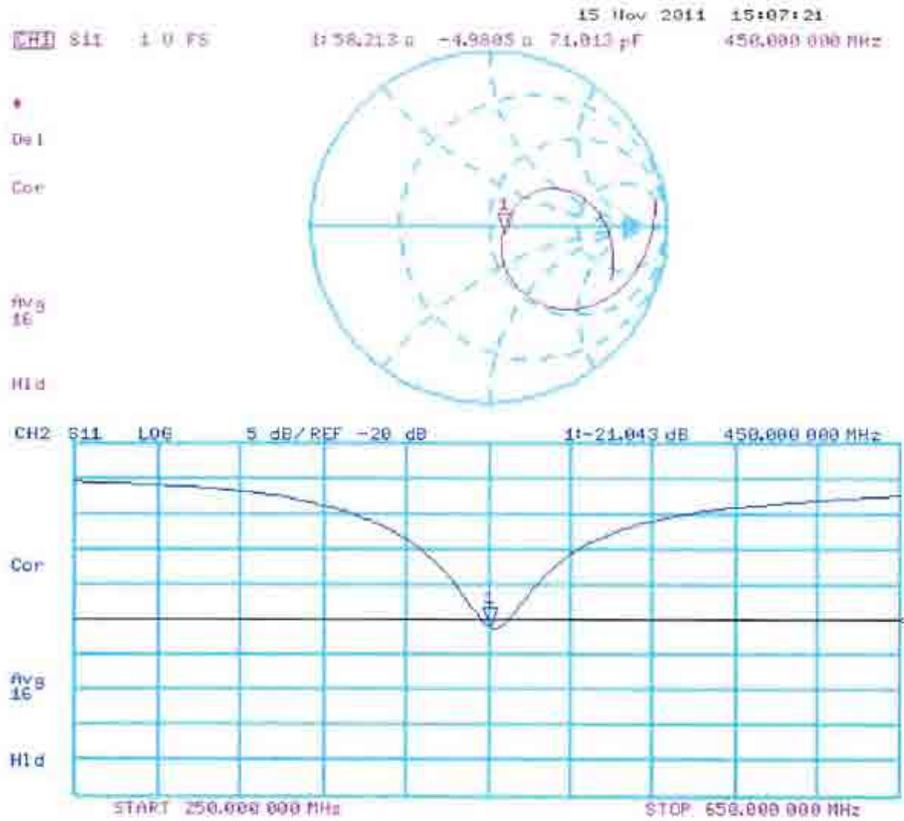
Peak SAR (extrapolated) = 2.765 W/kg

SAR(1 g) = 1.82 mW/g; SAR(10 g) = 1.21 mW/g

Maximum value of SAR (measured) = 1.940 mW/g



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.11.2011

Test Laboratory: SPEAG

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1077

Communication System: CW; Frequency: 450 MHz

Medium parameters used: $f = 450$ MHz; $\sigma = 0.92$ mho/m; $\epsilon_r = 55$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

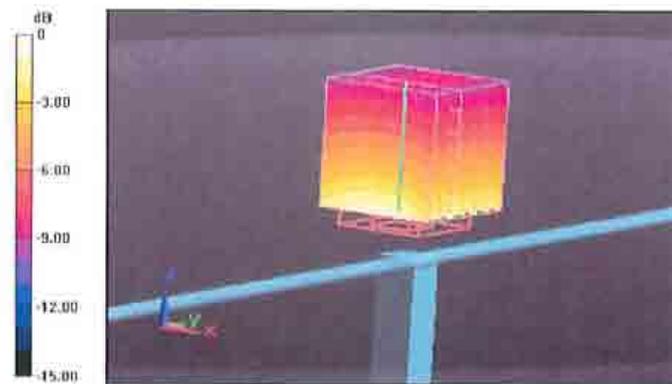
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 46.820 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 2.773 W/kg

SAR(1 g) = 1.77 mW/g; SAR(10 g) = 1.18 mW/g

Maximum value of SAR (measured) = 1.891 mW/g



0 dB = 1.890mW/g

Impedance Measurement Plot for Body TSL

